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Tablets and elderly users: Designing a guidebook

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Abstract

The elderly population in Norway is increasing in number, and there will be a greater need for health care services and care units. The introduction of welfare technology can aid facing this challenge in order to assist the elderly in keeping living independently at home.

A smart home care unit in Oslo has implemented technological solutions such as sensors for lighting, safety alarms and a tablet for each resident. The tablet is the basis of our study, and has features such as IP telephony and provides an overview of the current activities and food menu in the care unit. Thus, the tablet is not a stand-alone technology, but a part of the technology in the care unit, i.e. a part of the smart home. The introduction of the tablet proved to present some challenges, e.g. that the elderly find it difficult to use, they lack knowledge about what it can be used for, and some elderly do not wish to apply it.

The goal of our study has been to design a solution that can contribute to motivate the elderly to apply the tablet, as well as assist the ones who already use it. We have focused on exploring the challenges faced by the elderly residents regarding the use of the tablet in order to design a solution that can face these challenges. To do this, we have taken into account motivation and the diversity of the user group, and how these aspects affect the use of the technology. In addition, we have taken into account principles for universal design in the design decisions aiming at reaching as many of the target users as possible. Furthermore, we have been designing for and with the elderly. Thus, the elderly living at the care unit have been involved in the design process. Throughout the thesis we outline the elderly's needs, and how we could facilitate these needs through designing for a user experience among the elderly in a best possible way.

Working within design anthropology we combine an exploratory study with design. Our contribution is a guidebook, both digital and paper-based, aiming at creating a sense of empowerment and mastery among the elderly.

Keywords: *user experience design, universal design, welfare technology, smart homes, elderly users, guidebooks*

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Christina Haug and Fredrikke Holthe Kvam

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1 Introduction

We have found in our research that elderly are not experienced with technology and are not comfortable using it; we assume this is because of its new existence and rapid evolvement. We can maybe all relate to having grandparents who still go to the bank to pay their bills, and use cash at the store. We have probably all helped our grandparents, or even our parents, with their mobile phones and explained the same features repeatedly. Therefore, providing guidebooks customized for elderly can be helpful to assist them in understanding and applying new technology.

We read in newspapers and other media that *the age wave* (nor: eldrebølgen) is on the way. In a draft, *Case Description – When technologies move to the home*, Finken (forthcoming) defines the age wave as “*a popular expression used as a shortcoming for explaining the socio-economic challenges that evolve when the population of senior citizens increases while the labor force decreases*” (p.2). According to The Research Council of Norway (Hallén et al., 2014), statistical analyzes show that the number of people over the age of 67 will double by 2050. An increase in the number of elderly leads to a greater need for both employees and housing sectors. “*With an aging population, we face a double demographic challenge; the aging population's increased need for health services, while the supply of labor decreases*” (Teknologirådet, 2009, p.5, translated quote). Solutions within *welfare technology* and *smart home technology* can help face these challenges for both the elderly, and the employees in the health care sector. Safety alarms, GPS tracking of dementia patients, video consultation, and tablets that can be used for communication between the citizens and health care providers, are some examples of the many opportunities available within information technology and health (NOU 2011: 11, 2011, pp. 101-105).

Welfare technology is an aspiring branch in the care sector, and design solutions focus on the user and the users’ needs. It is considered as an assistive technology, which can provide support for the users, their relatives and care representatives. Going back twenty years there

was little talk about integrating information technology in the home, but as the technological era is upon us, considerable attention has been paid to welfare technology and how it can be integrated into society. The intention of welfare technology is to create as high quality of life as possible for those who are in need for care. To achieve this, the welfare technology solutions assist people in managing their own lives with less or no need for other people's assistance. The goal of the solutions is helping older people to stay at home and facilitate communication between citizen and health care providers. (Helsedirektoratet, 2012). In this thesis we study a welfare technological solution, and how the elderly living in a care unit embraces this.

1.1 Defining the topic

We were introduced to the topic of smart homes at an information meeting, held by the Design group at the Institute of informatics, regarding potential topics for master theses. As our supervisor presented the ongoing project at the care unit of this study, we became interested in designing a solution that could assist in giving the residents an understanding of the technology, and aid their everyday use of it. We viewed the available topics within smart home technology and learned that the care unit had implemented a welfare technological tablet solution, thus we decided to design a guidebook for the tablet¹. Furthermore, because of our previous knowledge and areas of interest within *User Experience Design*, we wished to learn more about aspects such as involving the user in order to carry out a design process.

After choosing the topic, we attended a seminar about welfare technology “*Tid for velferdsteknologi*”, arranged by Vestfold community college in cooperation with «Trygghetsnett i 12K» and SINTEF on April 17th, 2013. This was in the beginning of our work with the thesis. Because of that we got a valuable opportunity to be presented with an introduction to welfare technology, which made it possible for us to further define the thesis. During the seminar we learned that welfare technology is a wide term covering many aspects. It might be a GPS that a person with, for example, dementia can wear so that his/her spouse can locate that person at all times. The GPS can be implemented directly in the elderly's home or it can, e.g. be a portable artifact developed and customized for a specific disease. The «KOLS-kofferten», directly translated to English as the COPD-briefcase, is a portable box

¹ There already exists a paper-based user manual for the tablet, but it is not being used because it contains too much information (our notes from user training session).

that enables patients with chronic obstructive pulmonary disease (COPD) to receive assistance from a nurse via video communication. These are all examples of welfare technologies and how they can be used to ease the everyday lives of people in need of care. (Our notes from the seminar).

Furthermore, we have attended two other seminars as part of our motivation for gaining information about welfare technology and other relevant topics. On January 28th 2014, we attended a seminar held by The Research Council of Norway about how to meet the age wave (nor: *Hvordan møter vi eldrebølgen?*). Here we got insight into how health care services and health measures for elderly is considered and decided upon in the public sector, as well as what is focused on. The last event we attended was *eForvaltningskonferansen*, organized by The Norwegian Union of Municipal and General Employees with partners on February 12th, 2014. The theme of the conference was usability (nor: brukervennlighet) and “*What are the experiences we are left with after two decades of big government and municipal ICT projects?*” We learned about how the major agencies in Norway have proceeded in the development of digitizing their services and introducing self-service systems. Furthermore, the challenges and benefits this has caused and how important usability is and how challenging this can be when the target audience is people of different ages and life situations, such as people suffering from illness. (Our notes from seminars).

Through the participation in these seminars, we have gained an insight into what welfare technology is, and how it is treated and developed in both the private and the public sector. This provided us with a useful basic understanding of how welfare technological solutions work in practice and how they are emphasized. In addition, the seminars contributed to our understanding of the current position and growing importance of areas within smart home and welfare technology in the community, which we find particularly interesting.

The welfare technological solution in the focus of this study is evolving as a part of the everyday lives of the elderly residents, and the everyday working life of the employees in the care unit. Thus, we contribute to two aspects: We develop a design solution mainly for the residents, but also in certain sense for the employees in the care unit. In addition, we provide experiences about challenges regarding having the elderly as our target users in the design process. We outline these experiences in terms of the recruitment and the conduction of the different user research activities. Future researchers or designers can view our experiences

regarding conducting interviews and usability testing as a source of information on the challenges that exist within designing for and with elderly user. Through the study, we thus contribute to both the academic community and the care unit.

1.2 Defining terms

Throughout the study we use the terms *older people* or *elderly*. Other researchers categorize this population, e.g. as “*the young-old ages 65-74, old-old ages 75-84 and the oldest-old aged 85+*” (Crews & Zavotka, 2006, p. 113). However, defining who is *older* can be a challenge when involving elderly (see e.g. Huldtgren, Detweiler, Alers, Fitriane, and Guldemond, 2013; Brandt, Binder, Malmberg, & Sokoler, 2010). Huldtgren et al. (2013) discuss the issue of elderly who do not perceive themselves as old. When we use the terms *older people* or *elderly*, we refer to chronological age, i.e. those having lived 67 years or more. As mentioned earlier (p.1), *Teknologirådet* use this age in their description of an aging population. We are not referring to the general older population, but the elderly living at the care unit. Furthermore, there exists a diversity in the group of older people. Two people of the age of 78 are at the same chronological age, but their biological age can be different. Despite this diversity in the older population, most solutions designed or developed are not customized for elderly and does not take diversity into consideration. As stated by, Finken and Mörtberg (2014) “*Digital domestic care technologies feed on the idea of a homogenous group of citizens, through which heterogeneity of older people also gets blurred*”(p.8). Thus, the inclusion of elderly is important in order to consider the diversity amongst elderly, when it comes to their needs, wishes, aims etc.

We have been focusing on designing a guidebook customized for elderly. The guidebook is for the tablet that is implemented in the specific care unit of this study. This care unit opened in September 2012. It consists of 91 apartments for people over 67 years of age with disabilities. Each apartment is equipped with smart home technology such as automatic lighting, optional safety alarm and a tablet. (Finken, forthcoming). The term *tablet* is translated to Norwegian as *nettbrett*, and could be directly translated into Internet board. This should imply a board with Internet access, and well-known examples are *iPad* or *Samsung Galaxy Tab*. However in this thesis, we refer to this specific tablet implemented in the care unit.

Guidebooks are artifacts that we all can relate to and they are not always easy to use. We have all bought a dresser or a DVD-player and tried to use a manual to put it together or install software, and experienced difficulties in understanding the instructions given. Therefore, an important issue we wanted to address in this study has been: How to design a usable guidebook? We use the term *guidebook*² instead of *user manual*³ regarding our design solution. This is because the solution we have designed provides more than just guidelines for the functionalities, i.e. it provides general information about the functionalities, how to solve potential errors that may occur, as well as the guidelines. Thus, it is supposed to be a complete guide to the tablet, and not only instructions on how to use it. Therefore, we find it appropriate defining a guidebook as consisting of more features than a user manual. Further in this chapter we specifically outline our problem domain and present our research questions. In addition, we provide a brief overview of each of the chapters in this thesis.

1.3 Problem domain

Our first encounter with the care unit of the study was in the beginning of 2013. We were invited to participate in a meeting about the tablet. Present were an employee from the developing company of the tablet, the general manager of the care unit and three other employees. In addition, two elderly residents were also present. During the meeting we noticed that the elderly found the tablet fascinating, but they had trouble navigating and understanding how to use it. Seemingly simple tasks, such as making a phone call or listening to the radio, proved to be difficult for one of them to do without assistance. Thus, the need and desire for a guidebook became evident. We further discuss our experiences from this meeting in Chapter 6.1.1.

To further describe our problem domain we present a scenario where we meet Gudrun, who is made anonymous by us, and experience her use of the tablet. The scenario is written based on information collected through interviews with employees and their experiences with the elderly's first encounters with the tablet. Scenario: *“Gudrun is using her tablet when the screen goes blue. Gudrun becomes anxious and believes she has destroyed the tablet. She puts it away instead of trying to find a solution to the problem.”*

² Dictionary.com defines a guidebook as a book of directions, advice, and information.

³ The Free Dictionary.com, defines a manual as a small reference book, especially one giving instructions.

This scenario provides an introduction to the challenges faced by elderly using technology, e.g. they may be hesitant towards technology. Aspects we wanted to consider are diversity and motivation, which are important when designing and including elderly users. This is further outlined in the literature review. With our guidebook we hope to contribute to provide a low-threshold solution and give the elderly a sense of empowerment, by being able to use the guidebook to solve the problem on their own, instead of asking for help. It is also our wish that the guidebook can assist in freeing up the time the employees use in providing assistance with questions and problems regarding the tablet.

1.4 Research questions and purpose

Two important aspects of our thesis are *design for and with the elderly* and *design for all*. We have chosen to divide our research question into two parts, one exploratory and one design. In order to design the guidebook in a best possible way, we consider it valuable identifying the challenges the elderly experience with the tablet. Thus, our research questions are as follows:

1. Exploratory: What are the challenges faced by the elderly regarding the use of the tablet?
2. Design: How to best design a guidebook to meet the challenges faced by the elderly?

Through our twofold research question, we combine an exploratory study with design. We apply the approach of design anthropology to support our work. Thus, we combine ethnography with design in order to transfer our results from the exploratory part to design a solution that conveys these results in the best possible way. During the exploratory part we conducted interviews in combination with observations to identify the challenges and further gather information about the users and their needs. In the design part, we developed the design solution in terms of transferring these needs into requirements for the guidebook solution. Furthermore, we developed the prototype and evaluated this solution by conducting usability test. In the design part, we have additionally emphasized the following, which we will discuss further throughout the thesis.

- How to design for diversity?
- How to design to support motivation?

Thus, the outcome of the study is a guidebook for the tablet, which we have designed based on findings from the user research. In the involvement of the elderly in the design process, the elderly's role has been to provide their insights on the implementation and current use of the tablet, and their opinions regarding the development of the guidebook. In addition, they have offered feedback on the design solution.

1.4.1 Diversity, motivation and design challenges

Older people experience a decrease in cognitive and bodily functions, as a result of age. The extent of this varies among the group. Similarly, their experiences with technology may also vary from person to person. Thus, while designing, diversity should be considered. Janson, Mörtberg and Berg state that there is no such thing as an ideal user (as cited in Finken & Mörtberg, 2014, p. 8) and solutions should therefore consider the differences in the user group. Universal design can aid in resolving this issue. This is further explained in Chapter 4.2.

According to the Norwegian Health Directorate's report, motivating for use is an important part of designing, and the usability and utility of the technology are important aspects for motivating use (Helsedirektoratet, 2012, p. 37). With the guidebook we hope to create acceptance and desire to use the technology by customizing the design solution in a best possible way. Thus, motivation is an important factor. Merriman-Webster states "*Motivation is defined as the forces acting on or within a person to initiate behavior*" (as cited in, Phillips, Shneider, & Mercer, 2004, p. 52). This implies that without motivation being present, a task will not be performed or a system will not be used. This can also be transferred to the aspect regarding the use of the tablet. If the users do not have any motivation to use the tablet, it may result in them not even wanting to use it. We believe this motivational factor can be the guidebook; because with this we can illustrate usefulness through the explanations of the functionalities and help the elderly in understanding the different features on the tablet, hence motivate the elderly to use the tablet. Thus, we hope the design of the guidebook will consider the diversity and provide the users with motivation, so that they can experience and understand the benefits that may come with the technology on the tablet.

As a designer, one may encounter challenges regarding designing systems that are perceived as useful for the users and not a design based on the preferences of the designer. A challenge

is often to identify what the user wants from a system, so that the designer can provide usefulness and usability to the user. In many cases, users do not know what they want and therefore it is a challenge for a designer to interpret what the user is saying and doing, hereby aiming at identifying their needs and further establishing the system requirements (Sharp, Rogers, Preece, 2007). Our goal has been to design for and with the elderly, and in order to do this we have included the elderly in the design process. By including the users in the design process, we should achieve a better understanding of their challenges with the technology and therefore achieve a better understanding of the challenges the elderly face regarding the use of the tablet.

1.5 Thesis composition and structure

In this section we present a brief overview of each of the chapters in this thesis.

Chapter 2 - Literature review: In this chapter we present research areas we find interesting and relevant regarding our focus in the thesis. The areas we have chosen are qualitative studies of smart homes, user involvement with elderly, tablets and elderly users, universal design and elderly, as well as previous studies done on development of guidebooks. This chapter allows us to review previous research not only to be inspired by what other people have done, but also to find areas where our study can be of importance.

Chapter 3 – Empirical setting: In this chapter we present the care unit, the tablet and the people of interest in our study. We also present welfare technology and argue for the term.

Chapter 4 - Design framework: Here we present our design framework inspired by the relevant literature. Thus, we present in detail the theoretical principles we have chosen to adopt in order to explore the target users by conducting user research, and further the principles adopted in the design process. Additionally, we outline the design principles we were inspired by and therefore applied in our design decisions.

Chapter 5 – Methodological approach: In this chapter we present design anthropology, which has been an approach of ours. In addition, we outline the different research and design methods we have applied to answer our research questions. We explored aspects of the tablet through interviews in combination with observations, and further applied the methods of

prototyping and usability testing for evaluating our final design solution.

Chapter 6 – Designing for and with elderly users – A design for all: Here we present our findings from the user research in the exploratory part and further explain how we carried out the design process. We discuss the findings and relate them to the reviewed literature from Chapter 2 and the design principles from Chapter 4.

Chapter 7 – The Guidebook – Introducing the prototype: In this chapter we provide a detailed description of the guidebook, both the digital and the paper-based version. We illustrate the design using screenshots and excerpts from each version.

Chapter 8 – Conclusion: In this chapter we gather the threads, and summarize the work we have done and the findings we have made. We conclude the chapter with our contributions and our thought for further research.

2 Literature review

In recent years there has been an increasing amount of literature mentioning the digital divide, and the differences in use of technology between young and old people (see e.g. Selwyn, 2004). In a report from the Norwegian Health Department, elderly's use of technology has increased in the last few years, and they expect that this growth will continue (NOU 2011: 11, 2011). Even though the use of technology has increased, older people often experience more challenges in using technology (see, e.g. Culén, Finken, & Bratteteig, 2013; Dahle, 2012; Van Horen, Jansen, Maes, & Noordman, 2001). Previous research conducted has shown that several factors can contribute to this, e.g. a lack of experience with technology. In addition, older people often experience cognitive and bodily impairments, such as impaired vision, loss of hearing and reduced motor skills and memory.

In this chapter we outline what other studies have depicted on our topics of research. Based on this, we explain how our study differs from or is similar to these. We have chosen to focus on five research topics and relate other research on these to our thesis: *Qualitative studies of smart homes, user involvement and elderly, tablets and elderly, universal design and elderly and design of guidebooks*.

2.1 Smart Homes

“A ‘smart home’ can be defined as a residence equipped with computing and information technology which anticipates and responds to the needs of occupants, working to promote their comfort, convenience, security and entertainment through the management of technology within the home and connections to the world beyond”
(Aldrich, 2003, p. 17)

Although the concept of smart homes is well established, there is still a lack of academic research on the topic (Aldrich, 2003, p. 26). In recent years, the focus on welfare technology, especially smart homes have increased in Norway (see e.g. Helsedirektoratet, 2012; NOU

2011: 11, 2011). In order to relate previous research on smart homes to our thesis, we consider it important to provide a definition of what a smart home is. A smart home “should *enhance the independence and improve the quality of life of residents*” (Demiris et al., 2004, p. 89). A smart home consists of integrated technological solutions to aid in everyday activities and provides a feeling of safety and security. Some of the features of a smart home can be safety alarms, movement activated lighting and sensors in the bed that send out an alarm if the resident does not return to the bed before a certain amount of time has passed (Lê, Boi, & Barnett, 2012, p. 610). Additionally, Lê et al. (2012) define smart homes as “*the integration of home-based technology and services for a better quality of living*” (Lê et al., 2012, p. 608). An important aspect from this is that they recommend “*close consultants with potential users need to take place before, during and after the construction of smart homes*” (Lê et al., 2012, p. 614). This is important because by including the potential users in the design process, their needs and challenges are understood by the designer, which can increase the usefulness of the smart home. Other researchers support this statement (see, e.g. Culén & Bratteteig, 2013; Hawthorn, 2003). The usefulness of a design and the importance of including elderly users in the design process are further discussed below.

Lê et al. (2012) highlight how one should consider many aspects before building a smart home so that it is not created beyond the reach of its potential use. This is mainly due to financial issues. The paper focuses on how to design smart homes for elderly. While Lê et al. (2012) focuses on smart homes as a whole, we have focused on one specific technology inside the smart home, i.e. the tablet, which we have learned is a welfare technological solution. The developer of the tablet also defines it as welfare technology. The tablet as a welfare technological solution is discussed more closely in Chapter 3.4. The relevance for our study is that it focuses on how people can grow old in a positive way with help from technology. This is closely related to our research question regarding motivation for use in terms of providing the users with an artifact that can assist them in both understanding and using the tablet so that they can enjoy the benefits that come with it and therefore experience how technology can contribute to positive aspects.

An example of a previous study done on smart homes is Anne Jorunn Berg’s study on smart home technology in three smart home prototypes in North America in the mid-90s (Berg, 1994). In her study she focused on why housework was not considered when designing a smart home and how gender differences were overlooked in the design process (Berg, 1994).

This topic differs from ours, but her paper is relevant because it outlines the challenges of designing and the biases that can be transferred from developer to the product. The study discusses issues regarding what the designers take into account when designing, in addition to the issue of not designing for the users who actually use the product. By reading this paper, we have been inspired to consider what it is that the user really wants. As designers, we must pay attention to what the user needs, not what we as designers wish to design. We have to design so that the guidebook is to assist the elderly in using the tablet, and make sure it meets their challenges. These are aspects we have taken into consideration in our design process.

The studies mentioned in this section have studied smart homes for all ages, not specifically for older people. However, a report has been written on a project (BESTA 2000) of implementing a smart home in Tønsberg for older people with dementia. This was the first care unit in the world to implement smart home technology (Bjørneby, Clatworthy, & Thygesen, 1996, p. 39). This project places the study of smart homes to Norway, as the first country to implement smart home technology for older people.

2.2 User involvement with elderly

“Sensitivity and awareness of users’ motivations for participating are important considerations in working successfully with older people” (Eisma et al., 2004, p. 134).

There are a number of issues that needs to be considered when designing for and with elderly users. Firstly, current elderly have not grown up with technology like young people have, which may lead to a different view of technology and other challenges that are difficult to predict (Wagner, Hassanein, & Head, 2010, p. 870). Wagner et al. (2010) did a literature review on computer use by elderly users. Their survey of literature found reasons for non-use of technology, e.g. a perceived lack of benefit and a lack of interest or motivation, which can be important to consider when involving elderly users (Wagner et al., 2010, p. 874). Secondly, with increased age, there is diversity in the loss of motor skills, reduced vision and hearing and changes in cognition, such as memory loss and a prolonged ability to react (Ijsselsteijn, Nap, Kort, & Poels, 2007). Therefore, it is important to include the elderly in the design process so that the system is user friendly and understandable for them, i.e. designing for the intended user.

Some studies have been conducted on how to design for and with elderly, and the challenges that may come with this (Culén et al., 2013; Gregor, Newell, & Zajicek, 2002; Aarhus, Gronvall, & Kyng, 2010). Dickinson, Arnott, and Prior (2007) explain characteristics of elderly that researchers must consider when designing with elderly; these include lifestyle characteristics, sensory and cognitive changes and mobility and illness (p. 3). Dickinson et al. (2007) describe how these characteristics create challenges when designing for and with elderly and should therefore be taken into account when designing. Firstly, older people tire more easily than younger people, which can affect the duration of an interview or a usability test. Secondly, most elderly suffer from reductions in the ability to remember and perceive and impaired vision, which can influence the responses you achieve during user research. Thirdly, many elderly have poorer mobility skills, which make it harder for them to move around, meaning, the researcher has to have the opportunity to come to them. (Dickinson et al., 2007).

Culén et al. (2013) did a study on a smart gym at the same care unit as our study, and found that the machines and the technology were difficult to use and manage by the elderly. They describe the importance of bodily and cognitive mastery when designing technology to be used for exercise in a gym, *“in order to exercise one has to master the gym equipment and its technology, cognitively as well as bodily”* (Culén et al., 2013, p. 609). This can be directly transferred onto our study in the sense that mastery is an important aspect for using the tablet, and both cognitive and bodily functions influence the use, and these can vary from person to person. This leads us into the topic of diversity, one of the most important issues to consider when designing with elderly (Brandt et al., 2010; Gregor et al., 2002). Various aspects can elucidate diversity in elderly users, e.g. diversity in age and impairments, technological abilities and needs. Brandt et al. discusses the term of situated elderliness, which they define as *“practices that include activities that for some reason or another has become more challenging or perhaps even impossible to carry out by himself or herself”* (Brandt et al., 2010, p. 402). Situated elderliness creates diversity in the sense that introduction of technology can create differences and exclusion in a user group, e.g. *“when a bank decides that all transactions have to be carried out over the Internet”* (Brandt et al., 2010, p. 402). This excludes all the customers of the bank who do not use the Internet. Diversity is also present in what the users require from the technology. The needs of elderly users differ, not only from the needs of younger people, but also within the user group.

Aarhus et al. (2010) carried out design-work regarding user involvement with elderly people suffering from vestibular dysfunction, which they define as “*an inner-ear problem causing vertigo*” (p. 1). Despite the fact that the study focused on transferring training sessions from the hospital to the home, it is relevant in that it outlines different challenges when using elderly as a user group and how to deal with these, e.g. motivating the user to do the exercise, adjusting activities to the person’s current state of mind and the challenge of working with several different elderly users throughout the study. Aarhus et al. was designing “*new technology with and for elderly*” (Grönvall & Kyng, 2012, p. 391). The paper also describes the challenges of working with ill users, which is closely related to the topic of age-related impairments mentioned earlier. The impairments can also pose a challenge when it comes to the feedback and the performance of the different tasks and activities.

According to Eisma et al. (2004), there are several challenges to consider when involving elderly. The paper covers how older adults perceive technology and how they can be included in the development process.

These studies advances our understanding of the possible challenges we have to consider when involving elderly users in our design process, such as the possibility that their cognitive deficits may affect the feedback, and that the duration of the encounter is affected by the fact that elderly people tire easily. In addition, many elderly experience difficulties in using technology (Culén et al., 2013, p. 609). In the following section we outline how these challenges are relevant according to diversity and motivation.

As mentioned, Culen et al. (2013) discuss the importance of mastery of technology, which is influenced by cognitive and bodily mastery. Mastery can be related to the perceived usefulness of a design and thus, the motivation for using it. Culen et al. (2013) concludes that elderly need to gain both cognitive and bodily mastery as a factor to influence motivation. A study done by Neil Selwyn points out that “*when a system is useful and training is made available, older adults will take part in the Information age*” (Selwyn, 2004, p. 382, cited Rousseau & Rogers, 1998, p.427). This is supported by Eisma et al. (2004) who claim that elderly are more likely to use technology if they are positive towards it. They studied patterns for technology use and found that a user’s perceived usefulness of a technology is important in terms of whether the technology is used or not, especially when it comes to elderly. Similarly, Selwyn (2004) did a research project on patterns of elderly’s motivation for use and

non-use of technology. He found that most elderly acquire computers through encouragement from family and friends. *“Family and friend are therefore very important elements in many of our interviewees’ adoption of ICT”* (Selwyn, 2004, p. 374). Friends and family can be important for learning when elderly are introduced to new technology, such as the tablet in our case. However, for motivating use, the elderly needs to be made aware of the usefulness of the design (Eisma et al., 2004, p. 139). The usefulness of a design is closely linked to motivation. Based on the definition of motivation by Meriman-Webster (as cited in, Phillips, Shneider, & Mercer, 2004) mentioned in Chapter 1.4, motivation and the feeling of accomplishment drive human behavior. Hence, in order for humans to be motivated to use, e.g. technology, we need to understand its usefulness. If a user does not see the value of the technology, s/he will not use it. If the user does not know how to use the technology and find it hard to learn, the user will most likely not use it. The usefulness of a design is therefore an important aspect in order to increase use.

Many elderly are not motivated to learn new technology. Often, this is not related to the ability to learn the technology, but rather the fact that they do not need it (Tacken, Marcellini, Mollenkopf, Ruoppila, & Széman, 2005, p. 128). Davis (1993) also studied perceived usefulness as part of the Technology Acceptance model. *“The technology acceptance model (TAM) specifies causal relationships between system design features, perceived usefulness, perceived ease of use, attitude toward using, and actual usage behavior”* Davis (1993, p. 475). Figure 1 shows how the Technology Acceptance model is structured.

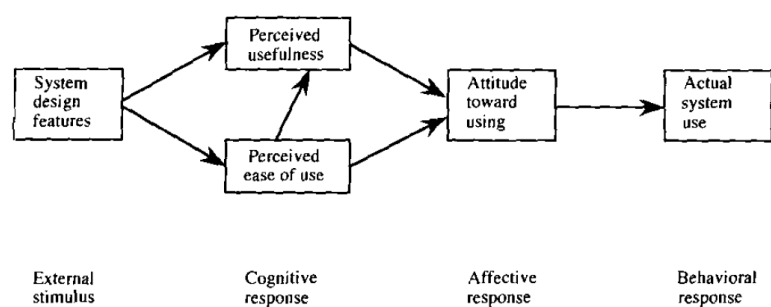


Figure 1: Technology Acceptance Model (Davis, 1993, p. 476)

Davis states that increased use requires acceptance of technology, perceived usefulness and perceived usability (Davis, 1989, p. 320). Davis’ technology acceptance model is relevant for our thesis in that it can help explain the reasons why people do not use the technology developed, e.g. a technology needs to be user-friendly and usable and it needs to give the user a sense of utility. In our study, this means that we have involved the elderly themselves so

that they can articulate and point to what the terms user-friendly and sense of utility is for them, so that we can design to support this in the best possible way. These reasons can inspire us in the design of the guidebook, to help increase the use of the tablet through the use of our guidebook.

Summing up, it can be concluded that motivation for use and understanding the utility of the technology are two key aspects to designing useful technology. By considering the usefulness of the design when designing it can be easier to accompanying the user's needs. This is discussed in Chapter 4.1 where we relate the importance of the usefulness of design to the design of our tablet.

2.3 Tablets and elderly users

Tablets take part in the recent introduction of welfare technology, and aims at simplifying the everyday lives of elderly people (see e.g. "Altibox - Velferdsteknologi," n.d; Haugan, 2011). There have been a number of introductions to the use of tablets by elderly in the literature. In this section we present a sample of them. Bærum municipality has, in cooperation with the University of Oslo and Sintef, introduced a group of elderly to the use of tablets, as a means for communication and social contact as well as an aid in the home (Kjærnlie, 2014). In Trondheim, a group of elderly has tested an application on a smart phone: "*On the new app, the elderly post activities remain informed about various events that might suit them and see which of their friends are participating*" (Dragland, 2014, translated quote). In a master thesis from Stavanger (Dahle, 2012), elderly's difficulties using an *iPad* are described. The study highlights the impact of cognition, belief in mastery of technology, and experience with technology in relations to the ability to perceive and use smart home technology (Dahle, 2012, p. 38). Our study is limited to focus on a specific tablet solution, implemented in a smart home care unit, and used by the elderly residents.

In 2012, Werner et al. published a paper in which they describe the use of an *iPad* to evaluate the usability and the acceptance of tablets by elderly. The study shows that tablets can ease the access to the Internet, and the participants were positive towards the tablet. Alvseike and Brønnick (2012) did a similar study on smart home technology and how the elderly are able to use an *iPad* to control the technological solutions implemented in their homes. However, the results of the study differed from that of Werner et al.'s (2012) in the sense that the study

showed that more than half of the participants are unable to use the iPad to adjust the lighting, regardless of age. These studies relate to ours in that they both concern elderly and the use of a tablet. While the tablet in Alvseike and Brønnick's (2012) study is used to control lighting, our tablet is in a way used to control everyday activities, as explained in Chapter 3. By reading the paper, we gained insight into user involvement with elderly users and how they interact with a tablet, in that case, an iPad. Lessons learned from reading this paper is the factors to consider when designing for elderly users, such as the effects of cognition, self-efficacy and previous experience with technology (Alvseike & Brønnick, 2012, p. 303). These studies are also supported by the literature described in the section about user involvement above.

Culén and Bratteteig (2013) also identify the challenges of the use of touch-based screens by elderly adults. One of the key aspects in this paper is the importance of listening to the user's explanations, not just why they use the technology, but also why they choose not to use it. To design a guidebook for the use of the tablet, we have to be aware of the challenges and hesitations for using the tablet, so that the guidebook could fit all users and their needs. Most tablets are designed for the general population and not specifically for elderly people (Jin, Plocher, & Kiff, 2007).

To sum up, there exists diversity in the group of older people when it comes to the use of technology. In this case, these differences need to be considered regarding the use of the tablet, and in order to include older people in design.

2.4 Universal design and elderly

The topic of universal design started evolving in the 1950s and in the first decades, most literature was focused on universally designing buildings (Institute for Human Centered Design, n.d). In recent years, there has been an increase in the focus on developing universally designed ICT solutions (see e.g., Kim et al., 2007; Marcus, 2003; Plos & Buisine, 2006). In Norway, regulations for universal design of ICT solutions have been introduced. The regulations state that: *“All new ICT solutions developed must be universally designed as of July 1st 2014. Existing solutions shall comply with the requirements by January 1st 2021”* (Difi, 2013, translated quote). We consider the way this affects the design of new solutions as important and aim at taking these guidelines into account in our design of the guidebook.

In order to understand how to universally design for elderly, it is important to provide a definition of what universal design is. Derived from a paper by Crews and Zavotka (2006), universal design can ease the everyday lives of elderly, by assisting in the completion of day-to-day activities, e.g. showering, toileting and cooking. They claim that universal design is adjusting the surroundings to the person, instead of the person adjusting to the surroundings (Crews & Zavotka, 2006). Demirbilek and Demirkan's (2004) statement, "*A house that is inadequate for the needs of the people living in it, never becomes a home*" (p.361) supports the claims by Crews and Zavotka.

In the literature, "supporting aging in place" is an important factor (Demirbilek & Demirkan, 2004, p. 361). Demirbilek and Demirkan (2004) discuss the importance of including elderly users in the design process, so that the designer understands their needs and requirements more clearly. Hawthorn (2003) supports this view and discusses universal usability in a study resulting in an email system for elderly. He argues that in order to design for elderly, it is not enough to depend on guidelines; rather the designer has to include the elderly in the design process (p.38). Thus, when designing a guidebook, universal design should be considered, especially when designing for elderly users. As mentioned earlier, Culen et al. (2013) studied the impacts of bodily and cognitive mastery to use gym equipment. They discuss challenges the elderly faced when interacting with the technology, e.g. because of an inconsistent use of icons. Given that cognitive and physical abilities reduce with age, universally designed solutions are important so that the technology is available for everyone. As previously mentioned, use of technology is motivated by the usefulness of the design. The elderly included in our study are over the age of 67, and differ in their experiences and knowledge regarding technology. The diversity in the user group poses challenges to the design. Universal design is therefore an important factor when aiming at minimizing these challenges; because when a product is universally designed, diversity is taken into account. As stated by Crews and Zavotka (2006) "*Universal design benefits people of all ages and abilities*" (p. 116). We believe a universally designed guidebook can increase the motivation for use, because its goal is to be easy to understand and easy to interact with.

2.5 Design of guidebooks

User manuals are common for mobile phones and other artifacts. However, there are few user manuals available for assistive technology, such as smart homes etc. With a growing elderly population and the increased focus on assistive technology designed for elderly, we believe there should exist instructions on how to use the technology developed. Guidebooks provide the user with instructions on how to use and/or or assemble the artifact bought. Traditionally, guidebooks are paper-based, but designing them electronically has its advantages. Paper-based guidebooks are limited by size, that is, a lot of information must give way due to space limitations (Aoki & Woodruff, 2000, p. 319). It can be a challenge to decide what information to use and what not to use. Digital guidebooks can resolve this challenge in that they have unlimited space (Aoki & Woodruff, 2000). Studies have been conducted on the effects of the lack of information in a guidebook, especially focused on the effects on elderly users (see e.g., Christoffersen & Møller, 2009; Van Horen et al., 2001). Van Horen et al. (2001) discuss how the lack of certain information, e.g. that they need to know what tasks to perform and how to perform them, affected the elderly in their task performance. They conclude that elderly have greater difficulty using guidebooks than younger people, much because of the use of implicit information in the instructions. By implicit information Van Horen et al. (2001) mean the information the users have to interpret from the text given and not information that is clearly described. Cohen states that elderly people have a decreased ability to make inferences (as cited in, Van Horen et al., 2001, p. 429). In the study, Van Horen et al. (2001) found that elderly had trouble performing the tasks when they were not given information about “why” and “with what”; the task was to be performed (p.429). This study can be used as an inspiration for evaluating the information included in our guidebook.

Similarly, Christoffersen and Møller (2009) discuss challenges elderly experience with guidebooks, such as the difficulty of distinguishing what is important and not important in the text and forgetting what they have done and what comes next (p.4). Christoffersen and Møller studied whether or not the use of “*controlled language could make guidebooks easier to understand by elderly people*” (Christoffersen & Møller, 2009, p. 1). Controlled language is used for text in guidebooks and is defined by Nyberg et al. as “*an explicitly defined restriction of a natural language that specifies constraints on lexicon, grammar, and style*” (as cited in, Christoffersen & Møller, 2009, p. 2). Examples of guidelines Christoffersen and Møller present from the European and Danish standard for manuals are the consistent use of terms,

explaining technical terms, avoiding inferences, list steps in a chronological order and illustrate instructions, to name a few (Christoffersen & Møller, 2009). The papers by Van Horen et al. (2001) and Christoffersen and Møller (2009) provided us with guidelines on how information should be presented or what kind of information should or should not be included in a guidebook to make it understandable for elderly. We discuss these guidelines up against our design in Chapter 6.2.2.1.

There is limited research available on guidebooks designed specifically for elderly users. However, chapter three, '*The ethnography of design*' in the book *Design Anthropology* from 2011, presents a project that resulted in a manual for a mobile phone, designed specifically for elderly users. Originally, the project's aim was to design a new mobile phone for elderly people, but the inclusion of elderly users provided the research team with new issues and ideas. The problems the users experienced with the phone, was not because of the users or the device, but rather how the users were able to learn to use the device (Bichard & Gheerawo, 2011, p. 49). In this project, the manual was designed so that the users could place their phone inside a book (that works as a guide) in order to see exactly how setting up the phone (see, Bichard & Gheerawo, 2011, p. 51; Vitamins, n.d). In this way, the information in the manual is directly communicated to the users, thus, eliminating the need to make inferences.

Other research has been done on readability and how improving this can improve the motivation for reading the instructions (see e.g., Michielutte, Bahnson, Dignan, & Schroeder, 1992). In Michielutte et al.'s (1992) paper about writing educational instruction material about health issues, they state that most of the written material is lacking readability and that the ones who need the information most are often those with reduced reading abilities. They propose the use of illustrations and narrative text to improve the readability. Similarly, Bernier argues that, the readability of most of the user instructions is too advanced and requires a higher readability level than the elderly possess (as cited in, Husted, Miller, & Brown, 1999, p. 34). Readability is relevant in this study because we are designing a guidebook, which includes written information and explanations of how the tablet is used. So if the elderly are to benefit from the guidebook, they rely on being able to read its contents.

2.6 Summary

The review of literature in this chapter has focused on qualitative studies of smart homes, user involvement with elderly, universal design and elderly, as well as design of guidebooks. We have presented studies involving elderly users and the challenges that may come from this. Through reviewing the literature, we have learned how elderly interact with tablets and how including elderly in the design process is important related to the usefulness of design for the users and how considering universal design is especially important when focusing on elderly as target users, much because of their cognitive and bodily impairments. In addition, the reviewed research explains functionalities a guidebook should contain in order to be best adapted to elderly users. Throughout the review, motivation and diversity have been key elements to consider when it comes to elderly's interaction with technology, as well as designing technology for elderly.

However, there has been little mention of customizing technology for elderly in the reviewed literature, and this is something we contribute to by designing a guidebook for and with elderly. In addition, most of the studies on smart homes presented in this review have studied smart homes for all ages. However, we are studying a smart home care unit for elderly with technology implemented, e.g. a tablet, and by this we contribute to research on the topic of smart homes and older people.

3 Empirical setting

We have conducted our study and user research at a care unit in Oslo. The apartments in the care unit are smart homes, where welfare technology is implemented. Our main focus has been the tablet that is installed in each apartment in the care unit. Thus, each elderly living in the care unit have the opportunity to apply such tablet in their everyday lives.

In this chapter we present the care unit as being a smart home, the tablet as being a welfare technological solution, and the target users as being the elderly residents and other people/actors involved in our study. We do this to outline the empirical setting for the study in detail.

3.1 The care unit

The care unit opened in September 2012, and consists of 91 apartments for primarily people over 67 years of age with disabilities. Each resident has been offered a safety alarm, and each apartment is equipped with light sensors and a tablet to enable communication between elderly and the employees or between the elderly and their relatives (information gathered from the web page of the care unit). The care unit is a part of Oslo municipality's concept for future residential care units, and has been chosen to participate in a pilot project for the integration of technology in the home (eSenior, n.d; Vestreng, 2013). In addition to being a smart home it is a care+ unit, meaning a housing offer for those who have disabilities that make them unsuitable to live alone, but are too healthy to live in a nursing home (Oslo kommune, 2013). Care+ is part of a Scandinavian project to develop and test smart house technology in the care sector (Oslo kommune, 2013). One of the main differences between a care+ unit and a regular care unit, besides the integrated technology, is the 24/7 presence of a *husvert*. The role of the *husvert* is being available for any kind of inquiries from the residents. Another difference is the activity center, which includes a cafeteria and daily dinners (Oslo kommune, 2013).

The care unit has been an object of study at the Institute of informatics since 2010 as part of the A3 project. Work is ongoing to write a book about this project, including studies from the care unit (see e.g. Finken, forthcoming).

3.2 The tablet

As mentioned, each apartment has been equipped with a tablet to be used by elderly living in a care unit. The tablet cannot be used outside the care unit, because it needs to be connected to the network in the care unit to function. Its features include an activity calendar, possibility for video conversations and IP telephony, Internet access, radio, and the elderly have the opportunity to see the daily food menu for a week. Activities and dinners are added by the employees. Thus, the tablet becomes a tool for digital communication between the employees and the residents. The main intention with this tablet is to provide independence and a feeling of safety, which gives the elderly the comfort of living in their own homes. Instead of moving to a retirement home, they can manage their own lives, with a reduced need of care workers to assist them. (Field notes, September 2012). Figure 2 shows a photo of the tablet.

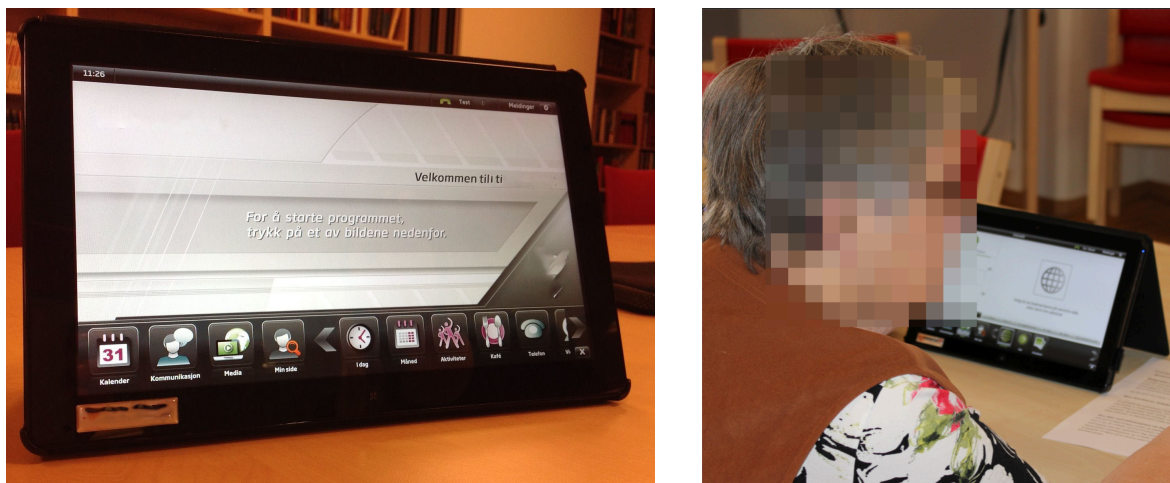


Figure 2: A photo of the tablet, and a photo of an elderly using it

The tablet has several different applications. To provide a better understanding of the tablet's features and applications we present, in the following sections, what the tablet contains and describe the various functionalities (Field notes, September 2012).

Calendar

Using the tablet, the elderly can keep track of their daily tasks and set reminders for appointments etc. The calendar can be used to enter appointments such as hairdresser, visits to the doctor or meetings with friends and family. Using the calendar they also find a list of activities that take place in the care unit and can sign up for these. Additionally, they can see the dinner of the day and order this.

Communication

Using the tablet, the elderly can communicate with their loved ones and other residents in the care unit. They can call, send text messages or make video calls with friends and acquaintances. The calling function is an IP-telephony solution, which means that the users can call for free through the network connection. Contacts can be stored on the tablet so they can easily find them and they can save those frequently used as favorites.

Media

The elderly can use the tablet to surf the web, check the weather forecast and store and view pictures in the photo album. The photo album enables family member to post pictures and share with the elderly. Additional features are radio and gaming.

My page

On my page, the elderly can view a list of all messages/alerts they have on their tablet and they also manage them, such as edit, delete, or confirm them as they are done. Examples of alerts are reminders in the calendar, a received SMS etc. They can also manage the settings on the tablet, e.g. change the language to English, enable/disable the sound for clicking on the screen and activate the radio.

The features described above presents the functionalities of the tablet. In Chapter 7 we explain the guidebook and how we designed it with regards to these features.

3.3 The people of interest

Here we describe the people involved in our study in terms of users and actors of interest regarding our purposes. The target user group consists of the elderly residents living in the care unit presented in this chapter. Additionally, other people we consider as users of interest are the employees working at the care unit. This is because the elderly users are those the interface on the tablet is developed for and they can apply it in their everyday lives. On the other hand, the employees are also users in terms of having it as a part of their job because the care unit they work for has implemented this solution in their offer to the residents. Therefore, the employees should learn it so that they can both add information, e.g. about the activities and the food menu, and be able to assist the residents in using it. Furthermore, involved in our study is also the developing company of the tablet interface in terms of being a source in gathering information regarding the technology of the tablet.

Regarding the main user group, i.e. the elderly, we wanted to include both active users of the tablet and those who used it less. This was to be able to explore the diversity in the user group. They were randomly selected with the help from the employees. Participation in the study was voluntary and the users had to sign an informed consent (see Appendix A). The target users can be defined as a heterogeneous user group, given that the elderly residents have different abilities and experiences with technology. The initial contact with our target users was through the employees at the care unit. As mentioned in the Chapter 1.3, our first encounter with a sample of representative users was at the meeting between the care unit and the developing company of the tablet. Furthermore, we recruited the users with help from the employees and learned to know them through the different methods applied in the user research.

Before ending this chapter we situate the tablet in broader terms of welfare technology and care technology. This is important for achieving a better understanding of the tablet as a technology, to correspond with technological measures within the public care sector, as described in the introduction.

3.4 Welfare Technology

We have presented the functions on the tablet, but how can it be defined as a welfare technological solution? Before discussing this, we define the term, and its intentions.

The term welfare technology is said to have its origin from Denmark and includes many different technologies. It is mostly used in Scandinavia; internationally the term used is *Ambient Assisted Living*. (Helsedirektoratet, 2012, p. 14-15).

“Most elderly prefer to live independently in their own homes as long as possible and postpone moving to senior communities or care centers” (Culén & Bratteteig, 2013, p. 460).

Welfare technology can help make this “wish come true”. By introducing different technology that can assist in everyday life, e.g. fall sensor, safety alarms, tablets with different functions for keeping up with activities and remembering. However, in order to achieve this wish, the technologies should be useable, or it may be or become a hindrance. This identifies the main principle we concern within welfare technology, and thus the reason why we have such a large focus on usability and usefulness design.

The intention with implementing welfare technology is to create as high quality of life as possible for those who are in need of care. To achieve this goal, welfare technology can assist people in managing their own life with less need of human assistance. From another perspective, the technology can enable them to live longer at home, instead of having to move to a nursing home or hospital. We consider the idea behind the tablet as similar to this goal, but we also concern the possible “loss” of the intention if the technology is too advanced for the user group to apply.

Welfare technology is an aspiring branch in the care sector, and the intention of the design is a focus on the user and the user’s needs. As stated by Nis Peter Nissen, *“welfare technology is not about technology ... but about humans”* (Helsedirektoratet, 2012). Welfare technology is considered an assistive technology, which can provide support to the users and their relatives and care representatives. A benefit of welfare technology is that it can help to increase the feeling of safety, the sense of security, participation in social contexts, mobility, and activity (Helsedirektoratet, 2012, p. 15). Welfare technology can be divided into four groups of technology, depending on the user needs, (1) safety and security technology, with the focus on creating a safe environment for the users, (2) compensation and wellness technology,

consists of technology that can assist and improve the wellbeing, (3) technology for social contact, which focuses on implementing technology that helps users get in touch with other people, and (4) technology for treatment and care, with the focus on giving the user the opportunity to be “the master of their health” (Helsedirektoratet, 2012, p. 17). The tablet can especially be considered a part of the two middle groups. Group two in the sense that the use of the tablet may increase social activity, hence increase their wellbeing by not feeling left out or alone. Group three in the sense that by using the tablet, the elderly can call their friends and family and keep up-to-date with what is happening at the care unit, as well as in the world through the internet.

Using the definition and the four types of welfare technology as a basis, we consider it meaningful to discuss why we have been focusing on welfare technology and not care technology in our thesis. In addition to how the tablet is a welfare technological solution. Is there any distinction between these two terms or are they two terms describing the same branch? Can care technology be considered a part of welfare technology, and not as a separate term?

3.4.1 Why welfare technology?

Care technology and welfare technology are often used to describe two different aspects. The report by the Norwegian Health Directory uses both welfare technology and care technology as defining the same. However, a chronicle posted in the “Trønder-Avisa” in 2011 discussed the use of welfare and care as the same, even though they are not synonyms. “*A welfare solution for someone who is self-reliant is considered care for someone in need of technical assistance in their daily lives.*” (Haugset, 2011, translated quote). As previously mentioned, welfare technology exists to assist in everyday life. Care technology can be defined as “*technological solutions that can replace or improve the need for activities performed by care units*” (Drøpping & Fyhn, 2002, p. 17, translated quote). Based on these two definitions of welfare technology and care technology, we believe welfare technology is more based on choice than a necessary requirement, while care technology is considered something that is required for the users and can help reduce the workload of the care workers. Care technology is for those who cannot function alone and need assistance. Welfare technology can also be for those who do not need the assistance per se, but the technology is used as a supplement for ensuring their wellbeing (see e.g. Helsedirektoratet, 2012). Care technology can contribute to

facilitate and ease care in everyday life, while the welfare technology can help simplify everyday life with technologies as an assisting factor. We believe welfare technology is for everybody, e.g. it can also be used in school or for children with difficulties, while care technology is for those who need it to live their lives.

Based on these statements, we can regard the tablet to be welfare technology and therefore concern the principles mentioned above. It is not a necessity, but it can help ease the everyday lives of the elderly. The different functions implemented on the tablet described in Chapter 3.2 can help the elderly to participate in activities and keep in touch with others. The tablet provides the elderly with the possibility of being both socially and intellectually active. In addition, the tablet enables the elderly to take part in the growth of technology.

3.5 Summary

Throughout this chapter we have outlined the empirical setting of our study and situated the tablet in the field of welfare technology. We have explained the care unit of our study, described the tablet and its functions, as well as presented the persons of interest, which are the elderly residents who live in the care unit, its employees, and the developing company of the tablet. In addition, we have concluded the chapter with introducing welfare technology and why we are focusing on this specific topic.

4 Design framework – drawing out principles for design

A chapter like this is, in many cases, dedicated to draw out the theoretical principles for the thesis. However, since we have been working within design aspects, we find it appropriate to draw out principles for design, and therefore named the chapter design framework.

Thus, in this chapter we outline the design principles we have chosen to apply in our design decisions. Additionally, we outline the principles adopted in the process of creating the design. Sharp et al. (2007) state that design principles are valuable abstractions that aid designers to think about different aspect of their design. Norman (2002) presents, in his book *The Design of Everyday Things*, some well-known examples of design principles i.e. visibility, efficiency, feedback, constrains, affordances and natural mapping. He characterizes design principles in the preface of the book as *powerful tools* for ensuring that a design solution is understandable and usable. We have used the mentioned examples as an inspiration, in the sense of keeping them in mind while defining the design framework in our thesis. Furthermore, Unger and Chandler (2012) argue that having a framework to work within is extremely helpful, and such framework can be defined by using design principles. They define design principles as “*commonly understood rules, assumptions, or guiding statements that define the relationships between the elements of a design*” (Unger & Chandler, 2012, p. 186). Based on our context, i.e. the elderly users, the tablet that is a welfare technological solution and the care unit that is a smart home, we have chosen to concern principles for universal design, welfare technology and smart home solutions. We will, in this chapter, present in detail those principles within these areas we consider important and relevant for our aim. Before that we present the principles adopted in the process of creating the design.

This chapter describes *why* we conducted the activities we did and why we made the design decisions we did, while Chapter 6 gives a detail description of *how* we carried out the process to achieve our goals.

4.1 User Experience Design

We aim at designing for a user experience among the elderly. In the book by Unger and Chandler (2012) named *A Project Guide to UX Design for User Experience Designers in the Field or in the Making*, they broadly define user experience design as “*the creation and synchronization of the elements that affect users’ experience with a particular company, with the intent of influencing their perceptions and behavior*” (Unger & Chandler, 2012, p. 3). In our case, we aim at creating an *interactive design* solution i.e. a guidebook for the elderly who live in the care unit where the tablet is implemented and applied. We hope this will influence their usage of the tablet in a positive way.

Sharp et al. (2007) define interaction design as “*designing interactive products to support the way people communicate and interact in their everyday and working lives*” (p. 8). We consider this definition connected to our goal because we more concrete aim at designing an interactive solution that will *support* the usage of the tablet among the elderly.

Before creating the design, we found it valuable learning to know the users and the technology involved, i.e. the elderly and the tablet interface. Our first task was therefore to investigate the interface on the tablet e.g. the functionalities and the properties. In addition, learning to know the elderly users in terms of their preferences and skills within the technology. We aim at understanding this because as designers one should know about the users, the technology and the interactions between them in order to create effective user experiences (Sharp et al., 2007, p. 11). Furthermore, user experience is described as “*how a product behaves and is used by people in the real world*” (Sharp et al., 2007, p.15).

We will in the following present the principles adopted through the whole process, both in the exploratory part and the design part, some of the principles are adopted in both parts and some are most suitable for either one of them.

4.1.1 User Research

As stated in Chapter 1.4, in the exploratory part of our research question we aim at finding the challenges faced by the elderly while using technology, specifically the tablet in our case. This aim requires research. We have been inspired by the basic steps of user research presented by Unger and Chandler (2012), which are listed below:

- *Define your primary user group*
- *Plan for user involvement*
- *Conduct the research*
- *Validate your user group definitions*
- *Generate user requirements*

(p. 102)

We consider the first four steps as primarily involved in our exploratory part, while the last is moving over to the beginning of the design part of our study. Additionally, some of the user research techniques presented, e.g. usability testing, in the third step is as well adopted in the design part. We discuss this more below.

Concerning the first step and because of the given context of our study, the main user group, i.e. the elderly, involved was defined from the beginning. As mentioned in Chapter 3.3, we consider it important defining which other people who are in some way connected to our user group through the technology. In our case the employees become users in terms of being employed at the care unit, and are therefore using the tablet in their job. We further identify these people as our key persons because we consider them as well interesting to talk to due to their experiences and knowledge regarding older people. We define them and how we conducted the recruitment in Chapter 6.1.

We consider step 2 and 3, which is about planning and conducting the user research in terms of choosing methods and techniques applied, as covered in Chapter 5. But find it meaningful to mention the technique presented by Chandler and Unger (2012) called *Contextual Inquiry*, because after reading and learning about this technique we feel that we recognize the characteristics when we conducted the observations. This is because we conducted these observations in the care unit that is the users' normal and everyday environment, which is identified as a characteristic within contextual inquiry (Chandler and Unger, 2012, p. 108).

Concerning the fourth step, Chandler and Unger (2012) suggest creating *Personas*, which they define as “documents that describe typical target users” (p.130). Furthermore, the recommendations say that one should create at least three persona documents, including their name, age, location, occupation, biography, and a photo (Chandler & Unger, 2012, pp. 134-136). This must be supported by research and therefore consist of *real* behaviors of *real* users. This can help in resolving conflicts that may occur in the design making and decision development, so that the designers can continue with the process. (Chandler & Unger, 2012). We explain why we consider creating the personas valuable and present them in Chapter 6.1.4.

As stated, the fifth and last step is, in our case, overlapping with the next section and the design part in general, and is therefore covered below.

4.1.2 Carrying out the design process

After having defined the user group and our specific aims, we consider it is time to start with the design process. Thus, we describe in the following the principles adopted, and other aspects taken into consideration in order to carry out this process.

Sharp et al. (2007) present the international standard (ISO 13407) that provides guidance on human-computer design activities by illustrating the lifecycle of an interactive product (p.462).

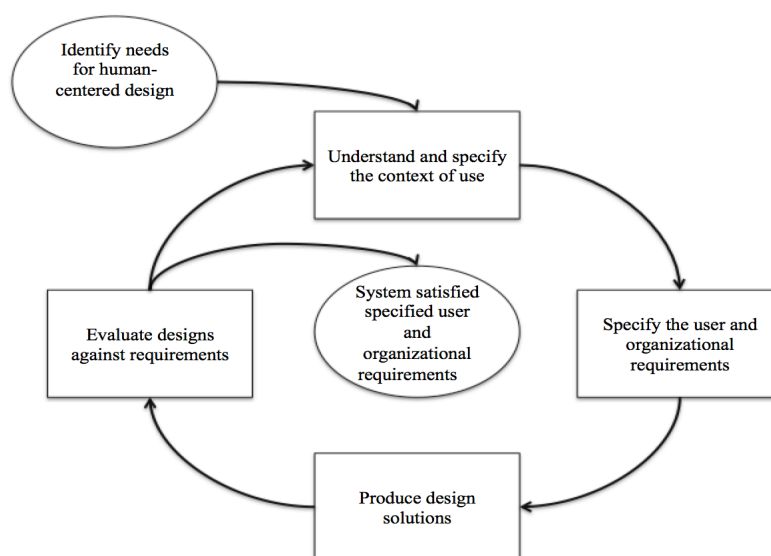


Figure 3: ISO 13407 human-centered design lifecycle model

Figure 3 is adapted from Sharp et al. (2007), and illustrates the human-centered design lifecycle model, suggested in ISO 13407. We consider this model valuable for our aims in terms of concerning the aspect of editing the design solution in relation to the user research and findings during the process. This model illustrates how a design process is iterative because, as Figure 3 shows, the activity *Evaluating designs against requirement* suggests either moving back to specifying the context or that the system is satisfying the requirements. We experienced that our process proved to become such iterative process. An example is that we edited a selection of labels, and certain ways of structuring the information in the prototype based on discoveries made in the user research. In Chapter 6.2 we outline these discoveries in detail.

However, since we are designing an interactive solution for an already existing interactive product, we consider it more suitable to outline and base our process on the four basic activities involved in a design process, which we have adopted in order to design for the user experience among the elderly:

1. *Identifying needs and establishing requirement for the user experience.*
2. *Developing alternative designs that meet those requirements.*
3. *Building interactive versions of the designs so that they can be communicated and assessed.*
4. *Evaluating what is being built throughout the process and the user experience it offers.*

(Sharp et al., 2007, p. 17)

Concerning the first activity presented above, research shows that poor and too little specifying, e.g. of the systems requirements, in an early stage of an IT project can cause problems and failures (Sharp et al., 2007, p. 475). Thus, clearly specifying the user needs and requirements is an activity we consider important in our design process. We identified the user needs and established the requirements by analyzing the findings from the user research we conducted. Sharp et al. (2007) identify requirement as “*a statement about an intended product that specifies what it should do or how it should perform*” (p.476). They further describe the two different terms that are traditionally used for two different kinds of requirements within software engineering. Those are *functional requirements* and *non-functional requirements*, where the first one covers what a system should do and the second

one covers the possible constraints for a system and its development (Sharp et al., 2007, p. 477). We have chosen to adopt these terms, and establish both types of requirements for the guidebook.

Furthermore, we consider the second and the third activity as covering the development of the prototype. A prototype presents a limited version of the design and makes it possible for the users to explore it (Sharp et al., 2007, p. 530). As we describe in more detail in Chapter 6.2.2, we chose to begin this process by developing wireframes, first sketching by hand and secondly creating them using the tool Adobe Photoshop. Unger and Chandler (2012) states that wireframes is used in prototyping of web pages or application screens to identify the elements that will be displayed. With other words, wireframes depict how each page should look from an architectural perspective (Morville and Rosenfeld, 2007, p. 307). We therefore consider this technique as suitable for our aim. Furthermore, literature distinguishes between *Low-fidelity prototyping* and *High-fidelity prototyping*. We consider the process of developing the final prototype and different versions created as covering the properties of both low-fidelity and high-fidelity. In Chapter 5.4.1 we present the difference between them.

Concerning the fourth and last activity, to evaluate what is being built we conducted a usability test. Chapter 6.2.4 describes in detail how we did this, and what we experienced and learned, while the method is presented in Chapter 5.4.2. Usability testing requires planning. Inspired by the book, "*Praktisk brukertesting*", we developed a test plan to be better prepared for the test. According to Toftøy-Andersen and Wold (2011), a test plan should include a date and time for the test, the purpose of the test and what is being tested, a description of the task the users are to perform, questions to be asked before and after the test, in addition to a time schedule for the different users (p. 38). They recommend using three to four participants when you are not experienced with usability testing. Even though we have conducted usability tests in previous projects, we planned to use four participants to test our guidebook. We chose to divide roles, one test leader and one observer, which are also recommended by Toftøy-Andersen and Wold (2011).

To finish up about user experience design, as discussed in Chapter 2.2, in order for the user experience to be successful, a user needs to perceive the usefulness of a design.

“If older people have a positive attitude towards technology in general, they will be more likely to use the device, but this is unlikely to happen unless the usefulness of the device is clearly communicated”

(Eisma et al., 2004, p. 139)

By considering the usefulness of the design when developing the prototype, we aimed at designing a guidebook that could accompany the user's needs and requirements, and aid in meeting the challenges the elderly faced when first introduced to the tablet. In addition, the guidebook can help convey the benefits of the tablet, thus increasing the motivation to use it. Our guidebook contains information about the tablet's functionalities as well as how to use them. Using these, the guidebook can be a motivator for increased use of the tablet.

4.2 Universal design

As mentioned in Chapter 2.4, in recent years there has been an increase in the focus on developing universally designed ICT solutions, and this is partly why we have chosen to apply it as a design principle.

Additionally, we chose to consider it as design principle because our target user group consists of older people and they often struggle with the same challenges as younger humans with disabilities e.g. impaired motor skills and impaired vision (Tollefsen, 2013, p. 30). We further consider it as a non-functional requirement that the system should be universal designed. Thus, we are taking into account principles of universal design, which we consider important for the residents in the care unit. Furthermore, since we are designing for an interface on a tablet, we consider it useful concerning the guidelines developed by the Swedish company Funka Nu, who are leading in the market for developing universally designed ICT solutions (Funka Nu, n.d). They present a set of guidelines for universal design within mobile interfaces in their paper *“Retningslinjer for universell utforming av mobile grensesnitt”* (Funka Nu, 2012). In Chapter 6.2.2.2 we present those of them we consider important and relevant concerning in our design based on our purposes.

Universal design is defined by Tollefsen (2013) as “*Mest mulig for flest mulig*”, directly translated to English “*as most as possible for as many as possible*”. Norwegian Design Council presents seven principles building on the Principles of Universal Design developed by North Carolina State University, The Center for Universal Design.

1. *Simple and intuitive in use: the design should be understandable regardless of the user's experience, knowledge, language skills, or current concentration level.*
2. *Understandable information: the design should communicate necessary information to the user in an efficient way regardless circumstances and sensorial skills.*
3. *Tolerance for mistakes: the design should minimize the damages that could lead to adverse consequences or minimize unintended actions.*
4. *The same possibilities for everyone: the design should be usable and accessible for everyone.*
5. *Flexible in use: the design should accommodate a wide range of preferences and skills.*
6. *Low physical effort: the design should be usable in an efficiency and conveniently way with a minimum of difficulties.*
7. *Size and space for access and use: appropriate size and space should enable access reach, manipulation and use, regardless the user's body size, body position or mobility.*

(Translated from Norsk Designråd, 2013)

After looking at those principles in the article *Maximizing Usability: The Principles of Universal Design* by Story (1998).

The Norwegian Agency for Management and eGovernment (DIFI) presents the following definition of designing universally “*designing, or accommodating, the main solution with regards to physical conditions, so that the solution may be used by as many people as possible, regardless of disability*”. They offer a website that provides information, regulations and tools regarding universal design of ICT, which we have used in order to be sure that we follow the right guidelines in the developing of the design.

As stated, universal design is especially relevant for us because our user group is elderly over the age of 67. Additionally, they often suffer from reduced motor skills and impaired vision as

we learned from reviewing literature. From this we also learned the benefits of including the elderly in the design process to explore the diversity, and not only depend on the guidelines (referring to page 17). Thus, universally designed systems can aid in increasing the usability of a design for elderly. We discuss this aspect further in Chapter 6.2.

4.3 Design considerations regarding welfare technology

In the following we outline why we consider welfare technology as part of our design framework based on our context and aims.

The report about Welfare Technology from the Norwegian Health Director (Helsedirektoratet, 2012) gives a frequent focus on how the technology is supposed to give the elderly the opportunity to manage their own life with no or less external help. In other words, the technology is in many ways supposed to reduce the need of human labor and at the same time create higher quality of live among people who have a need of care. Considering the tablet, gathering all the functionalities in one place, and enabling the elderly users to learn them, may create a feeling of independence and increase their quality of live.

The report presents a part about standardization and communication solutions. We find this part interesting and relevant for our aim. The standardization aspect may be important to take into consideration while designing and developing the guidebook. The report states that standardization on welfare technology solutions is important due to the fact that technology should be able to communicate. They write in the report that this is important for the needs within both health services and welfare services. The reason for this is that standards make sure that information is communicated and understood across different equipment from different producers. And without this feature, the functionalities and purposes might become impaired considering a longer time perspective. The report states that this feature is a limitation of the welfare technology solutions that exists today and presents a vision and goals for implementing standards. *“Vision: Standards should support purposes of good health and welfare among the population”* (Helsedirektoratet, 2012, p. 45, translated quote).

In addition to the purposes for standardization mentioned above, the paper presents a list of objectives by adopting standards, where two of them are particularly of interest for our aim. The first one says that the standards should contribute to high quality work processes, cooperation, research, statistics, development, planning, management and financial benefits reaching all actors involved. We find this goal relevant because taking standards into considerations while designing and developing a guidebook for the tablet might help to promote these aspects. The other goal we felt was relevant is the one saying that standards should contribute that healthcare and patients/users receive user friendly and functional tools that promote quality. As discussed earlier, there is a risk that the tablet does not fulfill its purposes due to the difficulties the elderly have while using it. The main reason the tablet is implemented might disappear, and some users might choose not to use it due to poor interface design and bad customizing for older people. Thus, an elderly-friendly guidebook customized for the right aims may aid meeting these issues.

4.4 Design considerations regarding smart homes

Lê et al. (2012) identify smart homes as having the five basic features as shown in Figure 4. We have taken these features into account during our exploration of the tablet to achieve a better understanding of it in the context of smart home. In addition, we also considered these features when designing the guidebook for the same reason.

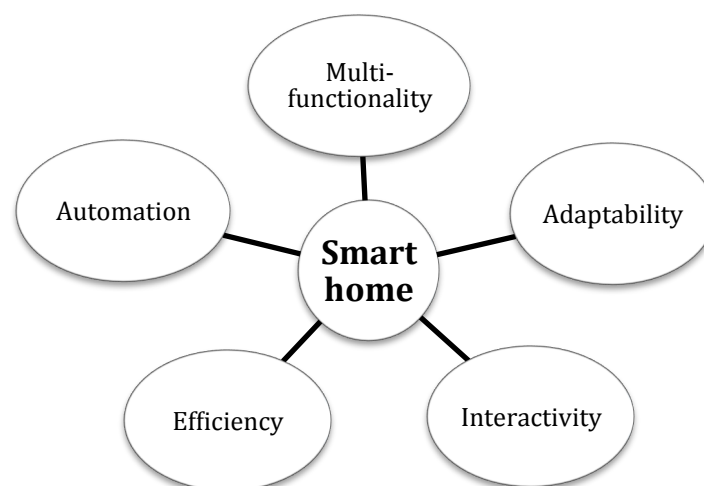


Figure 4: Conceptual Model of Smart Homes (Lê et al., 2012, p. 609)

In order to relate Figure 4 to our study, we present the definitions provided by Lê et al. (2012) on the different concepts (p. 608). In Chapter 8.2.2 we discuss the final design of the

guidebook up against these features.

1. *Multi-functionality: The ability to perform various duties or generate various outcomes.*
2. *Adaptability: The ability to adjust to meet the needs of the users.*
3. *Interactivity: The ability to interact with or allow for interaction among users.*
4. *Efficiency: The ability to perform functions in a time-saving, cost-saving and convenient matter.*
5. *Automation: The ability to accommodate automatic devices or perform automatic functions.*

The challenges Le et al. (2012) identify are as well important aspects to consider. They address challenges such as financial, technical and psychological accessibilities, and ethics. We believe these are in some degree connected to standardization aspect described above. Due to the fact that installing and maintain such technology might be expensive, it is important to collaborate with the right people during the developing. The most appropriate challenge of these four for us to consider was the technical accessibility. They are concerning the limited familiarity many elderly have with the advanced technologies and highlight the importance of not alienate elderly with unfamiliar, unmanageable and unnecessary technology. We considered this aspect as an important part of the background for our thesis. As stated several times, the main reason why we created a guidebook is due to the difficulties the elderly experienced while using the tablet.

To make the technology familiar for the elderly is challenging, if not impossible in this early stage of welfare technology implementation. But with some help from standards and in a long-term perspective, this might be feasible. On the other hand, to make it manageable for the elderly should be possible, and is also considered as a goal of ours. Another goal of the guidebook is that the use of the tablet increase. Such goal is also connected to issues of reducing the introduction of unnecessary technology. By introducing the guidebook, this is a desired outcome.

4.5 Summary

In this chapter we have defined and outlined our design framework, i.e. the design principles applied in the design decisions as well as the principles adopted in the process of creating the design. This creates a background for our choices described in Chapter 6. Based on the context for our thesis, we have concerned principles for universal design, welfare technology and smart home solutions. And furthermore, based on our main aim i.e. designing for a user experience among our target users, we have adopted principles within creating user experience design. Thus, inspired by the literature, we have outlined certain important steps and activities to conduct in order to complete the user research and carry out the design process and those principles to concern in the design decisions.

5 Methodological approach

In this chapter we outline the methodological approach and the methods we have used in order to generate empirical material to answer our research questions. First we present the field of research that we are working within, and then we provide a brief description of the research and design methods we have used to collect data. The data collected, both from using qualitative research methods and the design methods, have laid the foundation for the final design that we illustrate by presenting the prototype we developed. Thus, the prototype is based on the user research, i.e. the interviews, the observations and the usability test explained in this chapter.

5.1 Design Anthropology

The search is for creative insights rather than an expansive understanding of every aspect of a user's life. (Bichard & Gheerawo, 2011, p. 54)

Our study is positioned in the divide between qualitative research and design research. We are combining two mindsets or orientations, one of ethnography and one of design. There are several fields of research that describe the use of ethnography, such as participatory design (Simonsen & Kensing, 1998), and partly in human-computer-interaction (HCI) as described in the book *Research Methods in Human-Computer Interaction* by Lazar, Feng and Hochheiser (2010). Ethnographers aim at understanding human behavior through immersing themselves in what they are studying, while designers are interested in understanding behavior for the purpose of designing to meet the needs of the users (Blomberg, Giacomi, Mosher, and Swenton-Hall, 1993, p. 124). As stated by Blomberg et al. (1993) “*Designers spend more time testing and evaluating their designs in relation to the users' needs and abilities and less on the supported behavior per se*” (p. 124). Thus, ethnography is descriptive in the way that it describes how people actually behave, while design can be prescriptive in that it concerns how people ought to behave (Blomberg et al., 1993, p.125). We have aimed at considering both aspects, both the descriptive and the prescriptive. In doing so we combine

both research and design in order to include the elderly users to design with them, as well as for them and empowering the users through the use of the guidebook. Our study consists of two parts, an exploratory part and the other design. Thus, we draw on insights from HCI and usability in the design, in addition to having an ethnographic perspective with an explorative study. A relatively new field of research that combines the exploratory study and design together is *design anthropology*.

The focus for this thesis has not been on how many of the elderly that use the tablet, but rather how it is used or not used, what challenges the elderly face when using it and how these challenges can be met through a design solution. To decide which approach of method to use there are a number of factors to consider, such as what kind of questions to ask, which methods should be used etc. Which approach to be used, is partly decided by your research questions (Brikci & Green, 2007, p. 7). In addition to focusing on challenges, we focus on the diversity within the user group and how to motivate through designing a guidebook.

Design anthropology can be used when the purpose is to “*enable the designer to identify and investigate issues based on real user needs resulting in a solution customized for the user*” (Bichard & Gheerawo, 2011, p. 54). Design anthropology is a combination of two research fields (Otto & Smith, 2013). While anthropologists study cultures and human behavior, designers are focused on the interaction between humans and computers. Otto and Smith (2013), state that the relationship between these research fields has been through ethnography (p. 2). Murphy and Marcus (2013) discuss the similar aspects of design and ethnography, and state that design and ethnography are both people-centered, focused on research and produce a product and a process (p.257-258). Therefore, besides drawing on insights from user experience design, usability etc. we found it important also to use an ethnographic approach to our research questions. Ethnographic methods, such as participant observation, emerged from anthropology to enable “*long-term immersion of the researcher in a social setting*”, and in this way study everyday practices in detail (Otto & Smith, 2013, p. 2). Blomberg and Karasti (2013) define ethnographic studies to consist of gathering information in the settings they occur, thus, in line with this our data is derived from studies conducted at the care unit and not in a laboratory. Blomberg and Karasti (2013) also state that ethnography emphasizes the importance of paying attention to what people do, in addition to what they say. The use of these approaches enabled us to achieve an understanding of how the users interact with the technology by studying them in their own surroundings, meaning we are studying them in the

care unit during meetings, user sessions etc. as illustrated in the timeline on page 50.

From reading the literature we have learned that designers can benefit from adopting anthropology in the design process. Likewise, the understanding of design can be useful for anthropologists in their research of cultures where technology is implemented by introducing aspects of collaboration. As anthropologists can benefit from learning more about design, designers can benefit from learning more about people and their behavior. While the designer is focused on creating change, e.g. in the patterns of use, the anthropologist try to avoid taking part in what is going on. By combining design with anthropology, collaboration and the focus on change are introduced to anthropology and a better understanding of the user is introduced to the designers (Otto & Smith, 2013, p. 4). “*Design Anthropology moves from observation and interpretation to collaboration, intervention and co-creation*” (Bloomsbury, n.d), as stated in the summary of the book; *Design Anthropology: Theory and Practice* from 2013, on the publisher’s website.

As mentioned in Chapter 1.4, our research question is twofold, one exploratory part and one design part. Therefore, design anthropology can be used to support our work in this thesis, because the two parts of the research question both comprise each role, anthropology and design. The division of the research question can therefore be compared to the relationship between anthropology and design. Our study has been focused on finding the challenges the elderly face with the tablet identified as the exploratory part and designing a guidebook that could meet these challenges identified as the design part. Thus, we aim at transforming the data from the user research into a design solution (Kjærsgaard, 2013). During our study we have focused on two main aspects in order to design the guidebook: investigating the tablet and its functionalities, and exploring the relationship between the user and the tablet. Based on Kjærsgaard (2013), these aspects can be explained as being the focus areas of an anthropologist and a designer, where the former is the focus of an anthropologist and the latter is the focus area of a designer (p. 56). Therefore, we assume that design anthropology is a useful approach when the focus of the study is on both the users and the technology, i.e. when the goal is to gain insight into the human aspects as well as the technological aspects of a study.

Our study is within the interpretive paradigm, despite the fact that some of our methods have their origin outside this paradigm, such as usability testing. The interpretive paradigm focuses

on reality being constructed through the meanings people assign (Myers, n.d). To argue for the reason why we have conducted an interpretive study we draw upon the aspect of diversity, in terms of subjective opinions and meanings the elderly have on the tablet, their experiences with technology in relation to their situation. Thus, we decided to aim at designing for and with the elderly users. This decision was mainly because of our previous experiences and knowledge with including users in the design process. In addition, because we believed that the elderly users involved in this study have different needs with using the tablet. By including them in the design process, we can design a solution that will be of value to the elderly and take their needs into account. In order to conduct this, we have applied different methods of user research.

As designers we learn about the challenges and ways of interacting with the tablet, and through our guidebook we aim at enabling the elderly to learn more about the tablet.

5.2 Our choices

In consideration of the fact that our research question is twofold, we chose to apply certain methods to collect information about the users, e.g. their needs and experiences with the tablet. Additionally, we chose to apply certain methods for evaluating the guidebook. During the exploratory part we used qualitative methods, such as interviews in combination with observation, because we wanted an in-depth understanding of the challenges the elderly faced with the tablet. As stated by Orb, Eisenhauer, and Wynaden (2001) “*qualitative researcher focus their research on exploring, examining and describing people and their natural environments*” (p. 93). We used qualitative methods because we wanted to facilitate discussion around the tablet and thus gain in-depth information from the users than we would if we used quantitative methods, such as questionnaires (Sharp et al., 2007, p. 309). During the design part, we applied the design methods of prototyping and usability testing. We chose to develop a prototype because of the beneficial properties that comes with this methods e.g. the opportunity of analyzing and assessing it as it looks much a like the final product. Furthermore, we chose to conduct the usability test due to the reliable outcome a designer can receive from this activity. These choices are as well discussed in Chapter 4.1 and Chapter 6.2.4. We also used qualitative methods in combination with the usability testing to explore the users' experience with the guidebook. We have combined different methods in order to triangulate our findings and increase their credibility (Sharp et al., 2007, p. 342).

5.3 Exploratory part

Research methods can be used to build an understanding of the users' needs, requirements and attitudes toward a specific technology (Lazar et al., 2010, p. 180). According to Crang & Cook (2007), no research methods can be regarded as separate methods, but they must be used in combination to achieve the best result (p. 60).

In this chapter we present the different research methods we have used to examine the exploratory part of our research questions.

Despite the fact that we are using a design anthropological approach we have chosen to explain the research methods based on literature from HCI and ethnography. The reason for this is that we draw upon insights from the mentioned fields, as well as for designers, observation is about finding the people's needs and desires (Suri, 2011, p. 17).

5.3.1 Interview

Interviews can be divided into four groups, open-ended, structured, semi-structured or group interviews (Sharp et al., 2007, p. 298). Which type of interview to be used, depends on what you are studying and what kind of answers you are looking for. In this section we will focus on semi-structured interviews because this is what we have used in this thesis.

Semi-structured interviews are a combination of structured and unstructured interviews. Like in structured interviews, the researcher follows a guide with pre-prepared questions. However, semi-structured interviews can be used to gain as much information from the interviewee as possible because it allows the researcher to deviate from the pre-planned questions and explore comments by the interviewee (Lazar et al., 2010, p. 189). In addition, by choosing this form of interview, we give respondents the opportunity of elaborating their answers, thus providing us with the opportunity of an in-depth exploration of the topic. Probing, such as asking if there is anything the interviewee wants to add, can also be used to obtain more information from the interviewee (Sharp et al., 2007, p. 300). In this, semi-structured interviews differ from structured interviews, and are therefore better to be used when the researcher's goal is to obtain a deeper understanding of the topic.

The benefits of semi-structured interviews are specifically their flexibility. Even though the researcher has planned the questions ahead, it is possible to change the order of the questions or introduce new ones, based on the responses from the interviewees. A drawback of any interview method is that it requires much work (Lazar et al., 2010, p. 192), both during the interview and after. During the interview it is important to take notes and pay attention to what the interviewee is saying. Thus, when we conducted our interviews, we divided roles; one was in charge of conducting the interview and the other in charge of taking notes. We did this so that the interviewer could concentrate fully on talking to the interviewee without being distracted by having to write down notes and we could additionally pay attention to what the interviewee was saying. In addition, interviews are done with one interviewee at a time and if you have a high number of participants, this is time consuming. After the interview, the most time-consuming exercise is transcribing and analyzing the interview. Robson states that, *“Turning a single hour of recorded discussion into text may take several hours”* (as cited in, Lazar et al., 2010, p. 198).

We conducted the interviews at the care unit. The reason for this is both that it is easier for us to come to them than it is for them to come to us, in addition to the fact that we wanted to do the interviews in a safe and familiar environment for the user group (Toftøy-Andersen & Wold, 2011, p. 44). This according to what we have previously mentioned in the section on design anthropology, about conducting research in its natural occurrence. We divided roles before the interview; one was in charge of conducting the interview and the other in charge of taking notes. We did this so that the interviewer could concentrate fully on talking to the interviewee without being distracted by having to write down notes.

5.3.2 Observation

Observation is useful when you are collecting data in its naturally occurring setting (Crang & Cook, 2007). Observation allows the researcher to observe how (from a designer’s perspective) the object of study is used, as well as finding challenges that are not explicitly expressed by the users (Lazar et al., 2010, p. 228). In design anthropology, a specific type of observation is used to examine the field of study, i.e. participant observation. Despite the fact that we have not applied this method or immersed ourselves in the situation (Crang & Cook, 2007, p.37), we are able to study the “real” interactions in a social setting, in that we are not conducting the study in a lab. This is in accordance to what we have previously mentioned in

the section on design anthropology about conducting research in its natural occurrence. Our observations are based on attendance at different activities at the care unit. We have been present at a meeting and participated in a training lesson about the tablet at the care unit. We observed how the users interacted with the tablet, as well as what they found challenging. We have also conducted observations during the interviews and usability testing as an additional method of gathering data to triangulate our findings.

5.4 Design part

In addition to the research methods we have applied design methods for designing, evaluating and testing our solution.

5.4.1 Prototyping

Prototyping enables the user to interact with a version of the intended design solution (Sharp et al., 2007, p. 530). A prototype can be anything that reminds of or resembles the final product, e.g. a square piece of wood, with the same size or dimensions, to be carried in your pocket as a mobile phone (Sharp et al., 2007, p.530). There are two types of prototypes, low- and high-fidelity. The low-fidelity prototype does not resemble the final product (Sharp et al., 2007, p. 531). The high-fidelity prototype looks more like the final design solution. The first can be done on paper and is simple, cheap and quick to modify, and the second uses material that is expected to be in the final product (Sharp et al., 2007, pp. 531-535). Prototypes can be used to test the functionality of the solution, as well as the designer's intention to understand the user.

During our study, prototyping has been an iterative process as described through Chapter 6.2. Our prototype has been through testing and evaluation to improve the quality of the design. We have designed two high-fidelity prototypes, one digital and one paper-based, which we discuss in Chapter 6.2 and describe in detail in Chapter 7.

5.4.2 Usability testing

A product's usability is an important aspect of the design. To avoid biases, i.e. make sure we have understood the users and their needs, in addition to finding errors or challenges with the design, usability testing can be applied to evaluate if the product is usable for the intended

user (Toftøy-Andersen & Wold, 2011, p. 24).

A usability test is a combination of methods. Toftøy-Andersen and Wold (2011) present a step-by-step guide to usability testing. We used this guide as an inspiration when planning our usability test (see Appendix C). The first step in a usability test is an initial interview, followed by tasks to be done while the designer observes and the test is finalized with an interview gathering thoughts from the user about the product (Toftøy-Andersen & Wold, 2011, pp.71-72).

We used the usability test as a way of evaluating our prototype by testing it with our users to see if we have understood our users' needs and requirements. The process and results from our usability test is presented in Chapter 6.2.4. First, we outline how we analyzed our data through the search of patterns.

5.5 Analyzing our data

In this section we outline our process of analyzing the data collected from the user research. According to Madden (2010), data can be divided into two categories. The first category is primary ethnographic data, which includes field notes, audio recordings and photos. The second is secondary data, which can be previous research on the field of study. (Madden, 2010, p. 137). Through our exploratory study we have collected both of these.

We have analyzed our data by comparing the data from the interviews and observations, and searching for patterns and deviations in both the answers from the users and the behavior of the users. We applied this approach both in order to explore the challenges faced by the elderly, and in order to best design the solution, based on data collected from the user research. With other words, the challenges faced by elderly users, identified in this thesis, are based on using this approach of analyzing the data. In addition, we have used the same approach regarding the design decisions e.g. in order to label and structure the content of the guidebook. This resembles the analytical method of thematic analysis, defined by Braun and Clarke (2006) as “*a method for identifying, analyzing and reporting patterns within data*” (p. 79). The use of patterns to study similarities and/or deviations is also discussed by Madden (2010). Madden (2010) describes analysis of data as the way in which the researcher identifies patterns in their notes that are relevant to the research questions asked (p. 139).

When analyzing data, different interpretations can be made on the same data set (Madden, 2010. p. 140). Thus, we chose to additionally take into account challenges faced by elderly users of technology as described in the literature to strengthen our findings. In addition, we consider recommendations and guidelines within designing for elderly users derived from the literature. In the next section we reflect on the ethical aspects of our study as well as the challenges we faced with our user group.

5.6 Reflections

The ethical perspective is an important aspect to consider when collecting data and conducting research. Confidentiality and informed consent are important ethical issues. The former is, especially in relation to the use of recordings, to ensure that the participant is protected from being identified. The latter is for providing the researcher with a confirmation that the participant is aware of the purpose of the data gathering, in addition to providing the participant information about the study (Sharp et al., 2007, p. 292). In this study, we administered informed consent forms to the users before each activity, i.e. the interviews and the usability testing. In these forms we informed them about the purpose of the study and that they would be participating in the study through observation, interview or usability testing. We informed the users that any information would be treated with confidentiality and we expressed to the user that they could withdraw from the study at any time. We also reported our study to the NSD⁴ (Norsk samfunnsvitenskapelig datatjeneste), and the users were also informed about this in the consent form.

“Designers often think of themselves as typical users” (Norman, 2002, p. 155). This statement leads us to another consideration, the effect the designer has upon the design process and the outcome of it. Ramos presents three problems that needs to be considered when doing research; the relationship between the participant and the designer, the subjective interpretations if the designer and the design itself (as cited in, Orb et al., 2001, p. 94). A challenge for researchers and designers is to put aside their own thoughts and experiences in order to design for the actual users and not design something you think the users want. Thus, when designing and conducting user research it is important to exclude your own thoughts about what you think the user needs, instead listen to what they actually want.

⁴ NSD is a service body for Norwegian research and ensures data dissemination. Its main purpose is to assist researchers and students when it comes to data collection (www.nsd.uib.no)

As previous research has shown, referring to Chapter 2, there are a lot of challenges when designing for and with elderly. By reading other research, conducting data collection through interviews and usability tests seemed like a straightforward approach. In this study, we learned how, in spite of good planning, collecting data and conducting usability testing present challenges when working with elderly users. This is further described in Chapter 6.2.

5.7 Summary

In this chapter we have presented our methodological approach and which data collection methods we have applied to study our research questions. Further, we have reflected on the ethical issues of research and the challenges of designing with an elderly user group. We chose to work within the field of design anthropology because it enabled us to investigate the exploratory and design part of our research question through the use of ethnographic methods as well as design methods. We adopted qualitative methods to collect user requirements, applied prototyping for the design solution and conducted usability testing to evaluate the design. Through the interviews we obtained an overview of the elderly's use and experience with the tablet. By testing the prototype, we evaluated our ability to meet the users' needs. We have also described how we analyzed our data. These aspects are further discussed in the next chapter.

6 Designing for and with elderly users – A design for all

As stated in the introduction of the thesis, we aim at *design for and with the elderly* and *design for all*. *For* the elderly in terms of creating a design that is customized for older people, *with* the elderly in terms of including them in the design process in order to get feedback on the design, and *for all* in terms of creating a design that can be applied by everyone in our user group, regardless of skills and possible disabilities e.g. impaired vision.

In this chapter we present the findings from both the exploratory part and the design part of this study. Firstly, the exploratory part in terms of what we found and what we have learned. Secondly, the design part in terms of how we have used the findings and transferred them into the design solution and how this design process was conducted. We will concern the principles outlined in Chapter 4, i.e. the principles of User Experience Design, Welfare Technology, Smart Home Technology and Universal Design to analyze what the challenges are, what is important, and how this can be transferred in a design solution.

6.1 Exploratory part

So, what *are* the challenges faced by the elderly regarding the use of the tablet? To find answers and explore this, we conducted interviews with the users, both the elderly residents and the employees of the care unit, and with the developing company of the tablet interface. In addition, we have observed how the elderly interact with the tablet and how they express their relations to it e.g. whether they use it or not use it. Further, how they speak regarding which terms they use for different functionalities within technology, specifically regarding the use of the tablet.

	Meeting in the Care Unit	Interviews in the Care Unit	Interview with the Developing Company	Interview in the Care Unit	Observation in the Care Unit	Usability Test of the Prototype
2013, January	2013, September	2013, September	2014, March	2014, March	2014, March	
Our first meeting with both the people, i.e the residents and the employees, and the technology in the care unit. Thus, we were introduced to the tablet for the first time.	We interviewed the employee with the main responsibility for the tablets and two of the residents/the elderly users in the care unit.	We interviewed an employee of the developing company of the tablet interface.	We interviewed the general manager of the care unit.	We observed a training session about the tablet for the elderly users.	We conducted a usability test of the prototype of the guidebook we have designed and developed.	

Figure 5: User Research Timeline

Figure 5 is a timeline that illustrates the activities we have conducted or participated in during our work with the thesis, in order to carry out our user research and when the different activities took place during the process. We will in the following describe them in terms of what we found and learned, and how this helped us to explore the challenges faced by the elderly regarding the use of the tablet.

Let us mention again that the care unit opened autumn 2012, which was the autumn before we started working with our thesis. The official opening ceremony was in January 2013, which means that we have been able to follow it from the beginning. We find this experience valuable because, for example, the opening has been discussed on the news, where e.g. the Minister of Health was present. Thus, we believe that we have been able to discover more interesting perspectives compared to if the care unit had opened several years ago. This is additionally due to the fact that the implemented technology is currently new for both the residents and the employees, and therefore we could compose questions regarding the implementation of the tablet in the interview plans. Furthermore, we believe that this contributes to avoiding biases in the sense that if we would have worked with users who were already familiar with the functionalities on the tablet. With other words, talking with the current users who got introduced to the tablet a short time ago enables us to better customize the guidebook in a way that it can provide usability for elderly newcomers to the care unit in the future as well. On the other hand, if the care unit had implemented the tablet several years ago, we believe both the employees and the residents would have been able to answer more in depth with regards to what they need and wish for in a guidebook. This is because by

applying a system over some years, one can believe that the user would have acquired both meanings and experiences regarding the system, which is an aspect we believe could be beneficial in a study like ours.

6.1.1 Our first impressions

As mentioned in Chapter 1.3 and as the timeline illustrates our first encounter with both the people and the technology in the care unit was on a meeting about the tablet. Present were the general manager, the employee responsible for the tablets and its training, two other employees, two elderly users/residents and one employee from the developing company. Since we were invited to participate in this meeting, we felt that it provided us an opportunity to meet the people of interest in an early stage of the work with the thesis. Thus, we got the opportunity to present us and our thesis. During the meeting we observed how the elderly interacted with the tablet and what they expressed about it. Furthermore, we got an impression of the current challenges faced by the elderly regarding the tablet. We found this participation valuable, and felt that it had provided us with a good starting point for both planning the interviews, and starting thinking about design solutions for the guidebook. For example, one of the users who were present had not used the calling functionality on the tablet before, but she got to try it during the meeting. She seemed happy and impressed that the tablet could do this. Observing this made us think that maybe not all the users were familiar with the different functionalities on the tablet. Thus, we started thinking about what kind of information we should provide the users in regards to the different functionalities in addition to guidelines on how to use them in the guidebook. Further, we observed that the two users who were present obviously had different skills regarding using the technology, which we could see while they interacted with the tablet. Thus, this made us think of the interview plan for the elderly, that we were going to develop, regarding including a question about how they consider their relation and skills within technology.

6.1.2 Conducting the interviews

To explore the challenges faced by the elderly we found it useful to talk to both the elderly users and the employees. As stated in Chapter 3.3, we consider both the elderly and the employees as users of the tablet interface.

Unfortunately we did not have the opportunity to contact the elderly directly, which we experienced as challenging in the recruitment for the user research. Our only chance to recruit users was to inquire those we randomly met at the care unit. On the other hand, we were able to contact the employees. We therefore scheduled a meeting with the employee who is responsible for the tablets in the care unit. We planned and hoped to be able to recruit at least two elderly for interviews the same day. This plan proved to be successful, much because the employee helped us. See Appendix B for the complete interview guide.

6.1.2.1 Interviewing the employee responsible for the tablet in the care unit

On this day, we first interviewed the employee. When we were planning this semi-structured interview, we composed the questions aiming at getting to know her work position, responsibilities, and impressions and experiences regarding implementing the tablet in the care unit. We were also curious about her opinions regarding developing a guidebook for the tablet. She told us that working with the new technology and the tablet is something she had wanted, and that she finds it exciting. She had therefore volunteered to have the main responsibility for the tablets in the care unit. She further told that they had faced some unpredictable challenges in the beginning of the implementation of the tablets in terms of errors that had occurred and that the elderly did not know how to solve them or even did not dare to try. This made us think that we should try to get an overview of all of these errors and implement guidelines on how to solve them in the guidebook. She also said that many of the elderly had not started to apply the tablet yet. This information made us think of how we could motivate for use in our design, which is emphasized in the design part. As mentioned before, we had got the impression that not all of the elderly are familiar with the features and possible benefits coming with the tablet, and that this may be the reason why they do not apply it. The employee stated, *“They can use the tablet to call for free, and this is something we try to use as an enticement aiming that more elderly will use it”* (Translated quote from an interview with an employee of the care unit). The employee further talked about their plan regarding user training of the tablet, which is arranging training sessions one day every second week. She also kindly invited us to participate on one of them, which we did and this is explained further in the design part.

6.1.2.2 Interviewing Eva

We then interviewed the first elderly user that the employee had helped us to recruit. We will call her *Eva* for the purpose of the study. Eva told us early in the interview that she only uses the tablet to see the food menu and the activities in the care unit. This is because it is not possible to look at this sort of information on her mobile phone, iPad or computer, which she uses for other purposes e.g. digitally reading news or using calendar. Therefore, early in the interview we understood that she was familiar with technology. She also stated that she did not have the impression that the tablet was much applied among the other residents in the care unit. And that she had been part of conversations where it had been discussed that it was too difficult to understand the functionalities and how to use them. But she was positive about developing a guidebook, and believed that it could make more of the elderly applying and exploring it, at least try to use it. Especially if it would be both digital and paper-based since this could reach a larger amount of the elderly in the care unit according to her.

6.1.2.3 Interviewing Ruth

The same day, we interviewed a second resident, whom we call *Ruth*. Ruth could tell us that she managed technology on an average level because she had used computers in her last job. But now her situation was that she did neither have another tablet e.g. iPad, or another computer like the first resident we spoke to, Eva. Thus, she did not have anything to compare the tablet with. She told us that her first impression of the tablet was good and that she uses it for reading the news, accessing Internet, listening to music, she smiled and said for example via *YouTube*. She further told us that she had tried to teach another resident in the care unit how to use it and he had impaired vision and was therefore not able to read everything written on the tablet's screen. Additionally, we asked if she was of the opinion that the tablet was much discussed among the elderly in the care unit. She answered that what the elderly mostly said regarding the tablet was "*this is not something for me*", "*this is something for the kids to play with*", "*I will never learn this*" or "*I cannot use this, my fingers are too stiff*" (Translated quotes from the interview with Ruth). She told us that those who had actually applied it mostly used it to view the food menu and the activities, which is in accordance with what Eva said. We told her that our aim was to design and developing a guidebook and asked about her opinion regarding this. She smiled and said "*I have heard several times other residents saying that we should have a user manual so that the users could try it step by step and not be afraid to touch the screen, which many of them are today*" (Translated quote from the interview with Ruth). She further stated that in a guidebook, she would wish for many

symbols and not that much text. Additionally, she thought that having it both digital and paper-based would be the best due to possible impairments and skill constraints among the elderly. But for her aims and the fact that she was quite familiar with the technology, she would not bother to bring the paper-based guidebook with her while using the tablet other places than her apartment in the care unit. Thus, for her a digital version would be best, so that she could have access to it all the time without changing her habits.

6.1.2.4 Interviewing the developing company

As the timeline illustrates, we also conducted an interview with an employee of the developing company. The reason we did this was to get to know the tablet better i.e. the functionalities and the technology so that we could begin our work with designing the guidebook. We wanted to examine how we could develop the guidebook in a way that it could run on the tablet. He told us that having it integrated, as an application on the tablet would be challenging if not impossible within our time schedule. We were therefore recommended to develop HTML files that could run in the web browser on the tablet, and we thought this was a very good idea. We asked additionally about the background and history regarding developing the tablet because we find it interesting and consider it valuable knowing this while working with our thesis. He told us that he had not been a part of the developing from the beginning, but wanted to tell us what he knew. In few words, what he told us is that they aim at replacing the traditional way of delivering services within health and care with IT solutions and tools, and the interface on the tables is one of these solutions.

6.1.2.5 Interviewing the general manager of the care unit

We conducted one more interview, which was our last, and with the general manager of the care unit. This interview was conducted when the design of the guidebook was almost complete. The reason why we did this parallel work structure with both interviews/observations and developing of the design was, first the fact that it depended on when the person to be interviewed had the opportunity to meet us and secondly that we found it useful to receive some new input on the way. In addition to asking the general manager about her experiences with the tablet, we found it useful to ask her about the language we use in the design of guidebook regarding terms and vocabularies, since she talks to the elderly every day. We therefore showed her the current version of the guidebook and got some helpful tips, which we will say more about in the design part.

6.1.3 Moving towards the design part

In order to analyze the data collected in the exploratory part, we applied the approach as described in Chapter 5.5, i.e. searching for patterns. Referring to the literature presented in Chapter 4.1.1, we present and describe two persona documents below, created based on the data collected in the user research. In order to develop these, and to find the typical target user, we applied the same approach for analyzing data. Thus, these are created on insights from the exploratory part, and meant to guide us in the design process.

As stated in Chapter 5.5, we searched for patterns in the data, also, in order to make design decisions regarding labeling of the content of the guidebook. Thus, we focused on the language used by the elderly to find what kind of terms they use within technology so that we could transfer these findings into the design solution. This is because we aim at designing as most suitable labels as possible for the guidebook. Labeling is further described below in this chapter.

The timeline illustrates two more activities, which are participation on the training session and conducting the usability test. We present these activities in the design part. First we outline the process of creating personas.

6.1.4 Creating the Personas

By conducting user research and analyzing the data collected, we have gotten to know our user group. We consider it valuable creating personas because we have discovered that recruiting users is challenging in our case and by creating personas we can get help from a *real user*, without consulting our target users in the design process between the interviews and the usability test. Despite the recommendation saying that one should create at least three personas, we consider it enough creating two due to our already restricted user group. But what we have discovered within our target user group is, as mentioned before, a quite large difference within technological skills. We brought this finding into the creation of our personas by trying to illustrate how the users may differ from each other. The first persona illustrates an old woman named *Gro*, who is familiar with technology and is applying the tablet for those aims she finds valuable. But she still needs some help in the beginning to understand completely how those functionalities work. Maybe a guidebook would make her apply the functionalities without any help and in addition provide her with enough

information to apply the other functionalities she does not use today. Figure 6 illustrates the *Gro* Persona document.

Gro – 82 Year Old Retired Office Worker from Oslo

Personal Background
Gro retired from her employment within office-services about 15 years ago. She is a widow with two children and five grandchildren. She lives in one of the smart home apartments in Blomst care unit for elderly located in Oslo.

Because she now lives alone and is retired, she has much free time during the day. She likes to read news, watch television and listen to the radio. Because of her previous work in offices, she was introduced for technology through work, and has since used computers occasionally. In addition, four of her grandchildren have smart phones and make her try games on these when they come to visit. All this make her quite familiar with technology.

More About Gro
Gro have got some impaired vision through the last years because of her age, buy with glasses she can read almost everything, but prefer large text and symbols because she get tires easily if the text is very small.

Gro and the Tablet
Gro uses the tablet almost every day. Because of her experiences within technology and with a little help from the employees in the care unit some times, she is able to apply those features she finds valuable i.e. calling family, reading news, listening to music or radio and viewing the food menu and activity plan in the care unit.

Figure 6: The Gro Persona document

The second persona we created illustrates an old man named *Hans* with low familiarity to technology and therefore has not applied the tablet. But because of how his life situation i.e. being much alone in his apartment or participating in the activities in the care unit, he could benefit from the features provided through the use of the tablet. This is mainly in terms of having the opportunity to view the activity plan in the care unit, but also as an entertainment option while he is in his apartment. Figure 7 illustrates the *Hans* persona document.

Hans – 87 Year Old Retired Teacher from Drammen

Personal Background

Hans retired from his employment as a teacher about 20 years ago. He is unmarried without children. He lives in one of the smart home apartments in Blomst care unit for elderly located in Oslo.

Hans have a small family, and rarely visitors. He is therefore much alone and spent much of the day watching television and reading the newspaper. But he likes to participate in the different activities arranged at the care unit. Technology is for him very unfamiliar.

More About Hans

15 years ago Hans was diagnosed with Parkinson's disease. For him it is therefore problematic touching small areas with his fingers.

Hans and the Tablet

Hans has never used the tablet. He does not know what he can use it for and because of his poor knowledge within using technology, nor does he have the motivation to try.

Figure 7: The Hans Persona document

A weakness regarding our personas is that they are without photo, which is recommended by Unger and Chandler (2012). Unfortunately, we did not have access to any suitable photos. Except this, all the information written in the persona documents are based on the recommendations as described in Chapter 4.1.1.

We found it valuable creating these personas, and discovered while creating them that it helped us learning to know the target users better. This is because it provided us with the opportunity to connect the fact that the residents in the care unit are primarily over the age of 67 (as presented in Chapter 3.1) with our findings, from both the user research and the literature review. Thus, the age and occupation is made based on facts about the care unit, the age related disabilities or illnesses are made based on reviewing literature about older people, and the skills and preferences within technology are based on our findings from the user research.

Summing up, conducting all the activities presented above enabled us to learn about the target users, and in the following sections we outline the design part of our study.

6.2 Design part

We will now turn to the design part and our second research question, *How to best design a guidebook to meet the challenges faced by the elderly users?* And as stated in Chapter 1.4, we have as well emphasized how to design for diversity and how to design to support motivation. In the following sections we describe how we used the findings from the exploratory part and transferred it into a design solution by presenting the whole design process based on the four basic activities by Sharp et al. (2007) presented in Chapter 4.1.2.

Thus, as presented in more detail in Chapter 4.1, Sharp et al. (2007) among others talk about the term *User Experience* and state that it is about a user's pleasure and satisfaction when using a product. *Design for a User Experience* is something we have understood to be interpreted as a way of focusing and aiming, and we consider this as an important aspect in our design process. Our aim has therefore been to design an interactive solution for a satisfactory user experience among the elderly, which is our user group. With a satisfactory user experience we mean that the elderly find the design solution useful and covering their needs.

We have considered the basic activities by Sharp et al. (2007), as presented in Chapter 4.1.2, and transferred them into our work with the design development process. We believe these activities can be used to explain our design process.

The following in this chapter will describe in detail how we conducted these steps and designed with the aim of creating an interactive solution for a satisfactory user experience among the elderly.

6.2.1 Identifying needs and establishing requirements for the user experience

Based on the findings from the user research we conducted in the exploratory part, we have identified the needs of our user group and established the requirements that our design should meet to create a satisfactory user experience among the elderly. In this section we first present these needs and explain how we identified them, and secondly how we applied these needs for establishing the requirements.

As stated in Chapter 4.1.2, research shows that poor and too little specifying, e.g. of the systems requirements, in an early stage of an IT project can cause problems and failures. Thus, the following sections outline a clearly specifying of the user needs and requirements.

6.2.1.1 The user needs

As previously mentioned, we observed how impressed and happy the resident in the care unit turned when she got to see the calling functionality on the tablet. Additionally, the employee of the care unit told us that they are trying to convey among the elderly that they can call for free via the tablet, which as well indicates that not all of the elderly are aware of the possibilities on the tablet. These findings made us identify the first user need:

- *The users need to understand what the tablet can be used for*

From each observation and interview conducted in the care unit, we got the impression that many of the residents found it challenging both understanding and using the tablet. For example, based on statements like *“this is not something for me”* or *“I will never learn this”* that we were told by Ruth that other residents had said. These findings made us identify the second user need:

- *The users need guidelines on how to use the tablet*

We discovered in the interviews that one of the users had other devices e.g. iPad and computer, and that she uses these for calling, accessing Internet etc. But since information regarding the food menu and the activities in the care unit can only be found electronically on the tablet, she uses the tablet for this aim. This indicates that she is a user of the tablet; she has taken it into use, but she might have other preference than other user. Additionally, we got the

impression from other users as well that this functionality is the one most in use. Based on these findings we identified the third user need:

- *The users need the opportunity to choose between the different guidelines based on what they prefer to learn about*

We discovered early in the study, e.g. when we participated on the first meeting in the care unit mentioned above, and that there is a difference in technology skills among the users. For example, we observed that one of the users who were present seemed to be quite familiar with the technology, while the other did not even know what she could use the tablet for. We also got this impression while we conducted interviews and other observations. Based on this, we identified the fourth user need:

- *The users need the opportunity to choose between the different guidelines based on their technologically skills*

In the first interview we conducted, with the employee responsible for the tablets in the care unit, we were told that they had experienced some unpredictable challenges concerning starting using the tablet. These challenges were mostly errors that occurred on the tablet. She identified the errors as the screen turning black or blue and that the elderly user did not know or dare to try to solve those. We consider it reasonable to think that this is one of the reasons why the tablet is not in use by everyone of the elderly. Additionally, we have noticed the elderly speak about the same errors as well. For example, one of them called the blue screen for “*The scary screen*” in one of the interviews. Based on these findings, we identified the fifth user need:

- *The users need help in solving other challenges that may occur on the tablet, i.e. the client stops running unexpected, which makes the screen different and unfamiliar.*

When we started to think of design solution before we even had started the data collection, we were considering whether the guidebook should be digital, paper-based or maybe both. We therefore wanted to examine this closer and added question about this in every interview plan for the users. Based on their answers and opinions, we included and identified the sixth user need:

- *The users need the guidebook both digital and paper-based*

Table 1 gives an overview of all the user needs.

	User needs
#1	The users need to understand what the tablet can be used for.
#2	The users need guidelines on how to use the tablet.
#3	The users need the opportunity to choose between the different guidelines based on what they prefer to learn about.
#4	The users need the opportunity to choose between the different guidelines based on their technological skills.
#5	The users need help in solving other challenges that may occur on the tablet, i.e. the client stops running unexpected, which makes the screen different and unfamiliar.
#6	The users need the guidebook both digital and paper-based.

Table 1: Table of the user needs

6.2.1.2 The requirements

After having identified the needs, we used them as the background to establish the requirements for the guidebook. Thus, the requirements are based on our findings i.e. the needs we have identified above. We use the principles described in Chapter 4 to analyze what the challenges are, what is important, and how this can be solved and structured in a design solution.

Two different terms are traditionally used for two different kinds of requirements within software engineering, those are *functional requirements* and *non-functional requirements*, as described in Chapter 4.1.2, where the first one covers what a system should do and the second covers the constraints a system and its development (Sharp et al., 2007, p. 477). Thus, we found it valuable to establish both kinds and present them in the following.

Based on the first user need, we established the first functional requirement, which is saying:

- *The design should provide a description for each functionality*

Based on the second user need, we established the second functional requirement, which is saying:

- *The design should provide a detailed guide on how to use it*

Based on the third and fourth user need, we established the third functional requirement. We chose to combine these two because we will have them as one function in the design, we will say more about this in Chapter 6.2.2.1. This requirement is saying:

- *The design should offer different levels of use based on the user's needs and skills*

Based on the fifth user need, we established the fourth functional requirement, which is saying:

- *The design should provide a description of challenges that may occur and guidelines on how to resolve them*

Based on the last and sixth user need, we established the last and fifth user need, which is saying

- *The design should be in two versions, one digital and one paper-based*

Additionally, based on the design framework outlined in Chapter 4, we established the following non-functional requirements:

- *The design should be universally designed*
- *The design should concern the principles for welfare technology*
- *The design should concern the principles for smart home technology*

Table 2 provides an overview of all the functional requirements and the non-functional requirements.

Functional requirements	
#1	The design should provide a description for each functionality.
#2	The design should provide a detailed guide on how to use it.
#3	The design should offer different levels of use based on the user's needs and skills.
#4	The design should provide a description of challenges that may occur and guidelines on how to resolve them.
#5	The design should be in two versions, one digital and one paper-based.
Non-functional requirements	
#1	The design should be universally designed.
#2	The design should concern the principles for welfare technology.
#3	The design should concern the principles for smart home technology.

Table 2: Table of the requirements

6.2.2 Developing alternative designs that meet those requirements

After having identified the needs and established the requirements we began the development of the design to meet the requirements, i.e. to meet the challenges the elderly faced, regarding the use of the tablet, through a design solution. As stated in Chapter 4.1, to achieve this we started the process of prototyping. We find this activity important in the design process and choose to conduct the development of the prototype in three steps. The first two steps consist of developing of wireframes, so that we can define how each page should look from an architectural perspective. First, we created the first version of our low-fidelity prototype by sketching the wireframes by hand so that we could easy get our ideas from the user research down on paper. This looks different from the final product, but as presented in Chapter 5.4.1, it might be done on paper and is simple, cheap and quick to modify.

We structured the different wireframes by number where the first is the main page, 1.1 is the page of the first navigation option on the main page and for example 1.2.1.1 – 1.2.1.n means that the page 1.2.1 has an unlimited amount of subpages. We used the same structure in each step i.e. from the hand-sketched wireframes and until the HTML documents that is the final prototype. By doing so, the same page will have the same name and be easy to track regardless type i.e. .jpg, .psd and .html.

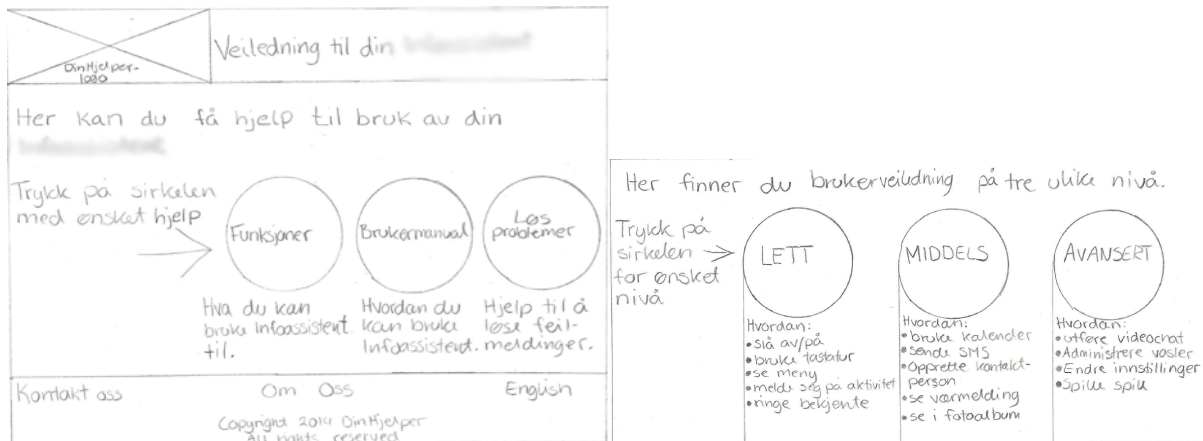


Figure 8: Two examples of the Hand-drawn wireframes, Low-fidelity prototype

Figure 8 illustrates how we hand-drawn the wireframes. These pages represent the main page and the page 1.2, which is the second navigation option of the main page and this consist of the guidelines for the different functionalities.

The next step was using these sketches to make the wireframes in Adobe Photoshop. The reason why did this additionally was for defining colors, fonts and sizes on text and figures/pictures so that we could better predict how the final prototype would look like. And since we are designing the system universally, and this implies guidelines on how to design the text, figures etc., we found it even more useful to define this before the development of the high-fidelity prototype so that we could visualize the design in an early stage and easily edit it if needed. We also consider having these wireframes to look at during the development of the high-fidelity prototype as helpful due to the fact that we then do not need to define the look and write the code at the same time.

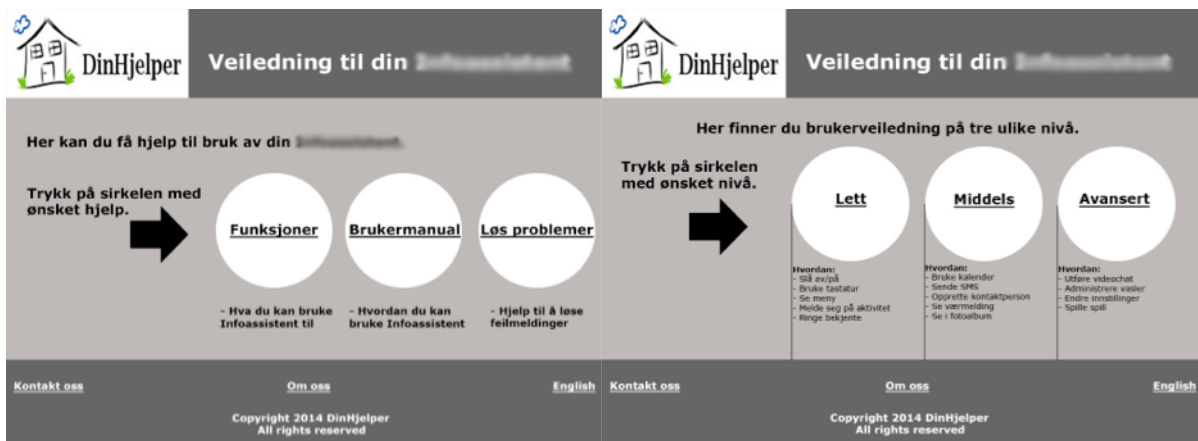


Figure 9: Two examples of the Photoshop wireframes

Figure 9 illustrates how the wireframes we made in Photoshop look. Please notice that we present the same pages as the hand-sketched ones, so that it should be easier to understand how the design is being realized.

6.2.2.1 How does our design meet the requirements

Based on the established functional requirements, we have chosen to divide the features of the guidebook into three categories i.e. the information about the functionalities, the guidelines for the functionalities, and the guidelines for how to solve the challenges that may occur. The user can choose between these features on the main page.

Thus, the first feature option consists of a description of the different functionalities on the tablet. This provides the user with information about what the tablet can be used for. The second feature option consists of the guidelines for the different functionalities on the tablet. To meet the requirement that says the design should offer different levels of use based on the users preferences and skills, we designed the guidelines divided in categories with three levels, *beginner*, *one step further*, and *advanced*. The idea behind the beginner level is that we have collected together the functionalities that we have found that the users mostly apply, with those we have discovered that are the easiest to use by investigating the tablet closely. The idea with the advanced level is the opposite, these functionalities we have found and discovered to be the hardest for the users to apply or they that are less being applied. The last level, which is the one in between, is a collection of functionalities that were left since we did not discover any significant reason to put them under either beginner or advanced. The different functionalities are listed in Table 3. The page where the user can choose level gives a short description of what can be found in the different levels. By designing in this way, we hope that the user will be able to easily choose his or hers level of suit. The third and last feature option consists of a description of the challenges i.e. error related challenges that may occur on the tablet and guidelines on how to solve them.

Beginner	One step further	Advanced
Turn off/on	Use the calendar	Perform video chat
Use the keyboard	Send a SMS	Manage the notifications
Look at the menu	Create a contact person	Edit the settings
Sign up for an activity	Look at weather forecast	Play games
Call a person	Look in the photo album	

Table 3: Table of the functionalities of the tablet

After having designed the navigation structures and developed the content e.g. the different descriptions, figures and pictures, we began to work with the paper-based version of the tablet. We aimed at using as much as possible from the digital design and structures, i.e. the three main categories and the same descriptions, figures, and pictures. This we believe will make it easier for the users who would like to apply them both. The main difference between the digital version and the paper-based version is that the paper-based version is able to consist of guidelines on how to solve other challenges e.g. the tablet is out of power, due to the possibility of using the paper-based version without actually accessing the tablet. Another difference is that, in the paper-based guidebook, we chose to remove the three levels regarding the guidelines to avoid too much information and flipping of pages. As mentioned in Chapter 2.5, paper-based guidebooks have limited space and prioritizing information is needed to avoid an overload of pages to flip through.

By developing both a digital and a paper-based version of the guidebook, we hope that it will be accessible for everyone in our target user group, because we also reach those people who find it hard or impossible to for example read text on a screen. This is the case for some elderly users as we learned during the interview phase.

We have focused on using as little text as possible in the descriptions, and using words that are easily recognizable and familiar for the elderly. We have observed which terms the elderly use for the different functionalities on the tablet and in within technology in general. We have transferred these findings from the exploratory part into our design solution. Morville and Rosenfeld (2007) talk about *Labeling Systems* in their book about Information Architecture, and describe it as a form of representation (p.82) and highlight that one should design the labels that speak the same language as the users (p.83). So, when we were thinking of labeling, or finding the most understandable terms for the different navigation buttons in our

design, we focused even more on how we had observed the elderly speak and using terms. Additionally, as presented in more detail in Chapter 2.5, Christoffersen and Møller (2010) talk about *controlled language* and present certain recommendations according to word level, text-based level and situation-model level. We are inspired by this and consider our design as mainly covering these recommendations. Concerning the word level recommendations, the written language in our design does not consist of abbreviations or acronyms. Neither does it have foreign words, technical terms or other special terminology. Concerning the text-based level, we do not have any text with complex syntax or inferences. Lastly, concerning the situation-model level, the content of the guidebook is designed and written focusing only on this single tablet interface. We have designed it so that the user can distinguish and choose between information by dividing the information regarding the guidelines for the different functionalities into three levels as described above. We consider this as covering the last recommendation saying that one should “*support the reader in distinguishing between “important” and “less important” information*” (Christoffersen and Møller, 2010, p. 4).

At first we used the actual name of the tablet interface given by the developers because we believed that the elderly used that name as well. In addition, we named the tree levels *Easy*, *In the middle*, and *Advanced*. But after our last interview, which was with the general manager of the care unit we learned that the elderly do not use or understand that name, they just use *nettbrett*, which is the Norwegian word for tablet, and could be directly translated into English as Internet board. We were as well recommended to use other names for the three levels by the general manager of the care unit that we interviewed. In addition, we were told that older people often do not understand the word *funksjoner* (Norwegian word for functionalities). After this experience, we changed and adjusted some of the terms used in the content of the guidebook. But whether we should change the term for functionalities or not, we wanted to examine closer. We therefore asked random people, if the person was old we asked whether s/he understood the term, and if the person was younger we asked whether s/he thought the parents/grandparents would understand it. This approach for testing the terms carries some characteristics from *guerilla testing* in the sense of being spontaneous and without formal organizing (Toftøy-Andersen and Wold, 2011, p. 129). The outcome of this small study was that we should not change this term. But to be completely sure, we also included questions about these words in the plan for the usability test so that we could learn the actual target users’ opinion about them, and maybe consider changing them after having asked the elderly in the care unit. In addition, we have added text that describes what the users need to do on

each page where the system requires an interaction by the user. As mentioned before, we have focused on designing universally as much as possible, the next section will explain more about this and also how we connect this with meeting the non-functional requirements of our design.

6.2.2.2 Designing universally

Tollefsen (2013) state that web is not for *everyone*, but by following some main rules, designers will be able to reach a larger group of people. The designer should write in a simple and understandable language, and use pictures and symbols to support the users understanding, and also use a standardized design and navigation system on the different pages so that the user will recognize it regardless which page s/he sees (Tollefsen, 2013, p.42).

We have used the universal design website of DIFI to ensure that we follow the guidelines in terms of setting right sizes, colors and fonts. To set the right colors, we used a contrast ratio calculator. The main background color of our design is grey because that is most suitable since we use black and white text color. The top and bottom parts are in a dark grey so that white text will make a good contrast. The background in the middle part is light, where the text is best readable in black. In addition, we set the text font to *Verdana*, which is recommended in the guidelines and used minimum 14 pkt. text sizes. Tollefsen (2013) highlights several times in their book the importance of choosing the right text font, text size and color contrast especially for people with impaired vision. Thus, this is particularly of interest for us because many of our target users have impaired vision.

As stated in Chapter 4.2, we are inspired by the paper developed by Funka Nu, and will now present the guidelines we find important and relevant to consider in the development of our design:

- *Do not use frames in the web interface*
- *Conduct practical tests of the solution*
- *Items that belong together should be grouped*
- *Work hard to create a clean design and minimize the number of "unnecessary" objects.*
- *Construct large click areas*

- *Limit the amount of information and number of visible objects*
- *Use familiar icons*
- *Design clickable objects so they look clickable*
- *Use clear contrasts*
- *Use understandable navigation concepts*
- *Make it possible to control the interface with only one finger*
- *Use images only if it truly helps the user*
- *Use brief but descriptive headlines to structure information*
- *Avoid abbreviations*

(Guidelines collected and translated from Funka Nu, 2012)

We consider our design covering all of these rules, some of them are self-explanatory by looking at the design, but let us describe those that are not. By dividing first the general information about the functionalities, the guidelines and the challenges solving on the main page, and further divide the different functionalities into levels based on user research, we worked towards grouping the items that belong together. The idea behind the circles around the main navigation is to construct large click areas. As previously mentioned, we have focused on writing as little information as possible. The icons we use are gathered from the tablet interface so that they are familiar for the users. Every clickable object is underlined in such way that the users should understand which ones are clickable. How we made the contrasts is described above. The images we have used are all from the tablet and implemented to support the information in the texts. We consider the headlines we have composed as brief, but helpful for the users in their navigation, and we did not discover any remarkable difficulties around this in the usability test.

We have discovered some challenges and constraints when it comes to meeting each recommendation within universal design because our design is running on an already developed tablet interface. This means that we cannot change or manage more in depth software functionalities. For example, the recommendation suggesting that software developed for mobile phones and tablets should provide zooming functionality is out of our managing possibilities (Difi, 2014). This functionality would have been useful concerning the guidebook and its users.

6.2.3 Building interactive versions of the design so that they can be communicated and assessed.

The third step is making the high-fidelity prototype, which can look much like the final product. This prototype is an interactive version of the design and can be communicated and assessed, which we have done by conducting a usability test. We used the tool *Dreamweaver* to build the prototype. We find this tool helpful in making the prototype since it enables us to visualize the design while coding and developing it, so that we easily can change and improve it if needed. In addition, the outcome is HTML files, which can be edited and viewed outside the tool as well. The design in the high-fidelity digital prototype is based on the design developed in the two first steps described above, and further transferred into the paper-based version.

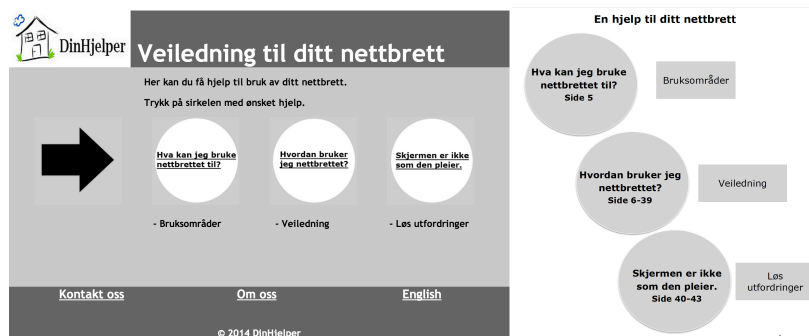


Figure 10: From the final prototype, both digital and paper-based

Figure 10 illustrates how the properties and design structures of the main page in the digital version are transferred into the paper-based version.

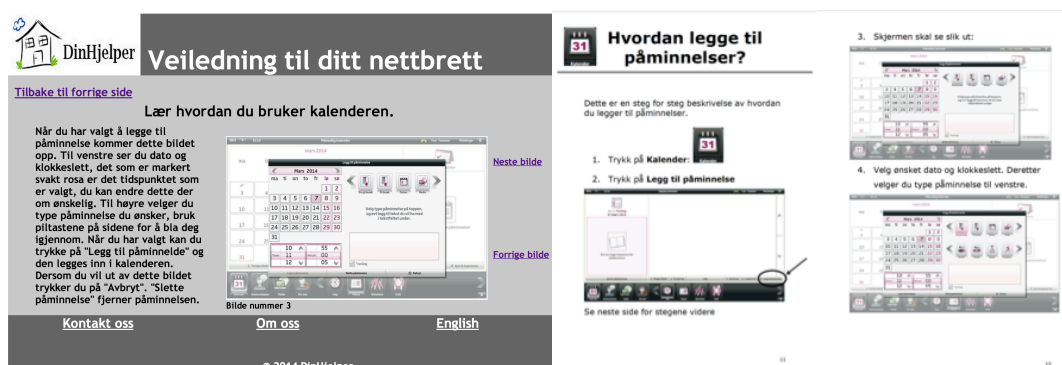


Figure 11: Guidelines for the Calendar feature, digital vs. paper-based

Figure 11 illustrates how the developed content and design structures of the guidelines are transferred into the paper-based version. See Chapter 7 for a fully description of the

prototype, both the digital and the paper-based.

Our final prototype is made in HTML and is thus web-based. This means that to run and use the guidebook, one will need to have network connection. We are concerned whether this would cause any challenges or problems for the users, but concluded that since the tablet also needs network connection to function, the user will probably not experience any particular problems regarding this. However, on the positive side this is probably the only challenge that may occur in running the guidebook, since it we have concerned the principle of standardized solutions by developing the prototype in HTML (HyperText Markup Language), which is an international standard (ISO 8879) for text formatting (W3C, 1999).

6.2.4 Evaluating what is being built throughout the process and the user experience it offers.

The fourth and last step is the evaluation of the design. To do so, we arranged a usability testing session at the care unit with the actual users. In this section we describe in detail how we conducted this activity and what we discovered from it.

6.2.4.1 The usability test

When the design of both the digital version of the prototype and the paper-based version was complete, and we considered the content of the guidebook as good, the prototype was ready to be usability tested.

As described in Chapter 4.1, we developed a test plan to better prepare for the usability test. We created the following questions and tasks for our usability test. To view our complete test plan, see Appendix C.

Initial questions:

What is your relationship with the tablet?

What do you use the tablet for?

What do you find difficult?

What do you call the tablet?

We call these functions, what do you call them?

Tasks:

Use the guidebook to perform the following tasks:

1. What do you understand from this page? (front page)
2. How would you proceed to find out what you can use the tablet for?
3. You wish to add a reminder, but need help in doing so. Where will you click/search to find information on how this is done?
4. Click/browse to Functions:
 - a. Click/look at Calendar: According to the text, what is the calendar for?
5. Can you show me how you would proceed to find information on how to call a friend?
6. Can you show me how you would proceed to find information on what's for dinner?
7. How would you proceed to find information on potential challenges that may occur?
8. Click on User Manual and then Calendar. You wish to go back to the front page. Where would you click? (This task is only for those who choose the digital version)

Closing questions:

How do you feel the guidebook assisted you in performing the tasks?

What do you find clear/unclear with the guidebook?

In your opinion, how is the content presented? Was it understandable, readable?

How was it to navigate on the digital/paper-based?

What do you think of our choices of color and text size?

How was the use of wording in the guidebook?

In the care unit they arrange training sessions where the elderly have the opportunity to learn how to use the tablet and ask questions if they wonder about anything regarding the tablet. The employee who is responsible for the tablets at the care unit arranges the training sessions once a week. With this employee we planned to join one of the sessions, so that we could recruit users to our usability test. We got to experience that we face some challenges regarding our user group in terms of that they often get tired and not everyone can or want to participate on this sort of activity (Dickinson et al., 2007). Additionally, we are only able to recruit users from that specific care unit because they are the only users of this specific tablet interface. This creates a limited group of people for us to ask. So we thought that participating in this training session was a good idea, since we could meet the actual users, observe, and get a better impression of what they actually understand while trying to learn and using the

functionalities on the tablet. We therefore met up in the care unit on the planned day to join the training session. The employee had told us beforehand that she never knows how many residents who turn up at the session, but there are always some. On that day, five residents came and it seemed that they were all on different technology levels. We introduced us and explained why we were there. We also got the permission from everyone to take pictures during the training session. We sat in a corner and observed the training. When they were done, we did as planned, asked the present residents if anyone had time to look at and try the guidebook we had developed. As explained in Chapter 4.1.2, we had hoped and planned to have four test persons, but because three of them were either tired or had appointments, only two had the opportunity to participate. These two had as well appointments not very long time after the session, so we had to test on one person each at the same time. This was also in contrast with what our plan said, which was that one of us should talk to the test person and one should observe and take photos. But the testing situation was successful in terms of that the test persons were calm, helpful and interested through the whole test. Maybe this calmness was because we had been there through the training session so that they got to know before the testing and that the test took place after a familiar activity i.e. the training session and in a familiar room. When we sat down with each test person everything else went according to the test plan and we made the best out of the situation by improvise e.g. taking pictures while the participants were reading the tasks.



Figure 12 Photo from the usability testing

We then went through the whole testing plan, and experienced that the rest went as we had planned. After our test persons had read, agreed and signed the inform consent, we started asking the pre-prepared questions, see page 74 for details. Figure 12 illustrates how we sat

down with the users and conducted the usability test.

Now, we outline what we learned from our two test persons by first presenting summaries of the answers from the initial interview:

Test person #1:

Solfrid (made anonymous by us) consider her relations to the tablet as good, and she uses it almost every day to read news, listening to music and play games. She thinks it is difficult to apply the functionalities that she does not know how to use; she finds it hard to try to learn it by herself. She has never heard the actual name of the tablet, and just calls it *nettbrett*. She knows about and understands the word functionalities, but state that she might not have used it herself. But she thought of it as suitable and understandable on the guidebook.

Test person #2:

Laila (made anonymous by us), finds the tablet interesting, but does not use it that often. When she uses it, it is for reading *Aftenposten* and check what today's dinner is and which activities she can attend. She states that she does not find anything challenging, but it requires effort. She explains that she owns a computer, but her apartment is small so there is no room for it. She stores it in a closet. When asked if she finds the tablet more convenient to use, she answers "*that at least it is smaller*" (translated quote from the usability test). She had never heard of the actual name of the tablet, so she calls it a *nettbrett*. When asked about the word *Functions* and what she calls the different use areas on the tablet, she said she does not remember what she calls them, but she understands the word functions when it is explained to her.

After having asked the pre-prepared questions we started with the tasks. We are again inspired by Toftøy-Andersen and Wold (2011) and how they suggest analyzing and reporting usability testing. They recommend task score, so we decided that we would score the tasks as following. If the test person completed the task without any help, the task was given the score 1. If the test person completed the task with assistance, the task was given the score 2. If the test person did not understand the task at all, the task was given the score 3. See Table 4 for the results.

	Test person 1	Test person 2
Task 1	1	1
Task 2	1	1
Task 3	2	3
Task 4	1	1
Task 5	1	2
Task 6	2	2
Task 7	2	2
Task 8	1	3

Table 4: Task score from the usability test

After having conducted all of the tasks, the post questions were next on the plan, and the following give the summaries of the answers:

Test person #1:

Solfrid thought that the digital guidebook was best and that it helped her in solving the tasks, once she had understood how it worked. She first found it hard to understand that the text under the navigation buttons was supposed to explain what they were for. She understood the content in terms of how it were formulated and structured. But met some challenges while navigating around because she did not always understand where to push. The text fonts, sizes and color contrast were very good according to Solfrid. She did not have any improving suggestions and stated that she had not seen many user manuals for technological equipment in her life.

Test person #2:

With the choice of using the digital user manual or the physical when conducting the tasks, Laila chose the paper-based because the digital version was too hard to read for her. She stated that she liked having a paper-based guidebook in her hands, but she did not read the content of it. When asked to search the guidebook for information on how to add a reminder, she thumbed up in the table of content and searched the page for calendar and found the information on calendar and also how to use it. She had trouble using the guidebook to perform the tasks. She was more focused on looking at it, rather than performing the tasks given to her. It also seemed that she was expecting a step-by-step guide to the different tasks. She needed assistance in completing the tasks and using the guidebook.

After having completed the tasks, she got tired and asked if it was all right if we could end the test.

The outcome and experience of the usability test made us commit changes in the design to improve the prototype of guidebook even more. On the main page, we changed how we expressed the features by changing the word in the circle with the information under the circle. For example, the circle with the guidelines option consisted earlier of the Norwegian word for guidelines while the descriptive text was underneath. We observed in the usability test that the users did not understand that this text was to explain the clickable button above it, and one of them actually tried to click on the text, not the button. We therefore found it meaningful changing this. Additionally, we changed the paper-based version to a more step-by-step description because before Laila had seen the content of the paper-based guidebook, she expressed *“How nice to get a step-by-step guide to how I can use the tablet”* (translated quote from the usability test). She seemed disappointed while realizing that the descriptions were not that straightforward. Thus, we found it meaningful editing the paper-based version. It is possible to visualize those changes by looking at the Photoshop wireframes compare to the figures from the final prototype.

6.3 Lessons learned

This section is devoted to outline the lessons learned from carrying out the design process. Additionally, we present what we experienced as particularly beneficial approaches.

We conducted the design development process in four main activities as described in this chapter, where some of the activities had important sub activities as well. Throughout this process we have learned the value of conducting all of the mentioned activities in this sort of processes and how the outcome and the results from the different activities have helped us to improve the design. When we think of how the design was when we began the development process, we can clearly see the differences from the first design proposal to the final. In addition, how this made us realize how the different activities have helped us in the process, and guided us to the final design. In the following section we outline our experiences from this process that we find most valuable.

After having collected enough data to establish the requirements, the process changed to be a parallel work with more interviews/observations and development of the prototype. Working this way gave us the opportunity to edit and adapt the prototype relative to the results from the user research. The final high fidelity and interactive prototype is different from the Photoshop wireframes when it comes to the language we use and how we use different terms. For example the fact that we first used the actual name of the tablet interface given by the developers because we believed that the elderly also used that. But after our last interview, with the general manager of the care unit, we learned that the elderly do not use or understand that name, they just use *nettbrett*, the Norwegian word for the term tablet. In addition, we named the tree levels *Easy, In the middle, and Advanced*, but were recommended to use other terms. Thus, these terms were changed right after talking to the general manager, and we experienced the value of speaking to a person who has worked with elderly for a long time. However, we were also recommended to change the term for functionalities. At that time we considered it meaningful examining this closer because we did not come up with a better word than functionalities or in Norwegian *funksjoner*. The outcome of this investigation was that we should keep this term. But since we were still not completely satisfied with it, we included it as an aspect to investigate even closer in the usability test. This proved to be successful and we found that the term *use areas*, directly translated to Norwegian as *Bruksområder* is a better solution. This provided us a better understanding of the value of working closely with the actual users. In other words, not always rely on testing with elderly in general, but testing with the actual users i.e. the residents in the specific care unit.

As stated above, when we went to the care unit to conduct the usability test we were hoping to recruit four elderly users, but did only manage to have two participants. We learned about challenges that often comes with having older people in the target user group presented in Chapter 2, they tire easily, some of them might be afraid of participation in such activity, and some might not want to or even are not able to e.g. because of diseases. Additionally, Lazar et al. (2010) identify working with humans as participants as a privilege, but also challenging and time-consuming in terms of finding the appropriate participants, informing them well, protecting their privacy and answer their question (p.367-395). We experienced and identified as well these characteristics of including the users and consider it maybe even more challenging while working with elderly in the target user group. For example, one of the participants in our usability test was not able to read the text on the informed consent; therefore we had to read it for her, which caused a delay. However, from this we learned that

having elderly as users to include in a usability test, the text on the informed consent document should be larger than normal.

By reviewing the results from the test, we found that they understood some tasks and needed help or did not understand the other tasks given. The only clear and straightforward finding we can conclude is that the guidebook was not completely self-explanatory. It could have been interesting to conduct a second test, preferably with the same users and examine how much they remember from the last time and whether the result would be different. Unfortunately, due to our time constraints and the challenges in the recruitment, we did not manage to conduct this. The ability elderly have to learn and remember instructions given in a guidebook could be a focus of further study on the topic of guidebooks and elderly users. However, in a positive way, we found that probably most elderly are able to apply it in some degree, and as stated by one of the participants in the usability test, *“I think I could have used this on my own, if someone first just once had showed me how it works”*.

6.4 Summary

In this chapter we have outlined the exploratory part of our study, as well as the design part. In the exploratory part we explained how we conducted the user research, and what we found and learned. In addition, we described how we analyzed the data from the user research and how we further learned to know the target users by creating the persona documents. Based on the findings from the exploratory part, we further outlined the design part. There we began with clearly identifying the user needs based on what found in the main user research, and applied these to establish the system’s requirements. Secondly, we presented how we developed a design solution to meet the requirements by conducting prototyping. The development of the prototype was conducted in three steps i.e. hand-sketched wireframes, digital Photoshop wireframes and the interactive HTML version. Conducting it this way enabled us to easy and quickly modify and improve the design based on assessments taken in the two first steps so that the main design decisions were made while starting developing the interactive version. We conducted a usability test of the final prototype to evaluate whether the requirements were met, conducting this activity enabled us to improve the design even more where this was necessary and enabled us to see the parts of the design that fulfilled the requirements and worked well for the users.

7 The Guidebook – Introducing the prototypes

Throughout this study we have design towards a guidebook for the tablet. In this chapter, we describe the digital prototype and paper-based prototypes in detail; especially we present how the digital prototype works because designing this was our initial and main aim. The process of designing the guidebooks and our choices are explained in the previous chapter.

In order to explain our prototype we present again the users, Solfrid and Laila mentioned in Chapter 6.2.4. Solfrid is familiar with technology; thus, we define her as an advanced user. She prefers to use the digital version of the guidebook. Laila is not familiar with technology and is therefore defined as a novice user. She prefers to use the paper-based version both because she is inexperienced with technology and she has difficulty reading text on the tablet screen. The scenarios presented are written based on the data from the usability testing.

7.1 Digital guidebook

This section is devoted to describing the functionalities of the digital guidebook. As mentioned in Chapter 6.2.2, our digital guidebook is developed in HTML and is therefore web-based. The digital guidebook is designed for use on the tablet; hence the interaction between the elderly and the guidebook is through touching the screen and choosing the different features.

After opening the digital guidebook, the users are presented with the home page, including a menu where they can choose what they need (see Figure 13). The three options are:

1. What can I use the tablet for? Use areas (nor: Hva kan jeg bruke nettbrettet til? Bruksområder)
2. How do I use the tablet? Guidelines (nor: Hvordan kan jeg bruke nettbrettet? Veiledning)
3. The screen is abnormal. Solve challenges (nor: Skjermen er ikke som den pleier. Løs utfordringer)



Figure 13: Home page

In the following sections we outline the different parts and the functionalities included in the digital guidebook. We present scenarios of use with Solfrid and Laila, in each section to explain the use of the guidebook.

7.1.1 What can I use the tablet for? – Use areas

Our primary idea was to design a user manual for the tablet. As mentioned in Chapter 6.1, during our exploratory part we found that in addition to guidance in how to use the tablet, the users also needed an overview of the various features on the tablet, which are described in Chapter 3.2.

Scenario: “Solfrid has just moved into the care unit and been presented with the tablet. She is familiar with technology and she is interested in finding out the different use areas on the tablet. She opens the digital guidebook on the tablet and chooses *Hva kan jeg bruke nettbrettet til?*. The four circles provide her a brief overview of the tablet’s use areas, but she is interested in a more detailed description of each of the use areas.” The screenshots for this scenario is shown below (Figure 14).



1. Solfrid wants information on what the tablet can be used for so she chooses: *Hva kan jeg bruke nettbrettet til?*



2. She is interested in knowing more about the calendar function so she chooses: *Kalender*.



3. This screen is displayed and she can read about the functionalities of the calendar.

Figure 14: Solfrid checking out the functionalities of the tablet

7.1.2 How do I use the tablet? – Guidelines

In order for the users to understand how to use the tablet we have integrated a user manual in the guidebook. When choosing *Hvordan bruker jeg nettbrettet?* a menu is displayed (see Figure 15). The user manual part of the guidebook is divided into three levels, depending on what the users need help solving or doing. Below each of them is an explanation of what features are included in the corresponding level. Taken from page 67, we present a table of each level and its related features (Table 5); in addition we show how the menu and the levels are presented in the guidebook (Figure 15):

Beginner (nor: Nybegynner)	One step further (nor: Ett steg videre)	Advanced (nor: Avansert)
Turn off/on	Use the calendar	Perform video chat
Use the keyboard	Send a SMS	Manage the notifications
Look at the menu	Create a contact person	Edit the settings
Sign up for an activity	Look at weather forecast	Play games
Call a person	Look in the photo album	

Table 5: List of each level and its features

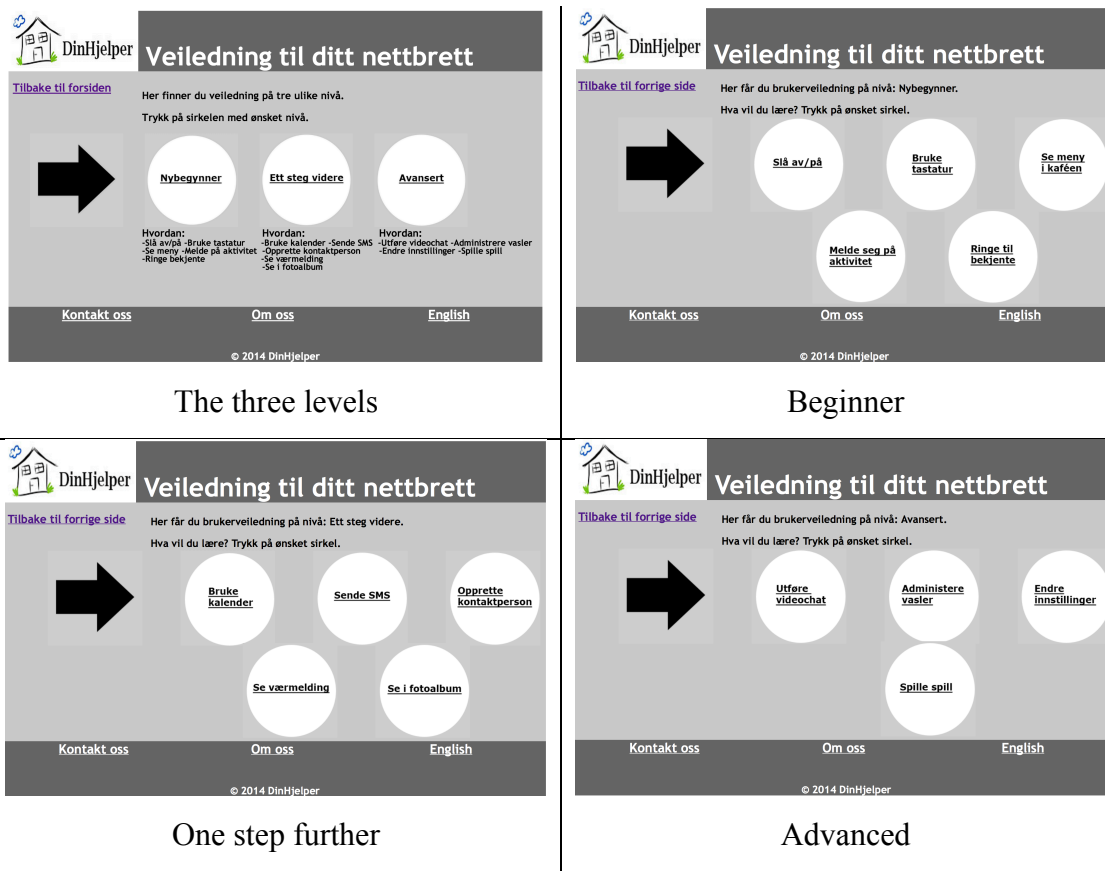


Figure 15: Screenshot of the different levels

We present a second scenario (see Figure 16) where Solfrid wants to learn how to perform a specific functionality on the tablet. Scenario: “Solfrid wants to add a reminder in the calendar, but she does not how to do this. She opens the guidebook on her tablet, chooses *Hvordan bruker jeg nettbrettet?* then *Ett steg videre* followed by *Bruke kalender*. She is then directed to the description on how to use the calendar, including how to add reminders.”



1. Solfrid opens the guidebook and chooses *Hvordan bruker jeg nettbrettet?*



2. She chooses *Ett steg videre*



3. She chooses *Bruk kalender*



4. She reads the guidelines on how to add a reminder

Figure 16: Screenshots outlining Solfrid's steps to find out how to add a reminder

7.1.3 The screen is abnormal – Solve challenges

During the use of the tablet, the tablet client can go into hibernate or stop working, which results in the screen changing. The guidebook can be used as a support for this, by providing the users with an explanation on how to solve the problem (see Figure 17). If something happens to screen that the elderly do not understand, such that it turns blue, the use of the digital guidebook will be difficult. However, we chose to include this feature of solving challenges in the digital version so that the elderly will have the opportunity to learn about what to do when it happens. They can either go in to read afterwards how to solve it or they can learn about it on someone else's tablet if they are together with someone else.



Figure 17: Problems that may occur with use

We present a scenario with Solfrid experiencing these issues. Scenario: “Solfrid is reading *Aftenposten* on the tablet when her doorbell rings. She puts away her tablet and opens the door. When she returns, the screen is showing a clock moving around. Even though Solfrid is familiar with technology she does not understand how to get back to reading her newspaper, but she touches the screen hoping this will solve the problem, which it does. Solfrid is curious to know why this happens so she opens the guidebook and chooses *The screen is abnormal*, then she chooses *Klokke på svart skjerm*.” Figure 18 shows the information the guidebook provides on this topic.



Figure 18: Black screen with a watch

In the next chapter section we present a brief description of the paper-based guidebook.

7.2 Paper-based guidebook

After designing the digital guidebook, the paper-based guidebook was developed based on the design of the digital guidebook. As previously mentioned, we wanted the paper-based version to be as similar as possible as the digital one regarding the design. In the rest of this chapter we present the paper-based prototype and present an excerpt pages from it.

The paper-based guidebook includes a table of content to make it easier for the users to locate what they are looking for. We present a scenario explaining a possible procedure inspired by our usability testing for learning how to make a phone call from the tablet, using the guidebook for assistance. Scenario: “Laila wants to learn how she can use the tablet to call her grandchild. She prefers using the paper-based guidebook because she has trouble reading from the screen on the tablet. She opens the guidebook and checks the *Innholdsfortegnelse*, finds *Hvordan ringe* then flicks up on the respective page and read the instructions”.

Figure 19 shows a selection of pages from the paper-based guidebook.

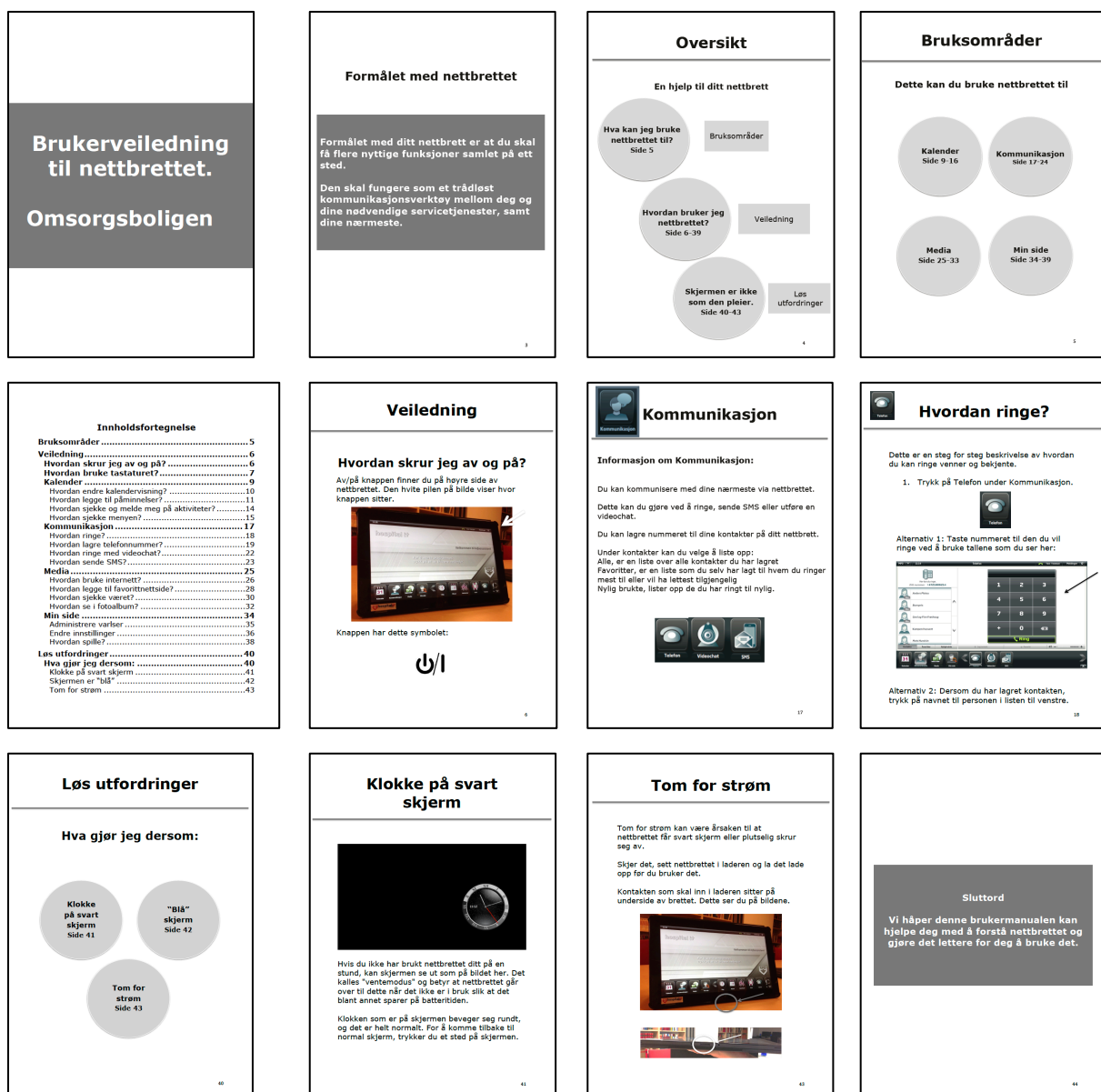


Figure 19: Extract from the paper-based guidebook

7.3 Summary

This chapter has been devoted to describing the prototypes, both the digital and paper based version, to provide a better understanding of how the guidebook is designed and how it can be interacted with. The main focus in this chapter has been the digital guidebook.

The guidebook contains information of what the tablet can be used for, as well as how it can be used. The users can choose whether they prefer to use the digital guidebook or the paper-based, according to what each of them prefer. Throughout this chapter we have described different scenarios of use, based on experiences from the usability testing, in order to explain how to interact with the guidebook. We have illustrated the scenarios by using screenshots from the guidebook.

8 Conclusion

We have based the study in our master thesis on two parts. First the exploratory part consisting of the main user research, and second the design part consisting of the process of designing solutions based on our findings from the user research. In this chapter we gather the threads, and outline what we consider we can present as concluding statements from this experience. Furthermore, we present our contributions and our thoughts for further research.

First, we repeat our research questions:

1. *Exploratory: What are the challenges faced by the elderly regarding the use of the tablet?*
2. *Design: How to best design a guidebook to meet the challenges faced by the elderly?*
 - *How to design for diversity?*
 - *How to design to support motivation?*

8.1 Exploratory part

8.1.1 The challenges faced by the elderly regarding the use of the tablet

Here we outline the challenges faced by the elderly users; additionally we describe how we identified them.

We have adopted and conducted different kinds of user research techniques in order to explore the challenges faced by the elderly. From observations conducted early in the study we discovered the difference between the elderly's skills within using technology. At the same time, we started to understand that exploring users of a technology developed to be applied in specific units does not mean that the users automatically are aware of the features

and possible benefits coming with it. Referring to discoveries made in the user research, as presented in Chapter 6, we found that not all of the elderly in the care unit are familiar with the features of the tablet, and that this lack of knowledge results in fewer users applying it.

We were introduced to certain errors that may occur on the tablet e.g. the interface client stops running without a warning, and the tablet screen becomes a *normal* Windows desktop screen. For people who are familiar with technology, e.g. youths, would probably understand and solve this problem immediately. However, we found that older people, in most cases, do not know how to solve problems of this kind, and many do not even dare to try to solve them. We present again the scenario from Chapter 1.3, which we wrote in an early stage of the study, and is based on the first data we collected; *“Gudrun is using her tablet when the screen goes blue. Gudrun becomes anxious and believes she has destroyed the tablet. She puts it away instead of trying to find a solution to the problem.”* Throughout the whole study, we have discovered this as a recurring aspect. We consider it as the elderly’s fear of using technology, and thus a main challenge, which results in less use of the technology among elderly.

Based on the findings presented above, we identified two main challenges faced by the elderly regarding the use of the tablet:

- Many of the elderly are not familiar with the features and possible benefits coming with the tablet, and therefore do not apply it.
- Some of the elderly who have tried to use it, have experience an error s/he does not know how to solve, and therefore puts it away and do not use it anymore.

In addition, the last main challenge identified is primarily based on what we learned by reviewing the relevant literature, but it also is an aspect discovered in the user research.

- Many of the elderly are not familiar with technology in general and do not know how to use the functionalities in the tablet, and therefore do not apply it

The challenge is mainly identified by reviewing literature, e.g. by Culén et al. (2013), Dahle 2012, and Van Horen et al. (2001), where a recurring statement is that older people often experience challenges in using technology. Our research also supports this statement, e.g. the discovery made regarding the difficulty among the elderly in managing a *normal* Windows desktop screen. Another example is the issues regarding terminology within information

technology discussed in this thesis, e.g. that elderly often do not understand the term *functionalities* in which we, as young adults, experience as a common and frequently used word.

Summing up, above we presented the three main challenges faced by the elderly identified in this study. The challenges are identified while analyzing the data from the user research, and identifying the user needs and requirements as presented in Chapter 6.2.1. Further in this chapter we present conclusions regarding the design part.

8.2 Design part

8.2.1 What to consider while designing a guidebook to meet the challenges faced by the elderly users

In order to carry out such design process, one should consider addressing each kind of users and include them all in the user research. By each kind we mean not only who the user interface is primarily developed for, but also who uses it, e.g. in terms of assisting the target users. As stated before, interviewing the employees of the care unit provided us with valuable information regarding how to design for the elderly e.g. the tips regarding the terms received from the general manager. We consider this experience in thread with statements from the literature, presented in Chapter 1.3, regarding the challenges faced by a designer, e.g. developing designs that are perceived as useful for the users, not based on the designer's preferences. In addition, the challenge with regards to that the users do not always know what they want. Thus, we consider the experiences with including the employees in the user research as significant with regards to the design decisions made, and solutions in the final design.

We have designed for and with the elderly; this approach could imply that the people involved in the process are the elderly as users and we as designers. But in order to design as best as possible for the elderly, one should consider involving people who know the target user group well. In the following we outline considerations regarding how to decide features/content and design structures.

We consider the requirements listed and described in detail in Chapter 6.2.1.2 as presenting the features one should consider including in the design of a tablet guidebook for the elderly users. However, how to structure these features and create the graphical design suitable for the elderly users is not that straightforward. As emphasized, how to design for diversity? How to design to support motivation?

We consider the main design choice we made as being the development of both digital and paper-based guidebook regarding designing for diversity. During our user research, we found that most of the elderly preferred the opportunity to choose between a digital guidebook and a paper-based guidebook. In addition, due to the different skills and preferences existing among the elderly, the people we interviewed also considered having it both digital and paper-based as in many ways necessary to reach everyone in the target user group. And thus design for diversity. We also considered a paper-based version would be useful when the tablet is not working at all, e.g. when it needs to be recharged. In this case, the digital guidebook would not be of benefit to the users. As mentioned, elderly are a heterogeneous group of people. Thus, by providing a digital and a paper-based guidebook we believe we are able to support the diversity. This is because we enable the elderly to choose which version they prefer according to their previous experience with technology, impairments or disabilities e.g. An example may be the elderly who find it difficult to read text on a screen, can use the paper-based version. In contrast, from talking to more technology experienced users in our study as well, we considered the unique benefits coming with the digital one. An example is the possibility of having the guidebook everywhere the tablet is, i.e. the users do not need to change their habits by bringing an additional artifact with the tablet if leaving the apartment. Thus, by providing the elderly with this choice we believe that we do not exclude any users from using the guidebook. A conclusion to be drawn from this is that the design solutions are for all.

As mentioned in Chapter 2, in order for elderly to apply the technology they need to perceive the usefulness of it. We hope that by introducing the guidebook, and thus provide the elderly with the explanations for what the tablet can be used for and how it can be used, will motivate them to use it. As mentioned earlier, from the user research activities we found that both the elderly and the employees were positive towards the idea of a guidebook for the tablet. However, we have found that concluding whether the guidebook can support motivation regarding the use of the tablet is challenging and maybe not possible at this stage. This is

because we consider it necessary to base such conclusion on a long-term perspective. The guidebook is not available for the elderly yet and therefore it is not possible for us to evaluate such aspects. Thus, in order to study the long-term motivation possibilities by introducing the guidebook requires further study. Such study could consist of an evaluation after having implemented and used the guidebook over a period of time. Thus, asking, “*in what way will introducing the guidebook motivate the elderly to use the tablet?*” could be a basis for further study on the topic.

8.2.2 Welfare technology and smart home

As stated in Chapter 4.3, welfare technological solutions can assist users in their everyday lives and provide them with an opportunity to manage their own life with no or less external help. But in order to achieve this, the solutions need to be usable. We consider this statement as the main background for the guidebook and our large focus on usability. As stated several times, the intention of the tablet can disappear if the target users are not able to apply it. Therefore, designing the guidebook as usable as possible is our hope in solving this issue, and promoting the intentions for welfare technology.

The conceptual model of smart homes presented in Chapter 4.4 can be applied to our study as follows. The guidebook is designed for the tablet, which is a technology implemented in the smart home care unit. It can therefore be said to have the same characteristics as a smart home is aimed to have. Firstly, the guidebook provides multi-functionality in that it enables the users in finding information on the different functions, as well as instructions on how to use them. Secondly, the guidebook supports different user needs by using levels in the guidelines, i.e. Beginner, One step further, and Advanced. Thirdly, by designing the digital version of the guidebook, the users can interact with the guidebook through the tablet. Fourthly, the guidebook provides efficiency in that the users can use it to solve the problems they encounter by themselves, without having to ask the employees for assistance. This saves them the trip down to the reception to find an employee to help them. Additionally, it can assist in freeing up the time for the employees. Lastly, the guidebook could support automation through the possibility of learning, meaning as the elderly learn the functions through the guidebook. The activities can be done without assistance, and thus the performance of the activity is automated. Through the use of the guidebook, the tasks, which the elderly find difficult, can be learned so that they do not need to use the guidebook to perform them. We present in

Figure 20, our own model adapted from the conceptual model by Lê et al (2012).

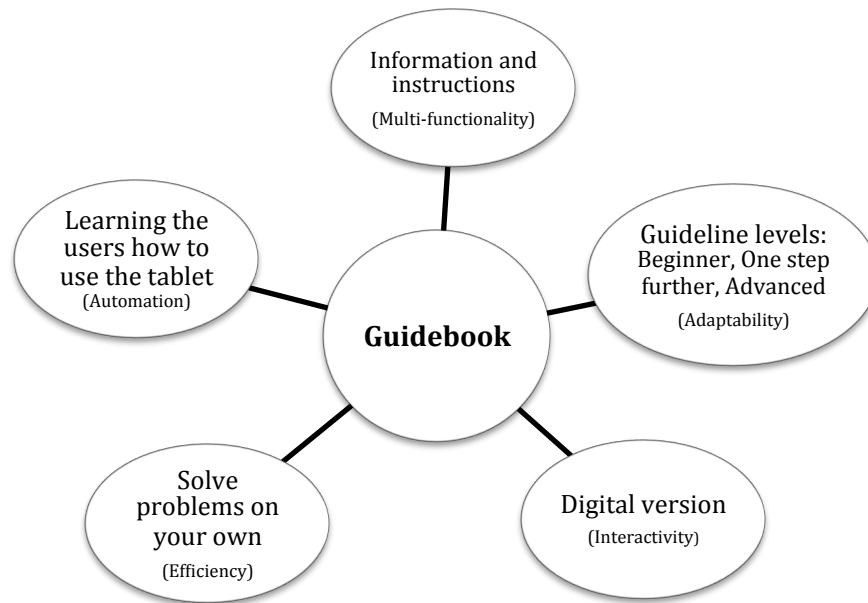


Figure 20: Our conceptual model of the guidebook

8.3 Our contributions

Here we present what we hope this study can contribute to others; especially those who want to design guidebooks for elderly users or include elderly in the design process. We have experienced through our own use of guidebooks that they are not always as straightforward to use as one first anticipates. Understanding instructions for installing a DVD-player or putting together a dresser can be challenging due to the way they are designed. Hence, designing usable guidebooks are essential to understanding and learning new equipment.

Through this study, we contribute both to creating a product for the elderly and the employees at the care unit, and at an academic level with our experiences of involving elderly in a design process. This is especially through the experiences of the methods we have used to explore and answer our research questions. A challenge we experienced with involving elderly users is that they tire easily, and that this affects us as designers when we need to plan and/or perform different sessions, such as interviews and user testing. This is also in accordance with the literature presented in Chapter 2.2. Thus, it may be helpful to plan shorter sessions with fewer tasks to prevent it from being interrupted because the user gets tired. In addition, as stated in Chapter 6.3, use larger text on informed consents or other documents to be read by

elderly participants.

In the beginning of the work with the thesis, we did not have any knowledge about welfare technology. Our attendance at the different seminars mentioned in the beginning of this thesis, reviewing the relevant literature, and our user research has provided us with an understanding of what welfare technology is and how it is used in the health care sector to ease the everyday lives of the ones in need of these assistive technologies. Based on the knowledge we are left with after conducting the study in this thesis, we believe that the guidebook can be defined as a welfare technological solution. This is because it can assist the elderly in applying the tablet, which is defined as a welfare technological solution, in their everyday lives. Furthermore, by applying the tablet they can experience the benefits coming with it, e.g. being socially and intellectually active through the use of the tablet's functionalities, e.g. calling friends and family, surfing the web etc. Thus, the guidebook can be used to assist the elderly in understanding the tablet, and hopefully increase the use of it. In addition, one could say that the guidebook might promote the tablet's ability to be a welfare technology.

To conclude our thesis, we would like to present a question for further research. This is about whether the design solutions made in our guidebook can be further developed and generalized to apply for other technologies in a smart home for elderly. Meaning, could this study be used to design guidebooks for other technologies implemented in the apartments at the care unit? Elderly moving into the apartments are introduced to new technologies that control lighting, heat, etc. These elderly are probably accustomed to control such features manually, and now they are suddenly automatic. Thus, perhaps the design solutions presented in this thesis could be adapted to be a guide to the home?

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Appendix A: Consent forms

Consent form employee

Forespørsel om deltakelse i forskningsprosjekt

Brukermanual for nettbrett ved omsorgsbolig i Oslo

Bakgrunn og formål

Formålet med denne studien er å undersøke hvordan nettbrettet brukes av beboere og ut ifra dette lage en brukermanual. Studien er del av en masteroppgave ved Institutt for Informatikk, Universitetet i Oslo. Studien utføres som et samarbeid mellom to studenter.

Du blir spurt om å delta i og med at du er ansatt ved omsorgsboligen.

Hva innebærer deltakelse i studien?

Vi vil samle inn informasjon ved hjelp av intervju. Spørsmålene vil omhandle erfaringer med nettbrettet. Det vil foretas notering, og dersom du samtykker vil vi i tillegg ta lydopptak. Dette vil vi spørre om ved begynnelsen av intervjuet. Varigheten og tidspunkt for intervjuet vil tilpasse seg behov og din tidsrådighet.

Hva skjer med informasjonen om deg?

Alle personopplysninger, notater og opptak vil bli behandlet konfidensielt. Det er kun vi og vår veileder ved Universitetet i Oslo som vil ha tilgang til innsamlet informasjon som kan identifisere deg. Notatene og lydopptakene vil bli anonymisert og vil heller ikke kunne tilbakeføres til deg. Lydopptak vil lagres på en ekstern enhet som låses inn for å ivareta konfidensialitet.

Studien planlegges å avslutte 01.05.2014. Personopplysninger og lydopptak vil slettes fire måneder etter endt prosjekt.

Frivillig deltakelse

Det er frivillig å delta i studien, og du kan når som helst trekke deg uten å oppgi noen grunn.

Dersom du trekker deg, vil alle opplysninger om deg bli anonymisert.

Dersom du har spørsmål til studien, ta kontakt med Christina Haug, 40886111 eller Fredrikke Holthe Kvam, 97573633

Studien vil meldes til Personvernombudet for forskning, Norsk samfunnsvitenskapelig datatjeneste AS.

Consent form interview elderly

Forespørsel om deltakelse i forskningsprosjekt:

Brukermanual for nettbrett ved omsorgsbolig i Oslo

Bakgrunn og formål

Formålet med denne studien er å undersøke hvordan nettbrettet brukes av beboere og ut ifra dette lage en brukermanual. Studien er del av en masteroppgave ved Institutt for Informatikk, Universitetet i Oslo. Studien utføres som et samarbeid mellom to studenter.

Du blir spurt om å delta i og med at du er involvert i bruken av denne teknologien.

Hva innebærer deltakelse i studien?

Vi vil samle inn informasjon ved hjelp av intervju og observasjon. Vi vil observere ditt handlingsmønster med nettbrettet. Observasjonen vil fokusere på hvordan nettbrettet brukes og blir forstått. Spørsmålene i intervjuene vil omhandle bruk, erfaringer og forventninger til nettbrettet. Det vil foretas notering og dersom du samtykker vil vi i tillegg ta lydopptak ved intervjuer. Varigheten og tidspunkt for intervjuet vil tilpasse seg behov og din tidsrådighet.

Hva skjer med informasjonen om deg?

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Studien planlegges å avslutte 01.05.2014. Personopplysninger og lydopptak vil slettes fire måneder etter endt prosjekt.

Frivillig deltakelse

Det er frivillig å delta i studien, og du kan når som helst trekke deg uten å oppgi noen grunn. Dersom du trekker deg, vil alle opplysninger om deg bli anonymisert. Det vil ikke få konsekvenser for ditt forhold til institusjonen om du velger å delta eller ikke.

Dersom du har spørsmål til studien, ta kontakt med Christina Haug, 40886111 eller Fredrikke Holthe Kvam, 97573633 eller vår veileder Sisse Finken, 22840643.

Studien er meldt til Personvernombudet for forskning, Norsk samfunnsvitenskapelig datatjeneste AS.

Consent form usability testing with elderly

Forespørsel om deltakelse i forskningsprosjekt

Brukermanual for nettbrett ved omsorgsbolig i Oslo

Bakgrunn og formål

Formålet med denne studien er å undersøke hvordan nettbrettet brukes av beboere og ut ifra dette lage en brukermanual. Studien er del av en masteroppgave ved Institutt for Informatikk, Universitetet i Oslo. Studien utføres som et samarbeid mellom to studenter.

Du blir spurt om å delta i og med at du er involvert i bruken av denne teknologien.

Hva innebærer deltakelse i studien?

Vi vil samle inn informasjon ved hjelp av intervju og observasjon i forbindelse med testing av brukermanualen. Det vil foretas notering og dersom du samtykker vil vi i tillegg ta bilder under testing. Dette vil vi spørre om før vi begynner. Varigheten og tidspunkt for testingen vil tilpasse seg behov og din tidsrådighet. Observasjonen vil fokusere på hvordan brukermanualen brukes og blir forstått.

Hva skjer med informasjonen om deg?

Alle personopplysninger, notater og opptak vil bli behandlet konfidensielt. Det er kun vi og vår veileder ved Universitetet i Oslo som vil ha tilgang til innsamlet informasjon som kan identifisere deg. Notatene og lydopptakene vil bli anonymisert i publikasjonen, og vil heller ikke kunne tilbakeføres til deg. Lydopptak vil lagres på en ekstern enhet som låses inn for å ivareta konfidensialitet.

Studien planlegges å avslutte 01.05.2014. Personopplysninger og lydopptak vil slettes fire måneder etter endt prosjekt.

Frivillig deltakelse

Det er frivillig å delta i studien, og du kan når som helst trekke deg uten å oppgi noen grunn. Dersom du trekker deg, vil alle opplysninger om deg bli anonymisert. Det vil ikke få konsekvenser for ditt forhold til institusjonen om du velger å delta eller ikke.

Dersom du har spørsmål til studien, ta kontakt med Christina Haug, 40886111 eller Fredrikke Holthe Kvam, 97573633 eller vår veileder Sisse Finken, 22840643.

Studien er meldt til Personvernombudet for forskning, Norsk samfunnsvitenskapelig datatjeneste AS.

Consent form interview developer of tablet

Forespørsel om deltakelse i forskningsprosjekt

Brukermanual for nettbrett ved omsorgsbolig i Oslo

Bakgrunn og formål

Formålet med denne studien er å undersøke hvordan nettbrettet brukes av beboere og ut ifra dette lage en brukermanual. Studien er del av en masteroppgave ved Institutt for Informatikk, Universitetet i Oslo. Studien utføres som et samarbeid mellom to studenter.

Du blir spurt om å delta i og med at du er involvert i utviklingen av denne teknologien.

Hva innebærer deltakelse i studien?

Vi vil samle inn informasjon ved hjelp av intervju. Spørsmålene vil omhandle utvikling av og erfaringer med nettbrettet. Det vil foretas notering, og dersom du samtykker vil vi i tillegg ta lydopptak. Dette vil vi spørre om ved begynnelsen av hver aktivitet. Varigheten og tidspunkt for intervjuet vil tilpasse seg behov og din tidsrådighet.

Hva skjer med informasjonen om deg?

Alle personopplysninger, notater og opptak vil bli behandlet konfidensielt. Det er kun vi og vår veileder ved Universitetet i Oslo som vil ha tilgang til innsamlet informasjon som kan identifisere deg. Notatene og lydopptakene vil bli anonymisert og vil heller ikke kunne tilbakeføres til deg. Lydopptak vil lagres på en ekstern enhet som låses inn for å ivareta konfidensialitet.

Studien planlegges å avslutte 01.05.2014. Personopplysninger og lydopptak vil slettes fire måneder etter endt prosjekt.

Frivillig deltakelse

Det er frivillig å delta i studien, og du kan når som helst trekke deg uten å oppgi noen grunn. Dersom du trekker deg, vil alle opplysninger om deg bli anonymisert.

Dersom du har spørsmål til studien, ta kontakt med Christina Haug, 40886111 eller Fredrikke Holthe Kvam, 97573633

Studien vil meldes til Personvernombudet for forskning, Norsk samfunnsvitenskapelig datatjeneste AS.

Appendix B: Interview guide

Intervjuguide for masteroppgave:

Brukermanual til nettbrett

Vi vil starte intervjuet med å presentere oss selv og vår masteroppgave. I oppgaven ønsker vi å kartlegge bruken av et nettbrett for deretter å kunne lage en brukermanual. I intervjuet vil vi ha fokus på bruk og erfaringer med nettbrettet.

Før intervjuet begynner, vil vi forespørre om lydopptak og innsamle samtykke fra deltakeren. Vi ønsker å foreta lydopptak for å gi riktigst mulig gjengivelse av intervjuet. Intervjuet vil deretter transkriberes på bakgrunn av notater og lydopptak.

I løpet av samtalen vil vi stille spørsmål rundt følgende temaer:

- Bruk av nettbrettet
- Forventninger om bruk
- Vanskeligheter med bruk

Intervjuet vil være samtalepreget og vare i ca. 20 min. Vi vil stille forhåndsforberedte spørsmål og eventuelle tilleggsspørsmål som måtte dukke opp underveis.

Vi garanterer full anonymitet av organisasjon og person ved bruk av resultater og innhentet informasjon i vår masteroppgave.

Oversikt over intervju spørsmål

Intervju ansatt#1

1. Hva er din rolle på her på huset?
2. Hvilken rolle har din arbeidsgiver i prosjektet?
3. Hvordan var prosessen for å innføre nettbrettene? Kom tilbyder med et produkt til dere eller kom etterspørselen fra deres side?
4. Hva er din personlige holdning til nettbrettene?

5. Hva var ditt førsteinntrykk av brettene?
6. Hvordan mener du hverdagen til beboerne har endret seg etter innføringen av brettene?
7. Hvordan føler du at beboerne viser entusiasme for brettet?
8. Har innføring av nettbrettene gått som planlagt? Hvis ikke, hva har gått "galt"?
9. Hva opplever du at beboerne har mest problemer med tanke på nettbrettet?
10. Er det flere beboere som bruker brettet nå enn i begynnelsen? Har opplæringen økt bruken?
11. Hva er de vanligste feilene som oppstår?
12. Hvor mange beboere bruker nettbrettet til hverdags?
13. Er det noen funksjoner på brettet som brukes mer enn andre? I så fall hvilke?
14. Er det noen funksjoner du eller andre ansatte savner?
15. Er det noen funksjoner beboerne har uttrykt at de savner?
16. Hva ønsker du deg i en brukermanual? Hvordan tror du den bør fremstå for å være mest mulig nyttig?
17. Tror du den blir lettest å bruke hvis den er i papirform, eller digitalt på brettet? Evt. begge deler?

Spørsmål til ansatt#2

1. Hvordan føler du at de eldre viser entusiasme for brettet? nivå
2. Har innføring av nettbrettene gått som planlagt? Hvis ikke, hva har gått "galt"?
3. Hva opplever du at de eldre har mest problemer med tanke på nettbrettet?
4. Hvordan har opplæringen påvirket bruken av nettbrettene? Er det flere beboere som bruker brettet nå enn i begynnelsen?
5. Hva er de vanligste feilene som oppstår?
6. Nå som dere har hatt nettbrettet en god stund, er det noen funksjoner dere eller beboerne savner?
7. Hvordan tror du brukermanualen bør fremstå for å være mest mulig nyttig?

Spørsmål til bruker:

1. Når flyttet du inn her?
2. Hva er ditt forhold til teknologi fra før?
3. Hva var ditt førsteinntrykk av brettene?
4. Hva bruker du nettbrettet til?

5. Er det noen funksjoner du savner på nettbrettet?
6. Er brettet et samtaleemne blant dere beboere?
7. Hva synes du er de største utfordringene med bruk av nettbrettet?
8. Kunne du tenkt deg en brukermanual?
9. Tror du den blir lettest å bruke hvis den er i papirform, eller digitalt på brettet? Evt. begge deler?
10. Hva ønsker du deg i en brukermanual?

Spørsmål til de som ikke bruker (bruker lite):

1. Hva er ditt forhold til teknologi?
2. Hva var ditt førsteinntrykk av brettene?
3. Er brettet et samtaleemne blant dere beboere?
4. Hvorfor bruker du ikke nettbrettet?
5. Tror du at du vil ta den i bruk dersom du får en brukermanual? Ville du i så fall likt best å ha denne i papirform eller digitalt på brettet? Evt. begge deler?

Spørsmål til leverandør av tjeneste

1. Hva inspirerte dere til å implementere dette nettbrettet?
2. Hvordan har prosessen rundt utviklingen vært?
3. Hvilken teknologi bruker dere?
4. Hva må brukes for å utvikle funksjoner på den?
5. Er det noen funksjoner som er planlagt, men som ikke er implementert enda?
6. Hvor ofte må brettene inn til reparasjon?
7. Hvilke tilbakemeldinger har dere generelt fått på brettene?
8. Har implementasjonen av brettene gått som planlagt?
9. Hvilke erfaringer har dere fått hittil av dette prosjektet?
10. Er dere i daglig dialog med Kunden? Evt. hvor ofte?
11. Hva er dine/deres tanker rundt en brukermanual?
12. Har du noen tips?

Appendix C: Testplan usability test

Testplan for brukertesten

Testgruppen består av to studenter ved Institutt for Informatikk, Fredrikke Holthe Kvam og Christina Haug.

Hvor og når:

Brukertesten skal utføres på ved omsorgsboligen (*anonymisert av oss*) i Oslo, mandag 17.mars fra kl. 12:00.

Formål og testobjekt:

Formålet med brukertesten er å undersøke om brukermanualen er forståelig og intuitiv for brukerne å bruke, og om den har noen mangler i forhold til utfordringene brukerne har med nettbrettet.

Funksjonalitet som skal testes:

- Ser brukeren hva de kan gjøre på siden?
- Klarer de å navigere seg til:
 - Oversikt over funksjoner
 - Brukermanualen
 - Utfordringer
- Skjønner de begrepene?
- Skjønner de bruksforklaringene?
- Er den lettleselig?

Brukergruppe:

Vår testgruppe består av 3 beboere ved omsorgsboligen. Testen utføres i omsorgsboligens i kjente omgivelser for brukerne.

Spørsmål før:

Hvordan er ditt forhold til nettbrettet?

Hva bruker du nettbrettet til?

Hva synes du er vanskelig?

Hva kaller du nettbrettet?

Vi kaller disse funksjoner, hva kaller du dem?

Oppgaver:

Bruk brukermanualen og utfør følgende oppgaver:

1. Hva forstår du av denne siden? (forsiden)
2. Hvordan vil du gå frem for å finne ut av hva du kan bruke nettbrettet til?
3. Du ønsker å legge inn avtaler på nettbrettet, men du vet ikke hvordan du gjør det.
Hvor vil du trykke/lete for å få informasjon om hvordan dette gjøres?
4. Trykk/bla opp på Funksjoner:
 - a. Trykk/se deretter på kalender: Ut ifra teksten, hva kan du bruke kalender til?
5. Kan du vise meg hvordan du vil gå frem for å finne informasjon om hvordan du ringer en venn?
6. Hvordan vil du gå frem for å finne informasjon om eventuelle utfordringer som kan oppstå?
7. Kan du vise meg hvordan du vil gå frem for å finne informasjon om hvordan du sjekker hva som er på menyen?
8. Klikk deg inn på Brukermanual og deretter på Kalender. Du ønsker nå å gå tilbake til den første siden du startet på. Hvor vil du trykke da? (denne oppgaven er kun for de som velger den digitale).

Spørsmål etter testen:

Hvordan synes du brukermanualen hjalp deg underveis med oppgavene?

Hva synes du var tydelig/uklart med brukermanualen?

Hva synes du om hvordan innholdet på sidene er presentert? Var det forståelig, leselig?

Hvordan synes du det var å navigere deg rundt på siden?

Hva synes du om fargevalg og skriftstørrelse.

Hvordan var ordbruken i brukermanualen?

Har du noen tilbakemeldinger på forbedringer av brukermanualen?

Oppgavebeskrivelse:

I denne brukertesten er det ikke brukerne som blir testet, men brukermanualen. De forskjellige oppgavene brukerne får vil teste de forskjellige funksjonene brukermanualen skal hjelpe til med og den vil gi oss en evaluering på om det vi har tenkt er intuitivt og forståelig også for brukergruppen. Bruker vi riktig ord? Forstår de hvordan de skal navigere seg rundt? Er den lettleselig og riktig fargevalg? Oppgave 1-2 tester brukermanualen og 3-8 tester menystruktur og navigering.

Timeplan

Vi har beregnet 30 min på hver test, med et kvarters pause i mellom disse for å notere og samle tanker før neste bruker.

Tid	Navn	Kommentar
12:00-12:30	Bruker 1	
12:45-13:15	Bruker 2	
13:30-14:00	Bruker 3	