

Developing a Framework for Improving Older Adults' Technology Acceptance
within a Case Example of Elderly Support:
Using Theory and Human Centred Design for Designing
the Introduction of the VictoryaHome System

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Abstract

Many assistive technologies are being developed to support independently living elderly and their often older informal caregivers in the ageing process. Even though these technologies have many advantages, the technology acceptance in this user group is generally low. A lot of research has therefore been done on designing systems with a better acceptance rate.

However, far less research focuses on the product implementation. This study therefore aims to develop a framework for improving older adults' technology acceptance within a case example of elderly support, focusing on the system introduction. In doing so, the currently available knowledge on influencing technology acceptance is synthesized first. Then, the case of VictoryaHome, a European research project that is developing an assistive technology for elderly and their caregivers, is intensively studied in order 1) to generate case specific design solutions for the technology introduction, and 2) to develop new insights into the current technology acceptance theory. To reach these objectives, a human centred design approach is followed and the first three phases of the human centred design cycle are executed. The first phase consists of understanding the context of use and eliciting requirements. Concept mapping is performed to get an understanding of the knowledge that users need to acquire. A hierarchical task analysis is performed to understand the tasks that users perform to achieve the system supported user goals. Laddering interviews are done to retrieve persuasive information that helps users in deciding to accept or reject the system. Finally, semi-structured interviews are held to retrieve user needs and preferences for the introduction. The next phase involves specifying these findings and formulating specific user requirements. These requirements are prioritised using the MoSCoW method. Based on the user requirements, users' preferences for solving these requirements and relevant design guidelines from literature, an initial evidence-based design for introducing the VictoryaHome system is produced. The introduction design involves: 1) an informational and motivational

video, 2) a training, where users have hands-on experience with the system in their own homes, 3) a user manual, and 4) supervised discussions leading to agreements to resolve privacy issues and to coordinate use behaviour between users. The user requirements, design guidelines and rich context information can on the one hand be used as example or inspiration for similar cases. On the other hand, the deep understanding of the study subject gained by in-depth qualitative research has theoretical implications. The results of this study suggest that two dominant models of technology acceptance could be integrated, and that ‘coordinating use behaviour’ could be an important additional determinant of technology acceptance in a multi-user context. Experimental studies are necessary to confirm the value of the found user requirements and the new insights into the technology acceptance theory.

Keywords: telecare, assistive technology, technology acceptance, human centred design, technology implementation, older adults, elderly

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Introduction

The world population is growing older. The World Health Organisation (WHO; 2013a) reported that in 2012, 11% of the world population was over 60 years old and they expect this number to increase to about 20% in 2050 (WHO, 2013b). In Europe, the proportion of people being at least 60 years of age is currently 20% already. The ageing trend does not only entail an increased older population, older adults' health has also improved over the years (Crimmins, 2004; CBS, 2002). These trends are in itself a positive signal reflecting improved living conditions. However, many people do still experience functional decline towards the end of their life because of diseases, conditions or impairments (Crimmins, 2004; WHO, 2013b). This is represented for example by the fact that in the Netherlands 70% of people over 65 years old have at least one chronic disease compared to 32% in the total Dutch population (Gijzen, Oostrom & Schellevis, 2013). So even though health has improved for elderly over the years, the saying 'old age has its infirmities' still holds true and with the growing number of older adults, supporting elderly in their daily functioning is a pressing issue.

Elderly support should preferably take place in the comfort of the older adult's own home with the help of family members and friends (Steele, Lo, Secombe, & Wong, 2009). Steele et al. (2009) state that remaining independent is something that is highly valued by elderly people. This could be an important reason why older adults tend to favour staying in their own home over placement in an institution (Tinker & Lansley, 2005). Tinker and Lansley (2005) further state that government policies in England also encourage people to live independently, demonstrated by a declining number of available places in care institutions and the higher costs for such places. The same attitude towards independent living goes for Dutch politics (e.g. Schippers & Van Rijn, 2014). Added is the vision that to keep elderly care affordable and to support person oriented, individually tailored care, informal care and the

collaboration between informal and professional caregivers should be promoted and supported (Asscher, 2013; Van Rijn, 2013). In other Western countries, an increase in the reliance on informal caregivers for elderly support is also visible (Magnusson, Hanson, & Borg, 2004). However, with a changing society where families become smaller and family members live far apart more often, including family members in elderly support is not always easy. Caring for older people in their own homes and supporting the involvement of informal caregivers thus asks for innovative ideas and solutions.

The role that technology can play in elderly support and its organisation is promising. The development and uptake of new technologies in healthcare has grown rapidly over the last decades (Magnusson et al., 2004). Furthermore, politics currently seem to encourage the implementation of such technologies. The minister of Health, Welfare and Sports in the Netherlands, for example, has recently published the five year goal to support older adults living independently by making telecommunication with health care professionals available and making use of domotics (Schippers & Van Rijn, 2014). Domotics is defined as “the integration of technology and services through home networking for a better quality of living” (Van Berlo, 2002, p.77). There is no restriction set on what sorts of technology or services can be used in the field of domotics. However, for the implementation of such technologies to be successful, there are important factors that should be taken into account.

For any technology to be beneficial for supporting elderly residents and their informal caregivers, it has to be *used* and it has to be used properly (DeLone & McLean, 2003). This might seem needless to say. However, especially when elderly users are part of the target group special care for this issue in the development of a technological aid or service is needed. Morrell, Mayhorn, and Bennett (2000) have shown for example that elderly people were the least interested in using the internet compared to other age groups. More generally, Venkatesh, Morris, Davis, and Davis (2003) reported that technology acceptance overall was

lowest among older people. Elderly people also encounter more problems with using technology (Napp, 2008; Hara, Naka, & Harada, 2009). Vision problems and reduced fine motor skills for example influence the ease with which a computer is used, making it more difficult to read (small) text on a screen and controlling the mouse cursor. Technological solutions are therefore designed that try to overcome these issues.

This research focuses on the implementation of such assistive technologies for elderly and their older informal caregivers, promoting technology acceptance by designing an evidence-based introduction of a system. A framework to improve technology acceptance is developed within a case example of elderly support. This is done by researching what factors influence technology acceptance and investigating how the design of a system introduction can positively influence these factors. A human centred design approach is followed to reach design solutions that relate closely to users' needs and preferences. The study involves the actual design of an introduction for the studied case system with an in-depth analysis of the case. The case study forms the basis for the development of specific design solutions for an introduction that could improve technology acceptance and more general insights into the technology acceptance theory. In this chapter, a more elaborate description of the target users is provided first. After that, a short overview of available technology in elderly and informal caregiver support will be given. The discussion will then move on to the issue of technology acceptance. Next, the design methodology, human centred design, is introduced into the discourse. Eventually, the studied case is presented and the scope of the research is set. The research questions are also formulated in this section.

Elderly and their Informal Caregivers

Independently living elderly form one part of the target group in this research. It was already stated that the elderly population is growing and that older adults value living at home independently (Steele et al., 2009). Statistics Netherlands, or in Dutch *Centraal Bureau voor*

de Statistiek (CBS; 2011) adds to this statement that elderly actually do live at home longer nowadays. They show that the percentage of Dutch people over 80 years of age that are institutionalised has decreased from 20% in 2000 to 14% in 2010 and that in 2010, six out of seven people over 80 still lived at home completely independent or with some form of support. Furthermore, it is stated that at this age women live alone at home far more frequently, since men generally pass away sooner than their female partners. However, getting older usually does not go without functional decline that is due to diseases, conditions or impairments (Crimmins, 2004). As a result, it is found that 72% of Dutch men and 76% of Dutch women over 65 years of age take prescribed medication, in comparison to 34% of the entire Dutch population (CBS, 2010). Functional declines that impact the use of technology range from cognitive declines, such as a decreased functioning of working memory, to reduced vision that i.e. impacts the effective use of information presented on a screen (Napp, 2008). An overview of the types of ageing related functional decline and the impact it can have on using technology can be found in Appendix A. As stated, technology use among older adults is growing, although it still does not reach that of younger people (e.g. WHO, 2013a; CBS, 2014; Czaja et al., 2006). To go beyond this numerical description and get a deeper insight into older adults living at home independently, Smart Homes (2010) has developed personas based on field work in one of their projects. A persona is a fictional person that is considered an archetype of actual users (Cooper, 1999). Creating detailed characters with a name, goals, and detailed individual and situational characteristics helps designers and others to really take the perspective of the users. The personas representing the elderly users relevant for this case study are described in Appendix B. They give insight into the elderly's enjoyments in life, their worries and wishes, their physical and cognitive problems and the views of their relatives.

The second part of the target group in this research consists of the informal caregivers or family and friends of the elderly resident. Middle-aged and older informal caregivers form a significant section among informal caregivers. CBS (2013) states that in 2012, 19 percent of people aged between 50 and 65 years old were an informal caregiver, which is the largest percentage compared to other age groups. Also, the number of hours spend on providing informal care tends to increase with age. In the group of informal caregivers, people under the age of 65 spend on average between 8 and 11 hours per week on providing care. For people aged 65 to 75 years old, this was 14 hours per week. Furthermore, CBS (2006) shows that informal care is given mostly to an ill or frail parent, which is the case for 60% of the informal caregivers. Most informal caregivers that take care of a parent are aged 50 to 54 years old. In this age group, more specifically people aged 50 to 65 years old, the employment rate has increased over the years, especially among women (Arts & Otten, 2013). Together with the fact that women provide informal care almost twice as often as men, this could partially explain why one in seven informal caregivers feels at least fairly burdened with providing care (CBS, 2013). Since adults over 50 years old have the most significant role in providing informal care, they will be the targeted informal caregivers in this research. Furthermore, they also fit the picture of users that less frequently use technology than younger users and are generally less motivated to use new technologies (CBS, 2014; Czaja et al., 2006). Thus, the target group in this study are independently living elderly and older informal caregivers, with adults over 50 years considered as older adults, and adults over 70 considered as elderly.

Technology in Elderly and Informal Caregiver Support Today

A wide range of technology is already available to help elderly in all kinds of facets of their daily living. These types of technology fall under the term assistive technology.

Magnusson et al. (2004) define assistive technology as: “any device or system that allows an

individual to perform a task they would otherwise be unable to do or increases the ease and safety with which the task can be performed” (p. 224). Some examples of assistive technologies for elderly are: alarm systems with which an elderly resident can send out an alarm in case of emergency; dusk till dawn lights that give a constant low intensity light during the night to prevent accidents when people get out of bed; something as simple as a walking stick; or something as complex as (social) robots that can perform various tasks, from grabbing and bringing items, to alerting people when they need to have a drink or take medication, or being some form of companion (Miskelly, 2001; Curry, Trejo, Tinoco, & Wardle, 2002; Huijnen, Badii, Van den Heuvel, Caleb-Solly, & Thiemert, 2011). This small selection of assistive technologies already shows that there are many different types of technologies available, and that there are many scenarios in which they can be beneficial. Kleinberger, Becker, Ras, Holzinger and Müller (2007) summarize the usage scenarios for technologies currently available to assist elderly in living at home independently as technologies for: 1) emergency assistance, 2) autonomy enhancement and 3) comfort. Figure 1 shows these categories, together with examples of activities to give a better idea of the scope of each category. The figure furthermore shows the categories being multiple inclusive, with categories on the left including all categories on their right. Thus, emergency assistance is seen as contributing to staying autonomous. Subsequently, both emergency assistance and autonomy enhancement contribute to living a comfortable life.

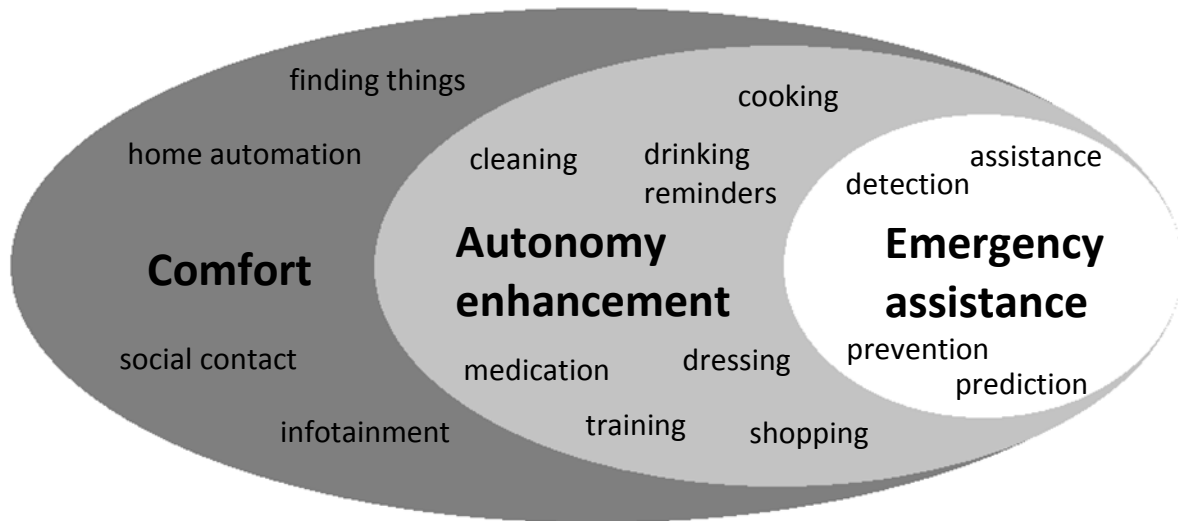


Figure 1. Usage domains for assistive technologies for elderly living at home. Adopted from Kleinberger, Becker, Ras, Holzinger & Müller (2007).

For (informal) caregivers, also different types of technologies have been developed to support them in taking care of elderly living at home. Most of the technologies that target older adults' caregivers pertain to the concept of telecare, which Magnusson et al. (2004) define as “the delivery of care services from a distance to elderly patients living at home, some of whom are living in rural areas” (p.224). These services consist for example of remote health monitoring services that can keep track of heart rate, skin temperature and activity. When (strong) deviations from baseline measurements occur, caregivers can decide to take action or prompt the elderly resident to take action. Other examples are the alarm systems mentioned before, or services for virtual visiting, where a video and audio connection makes it possible to have a remote doctor's consult for instance.

The supporting technologies and services for caregivers come with many advantages. Whitten, Doolittle, Mackert, and Rush (2003) mention benefits like time and travel savings, increased quality of care and the possibility to include family members in the caregiving process that are not able to be physically present. For the latter benefit, it should be considered that virtual visiting, or videoconferencing, adds value to just audio conferencing

because of the increased feeling of social presence that is experienced (Cukor et al., 1998). This means it feels more like having a ‘real’ visit or ‘really’ being with the other person. This feeling of social presence is formally defined by Lee (2004) as: “[the] experience of para-authentic social actors [which means]: experiencing the representation of other humans who are connected by technology” (p.45). Kristoffersson, Coradeschi, Eklundh, and Loutfi (2011) confirm that health care professionals experienced a high feeling of social presence when they used a telepresence robot to get in touch with elderly that were located in their own home.

For elderly residents and their caregivers to experience the benefits of supporting technologies, they have to use them properly. It has already been mentioned that aging comes with functional declines that can influence how successful the interaction with certain technologies is (Napp, 2008). In addition, elderly seem less interested in using certain technologies (Morrell et al., 2000). The next section will focus on the latter issue and addresses technology acceptance and its determinants.

Technology Acceptance

The acceptance of new technologies by its intended users is not a given, especially when elderly users are involved who tend towards lower technology use and acceptance. Technology acceptance is a term used to express the adoption of a technology by its intended target users and can be more specifically defined as the degree and manner in which target users use a certain technology and its capabilities (Petter, DeLone, & McLean, 2013). In businesses, the difficulty of achieving technology acceptance is shown for example, by the fact that even technologies that are introduced to support personnel in their activities are rejected by the same employees (e.g. Speier & Venkatesh, 2002). Or when the consumer industry is considered, it can be seen that certain technological products are able to successfully penetrate the market, while others fail. When it comes to elderly, Arning and Ziefle (2009) demonstrate that technology acceptance is significantly lower compared to other

age groups. However, older adults have been using technology more often over the years. Mitzner et al. (2010) note for example that overall older adults use a wide variety of technologies, ranging from microwaves and televisions to mobile phones and computers. CBS (2014) reported that in 2006 only 57% of people aged between 65 and 75 years had access to a computer compared to 85% in 2013. Having said that, computer access in this age group is still considerably lower than the average access in the Dutch population, which is 96%. Czaja et al. (2006) confirm that older adults are less likely to use computers, internet and technology in general than younger adults, and that older adults use computers for fewer activities. However, it must be noted that elderly tend to have positive attitudes towards several assistive technologies and their usefulness (e.g. Demiris et al., 2004; Gaul & Ziefle, 2009; Rahimpour, Lovell, Celler, & McCormick, 2007). Gaul and Ziefle (2009) report that even though many elderly have a positive attitude towards using assistive technology, acceptance was lowest in the oldest age group (75+). They also found that technology acceptance varied greatly in this age group was, indicating the importance of taking into account the diversity of an elderly user group. Broadbent, Stafford, and MacDonald (2009) found that acceptance of an assistive robot increased among elderly, when it was proposed to them that the robot could increase their independency if they could no longer handle everyday tasks. So, although technology acceptance is generally low among the oldest age groups, there is also a wide variation. Acceptance of assistive technologies seems to be higher than that of other technologies. The following paragraph reviews factors that influence technology acceptance.

Explaining technology acceptance.

Technology acceptance is an interdisciplinary research topic and has therefore been investigated from different perspectives in different fields of study. In this subsection the most important theoretical frameworks of technology acceptance from different academic disciplines are discussed. Together these frameworks form the theoretical basis for the

evidence-based design approach used in this study. Reed, McNicholas, Woodcock, Issen and Bell (2014) acknowledge the importance of identifying existing theory on producing desired situation improvements, such as improving technology acceptance, and note that its articulation can facilitate effective design. After the discussion of the different theoretical frameworks, the role of these frameworks in improving technology acceptance by means of designing a system introduction will be discussed in more detail and represented in an initial action-effect diagram (Reed et al., 2014). An action-effect diagram represents an intervention, in this case a system introduction, and its anticipated effects.

Behavioural Determinants.

Psychologists have investigated the behavioural determinants that affect people's technology use, resulting in the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh, Morris, Davis, & Davis, 2003). One often used model for explaining technology use is the Technology Acceptance Model (TAM) from Davis (1989). This model is based on the Theory of Reasoned Action (TRA), which predicts behavioural intention, an important predictor of actual behaviour (Ajzen & Fishbein 1977). Davis (1989) has put this theory in a technological context by specifying the to be predicted behaviour as using technology. Davis (1989) furthermore defines a technology's perceived usefulness and its perceived ease of use as the two main behavioural beliefs that influence the attitude a person has towards using that technology. Following from TRA, an attitude towards behaviour largely determines the behavioural intention, or, in this case, the intention to use technology. Since the introduction of TAM many researchers have proposed extensions or other changes to the model (e.g. Chung, Park, Wang, Fulk, & McLaughlin, 2010; Yang & Yoo, 2004). A review of such studies from Venkatesh et al. (2003) resulted in a widely accepted update of TAM, the Unified Theory of Acceptance and Use of Technology (UTAUT).

UTAUT (see Figure 2) contains three main determinants of the intention to use a certain technology, namely: 1) performance expectancy (similar to TAM's perceived usefulness), 2) effort expectancy (similar to TAM's perceived ease of use), 3) social influence, and 4) facilitating conditions. Facilitating conditions do not influence behavioural intention, but affect technology usage directly. Definitions of the four main determinants are shown in Table 1. UTAUT complies with the Theory of Planned Behaviour (TPB) (Ajzen, 1991) which is the extension of the TRA (Benbasat & Barki, 2007).

The model includes four moderating factors: gender, age, experience and voluntariness of use. In the target group of independently living elderly and their informal caregivers, females are overrepresented. Furthermore, they have an older age and even though older adults are getting more experienced with technology, this is generally still less than the younger adults in society. Venkatesh et al. (2003) describe the effects of the moderating variables on the relationships between the behavioural determinants and the intention to use technology. Their results show that for older women with little technology experience, the group that is overrepresented in our target group, the relationship between social influence and behavioural intention and the relationship between effort expectancy and behavioural intention is stronger than for younger male users with more technology experience. So, to improve the likelihood of people actually using a new technology, the behavioural determinants from the UTAUT should be taken into account when the technology and the accompanied introduction are being designed.

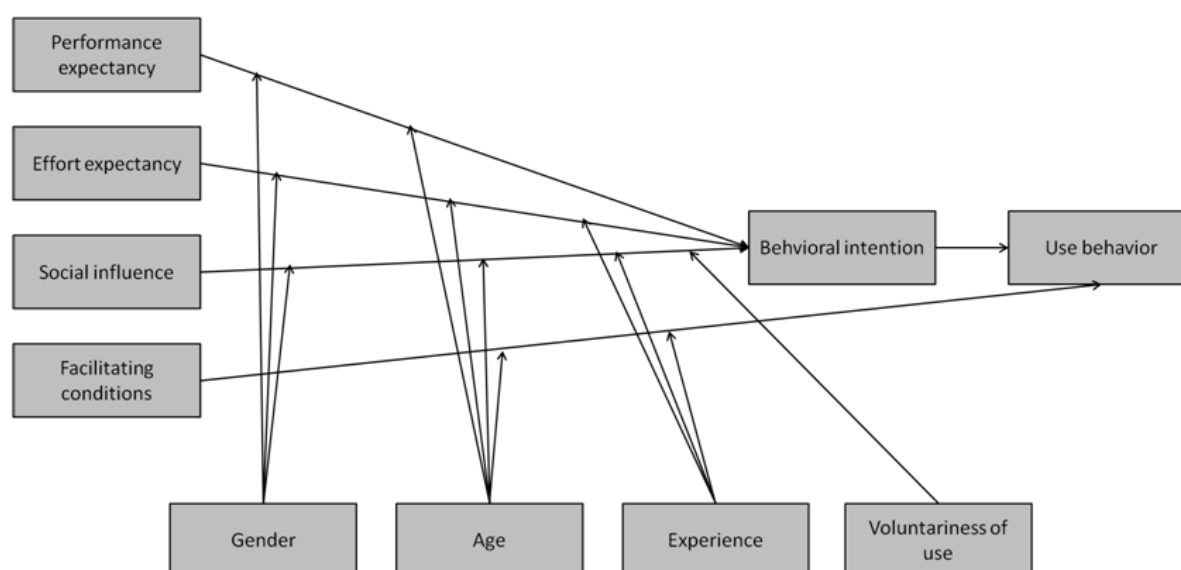


Figure 2. Unified Theory of Acceptance and Use of Technology (UTAUT), adopted from Venkatesh, Morris, Davis, & Davis (2003).

Table 1

Definitions and root constructs of UTAUT determinants, adopted from Venkatesh et al. (2003)

Determinant	Definition	Root constructs
Performance expectancy	The degree to which an individual believes that using the system will help him or her to attain gains in job performance.	Perceived usefulness, extrinsic motivation, job-fit, relative advantage, outcome expectations
Effort expectancy	The degree of ease associated with the use of the system.	Perceived ease of use, complexity, ease of use
Social influence	The degree to which an individual perceives that important others believe he or she should use the new system.	Subjective norm, social factors, image
Facilitating conditions	The degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system.	Perceived behavioural control, facilitating conditions, compatibility

System and Design Characteristics.

In the field of Information Systems (ISs), scientists have researched the system characteristics that influence the intention to use technology and that lead to user satisfaction. An often used model in the ISs discipline to predict or determine the successfulness of an IS is the DeLone and McLean Information System Success Model (DeLone & McLean, 2003), which is shown in Figure 3. As can be seen, the model is a process model with three stages important for IS success: system creation, system experience and systems benefits. In each of these stages, different criteria for success are defined. After researching the associations between these factors DeLone and McLean (2003) decided to also incorporate the variance properties in the process model by showing the relations between the success factors. They found that the following system characteristics influence the intention to use an IS and the experienced user satisfaction: 1) the quality of the system, 2) the quality of the communicated information and 3) the quality of the service that comes with the system. The specific meaning of these and the other factors in the model as defined by Petter et al. (2013) are shown in Table 2. Wixom and Todd (2005) broaden our understanding of what system characteristics lead to user satisfaction by deriving antecedents from literature to the DeLone and McLean model's concepts of information quality and system quality. This has resulted in a list of more specific system characteristics that increase user satisfaction, that is shown in Table 3. It should be noted that even though Wixom and Todd (2005) tested the predictive value of these factors, they warn that the list might not be exhaustive and that their predictive weights may depend on usage contexts.

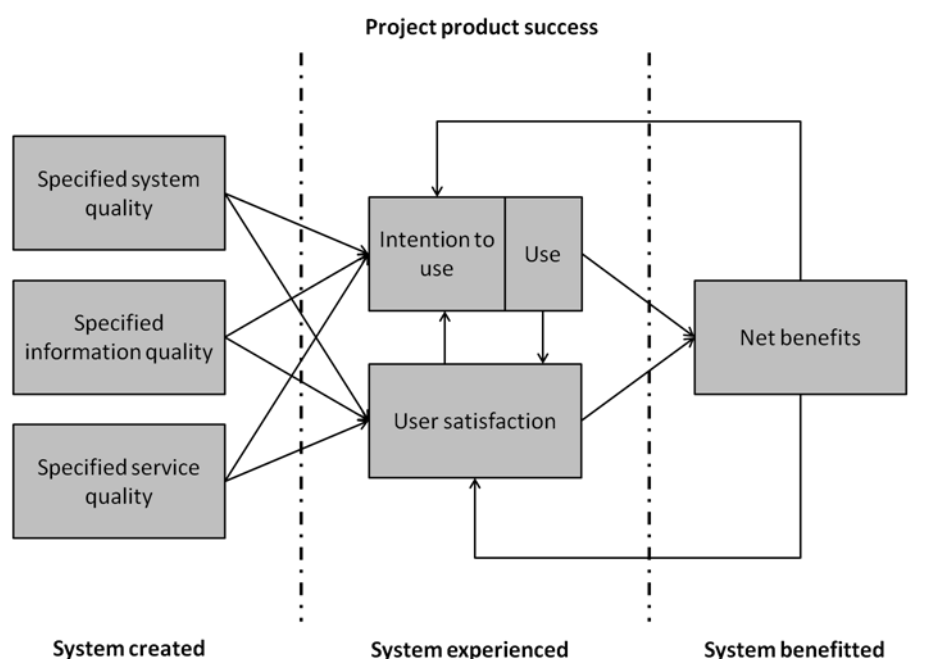


Figure 3. DeLone and McLean Information System Success Model, adopted from DeLone and McLean (2003).

Table 2

Variables in the DeLone and McLean model explained, adopted from Petter et al. (2013).

Success var.	Definition	Examples of root constructs, operationalizations and measures
System quality	Desirable characteristics of an IS.	Ease of use/ learning, system flexibility and reliability, intuitiveness, response time.
Information quality	Desirable characteristics of the system outputs (content, reports, dashboards).	Relevance, understandability, accuracy, conciseness, completeness, currency, timeliness, usability.
Service quality	Quality of the service or support that system users receive from the IS organization and IT support personnel in general or for a specific IS.	Responsiveness, accuracy, reliability, technical competence, empathy of the personnel staff.

System use	Degree and manner in which staff and customers utilize the capabilities of an IS.	Amount of use, frequency of use, nature of use, appropriateness of use, extent of use, purpose of use.
User satisfaction	Users' level of satisfaction with the IS.	Single item, semantic differential scales, multi-attribute scales
Net benefits	Extent to which ISs are contributing to the success of individuals, groups, organizations, industries, and nations.	Improved decision making, improved productivity, cost reductions, consumer welfare.

System characteristics can influence technology use by affecting a person's attitude. The DeLone and McLean model (DeLone & McLean, 2003) does not clearly explain how a system's characteristics influence technology use. Wixom and Todd (2005) clarify this relation. They state that based on system characteristics users formulate object-based attitudes, what they define as user satisfaction. However, Melone (1990) demonstrates that user satisfaction does not predict system use. Wixom and Todd (2005) tackle this issue by differentiating between object-based attitudes and behavioural attitudes as known from the earlier described TAM and UTAUT (Davis, 1989; Venkatesh et al., 2003). They state that user satisfaction, an object-based attitude, does not predict system use, or technology acceptance, on its own, but is fully mediated by behavioural beliefs and attitudes. This is in line with the findings of Venkatesh et al. (2003) who show that the behavioural beliefs in UTAUT are relatively good at predicting technology acceptance, in contrary to the object-based beliefs in the DeLone and McLean model (DeLone & McLean, 2003). Wixom and Todd (2005) explain that: "beliefs about using the system to accomplish a particular task [behavioural beliefs] will be shaped, in part, by the attitude towards the system itself [object-based attitude]; indirectly these beliefs will shape the attitude towards use and the eventual usage behaviour [behavioural attitude]" (Wixom & Todd, 2005, p.90). Thus, influencing

users' attitudes towards using a certain technology can partly be achieved by designing and developing a product that is perceived as high quality.

Table 3

Definitions of the key antecedents of information and system quality as defined by Wixom and Todd (2005).

Antecedent	Definition
Currency ¹	The user's perception of the degree to which the information is up to date
Completeness ¹	The degree to which the system provides all necessary information
Accuracy ¹	The user's perception that the information is correct
Format ¹	The user's perception of how well the information is presented
Timeliness ²	The degree to which the system offers timely responses to requests for information or action
Reliability ²	The dependability of system operation
Flexibility ²	The way the system adapts to changing demands of the user
Integration ²	The way the system allows data to be integrated from various sources
Accessibility ²	The ease with which information can be accessed or extracted from the system

¹ Antecedents of information quality ² Antecedents of system quality

Users' Knowledge and their Decision Making Process.

Sociology and communication research have explored stages that people go through when accepting or adopting (technological) innovations. This is outlined in the innovation-decision process, part of Rogers' (2003) diffusion of innovations theory. Rogers (2003) explains innovation diffusion as the "process by which an innovation is communicated

through certain channels over time among the members of a social system” (p.5). Part of this process captures the decision making process that an individual goes through when deciding whether or not to adopt a new technology. The related choices and actions are summarized in the stages of the innovation-decision process, shown in Figure 4. The first stage, the *knowledge stage*, is concerned with exposing an innovation to individuals and communicating three types of knowledge to them: awareness-knowledge, involving information that an innovation exists; how-to knowledge, involving the information necessary to use an innovation properly; and principles knowledge, involving information that deals with the functioning principles underlying how an innovation works (Rogers, 2003). At the second stage, the *persuasion stage*, individuals form an (un)favourable attitude towards the innovation based on its characteristics. Since innovations come with uncertainty, more information is sought in this stage on the innovation’s expected consequences. People interpret what messages are credible and consult peers and other individuals that are socially close for their insights. When an attitude is formed, the individual decides whether or not to adopt the innovation in the *decision stage*. This decision is preferably based on a trial period. After these more mental processes, an innovation is adopted and put into use in the *implementation stage*. In this stage, users are especially in need of technical assistance, since they are still figuring out how to use the innovation. Other purposes or modifications of the innovation are also likely to occur in this stage, a process called re-invention (Rogers, 2003). In the final stage, the *confirmation stage*, people look for reinforcement for the decision they have made concerning the adopted innovation. The original decision to adopt or reject an innovation can be reaffirmed or altered based on the messages that are received in this stage. A person thus goes through several stages when adopting a new technology. Supporting individuals in this process by promoting good information and good use of communication channels can increase technology adoption, or technology acceptance.

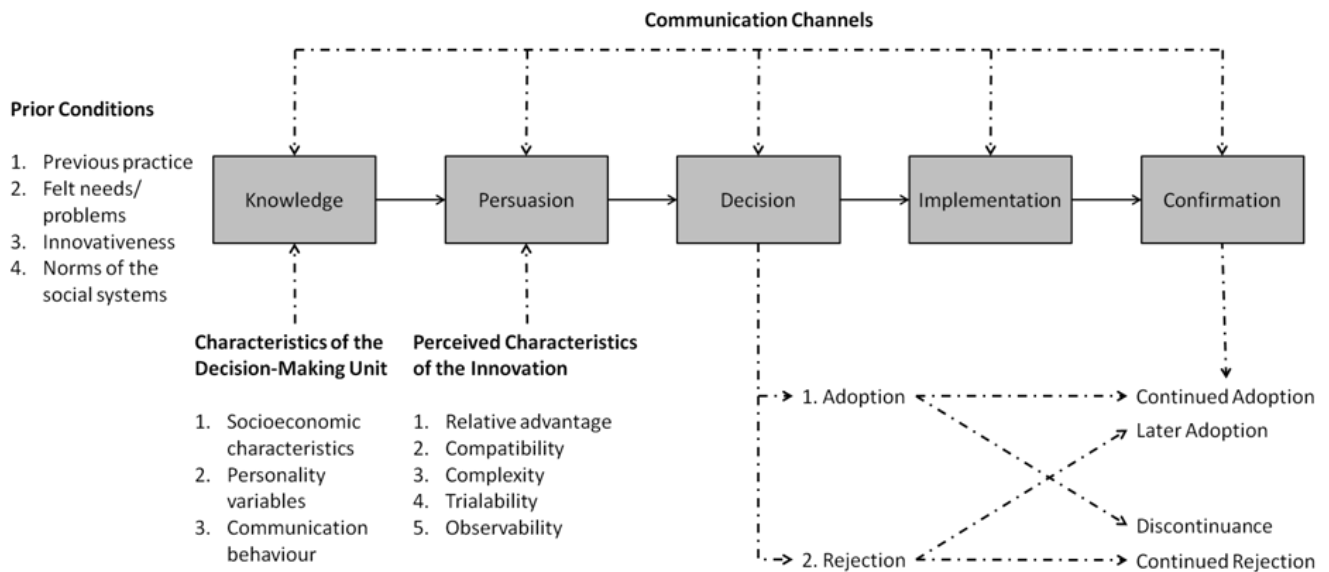


Figure 4. A model of the stages in the innovation-decision process, adopted from Rogers (2003).

In this section, the problem of technology acceptance, especially with elderly users, was raised and different models on explaining technology acceptance have been discussed. These models form the basis for the development of our framework for improving technology acceptance and the design of an evidence-based system introduction. A synthesis of the discussed models is found in the initial version of the action-effect diagram presented in Figure 5. It can be seen that the models and findings from DeLone and McLean (2003) and Wixom and Todd (2005) focus on improving technology acceptance by designing a high-quality system. This will lead users of the system to form a positive attitude towards the system itself and consequential towards using the system. Designing a high-quality system, which falls out of the scope of this research, thus indirectly influences the behavioural determinants described by Venkatesh et al. (2003) in UTAUT. It is proposed that designing a good introduction of the system can further influence these behavioural determinants, and so impact technology acceptance. Furthermore, Rogers (2003) has demonstrated the importance of supporting individuals in their decision making process on adopting technology by providing different types of information to increase their knowledge. Increasing users'

knowledge is therefore also an important aim that is proposed to be reached by designing a good system introduction. The theory presented in Figure 5 gives a clear overview of what factors should be influenced by the introduction to achieve improved technology acceptance. However, the underlying theory gives no direct insight into how the introduction design should be established to come to the best solutions. Therefore, the next section will focus on a design model, human centred design, that is used to achieve the desired changes.

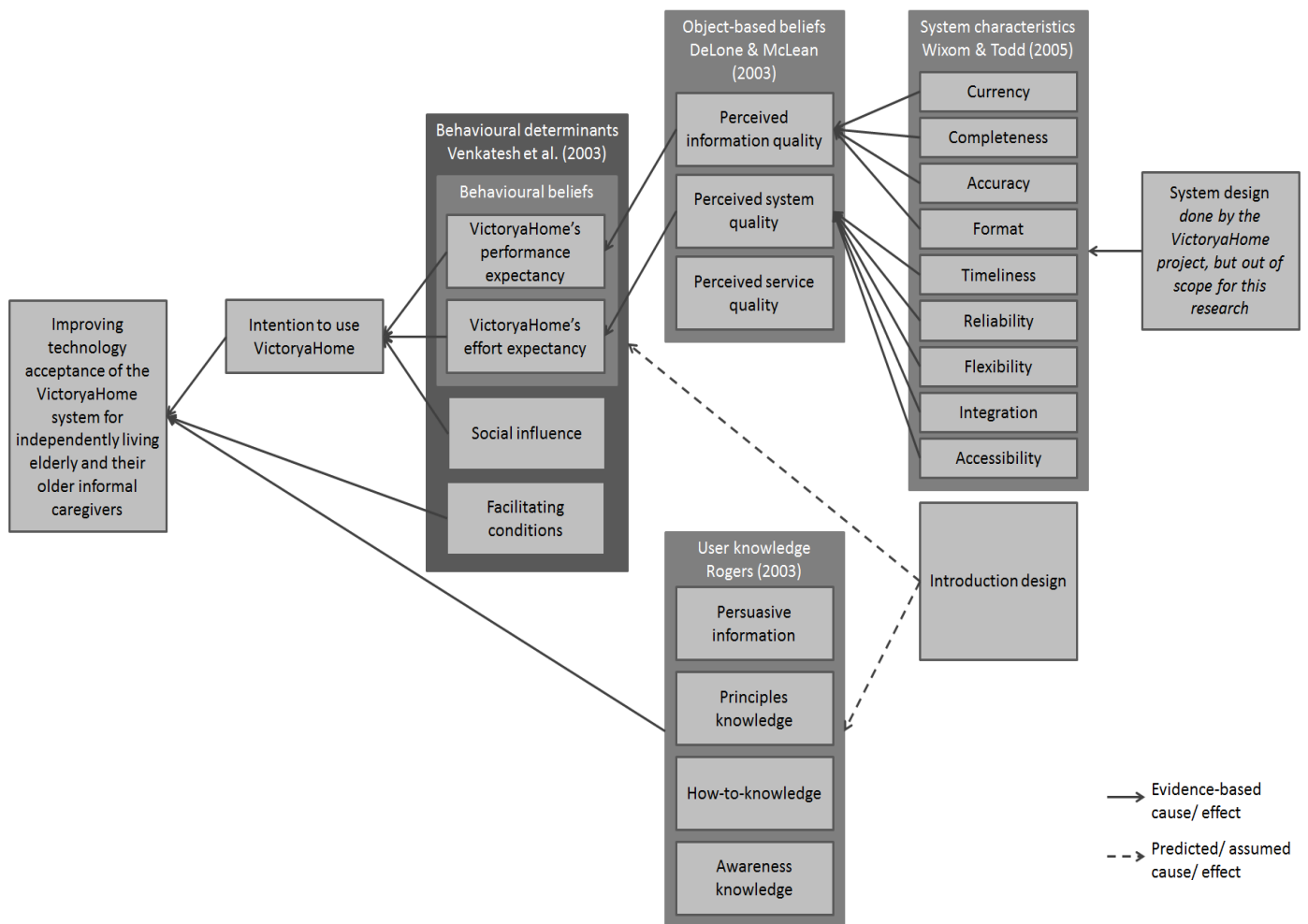


Figure 5. First version of the action-effect diagram representing the underlying theory through which the introduction design is proposed to have its effect on technology acceptance.

Human Centred Design for Technology Interaction and Acceptance

To support independently living elderly and their caregivers, facilitate successful user-system interaction, and improve technology acceptance the technological solution and their introduction have to be well designed. Human centred design (HCD) is a design philosophy that seems especially fruitful for addressing these issues. Human centred design (HCD), often referred to as user centred design, is a design philosophy that is concerned with incorporating the user's perspective into development processes in order to achieve usable systems (Maguire, 2001a). A more formal definition of HCD is given by the International Organization of Standardization (ISO) in their 9241-210 ISO standard: "[HCD is an] approach to systems design and development that aims to make interactive systems more usable by focusing on the use of the system and applying human factors/ergonomics and usability knowledge and techniques" (ISO/TC 159 SC/ 4, 2010, ch.2 par.7). These definitions illustrate two important aspects of the HCD philosophy. The first is the goal to develop usable systems and the second is using methods that focus on the user in achieving this goal.

Designing usable systems has many advantages, with i.e. safety being an important advantage in the context of elderly support. Usability is a highly valued characteristic in technology development and is defined by ISO/TC 159 SC/ 4 (1998) in their 9241-11 ISO standard as: "[the] extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use" (ch.3 par.1). This means that a technical system, such as a certain software application, should not only provide the possibility to fulfil certain tasks, but should do this in a way that supports users in interacting with the system. Besides preventing system misuse or users from becoming frustrated, designing usable systems comes with advantages like increased productivity, reduced errors, reduced need for training and support and improved technology acceptance (Maguire, 2001a). The fact that usable designs reduce the chance of users making

errors, and therefore increase safety, is especially important in safety critical situations where errors can have detrimental consequences (Harte et al., 2014). Such situations can be easily found in healthcare contexts, particularly when the users have to use a technology without assistance, as is the case with assistive technologies that elderly use in their own homes. Kaufman et al. (2003), for example, found a variety of usability problems with a telemedicine device that was used by (elderly) users in their own home to electronically transmit glucose and blood pressure readings to their physicians. In achieving usable designs following usability guidelines is essential (Bevan, 2009).

HCD is furthermore focused on using user oriented methods to promote usable designs. The key activities of HCD are summarized in the human centred design cycle, presented in the 9241-210 ISO standard, but adopted from Maguire (2001a) which is shown in Figure 6. The three principles that Gould and Lewis (1985) present as key principles for HCD can be derived from the figure. They state that first of all designers must study the users and the to be accomplished tasks. This is what also has to be done in order to understand the context of use and to specify good user requirements, two activities in the HCD cycle. Gould and Lewis (1985) then state that simulations and prototypes must be evaluated by means of empirical measurements where user performance and user reactions must be observed, recorded and analysed. Based on these measurements, prototypes need to be updated after which new measurements follow making HCD an iterative process. A user orientated methodology is important for developing any kind of system that is going to be used by people. However, the case can be made it is especially important for elderly users. As noted before, getting older comes with a wide variety of functional declines that can impact the interaction with a system. Furthermore, elderly are a very diverse user group. These factors make it hard to anticipate possible usability problems (Jastrzembski & Charness, 2007), and a human centred design approach can help discovering these issues before a product is released

on the market. HCD is a good methodology to follow for designing usable products and improving technology acceptance in general. However, because the diversity of the elderly users makes it hard to predict usability issues without following a HCD approach, this method is considered especially suitable for this study, which involves designing for independently living elderly and their caregivers. It is important to note that in this study not a technological system is being developed, but the introduction of such a system. However, for developing an introduction, which can be seen as a different type of system, the same HCD principles, such as usability and user-oriented design still hold. In the final section of the introduction, the scope and context of the research are given, together with the research questions.

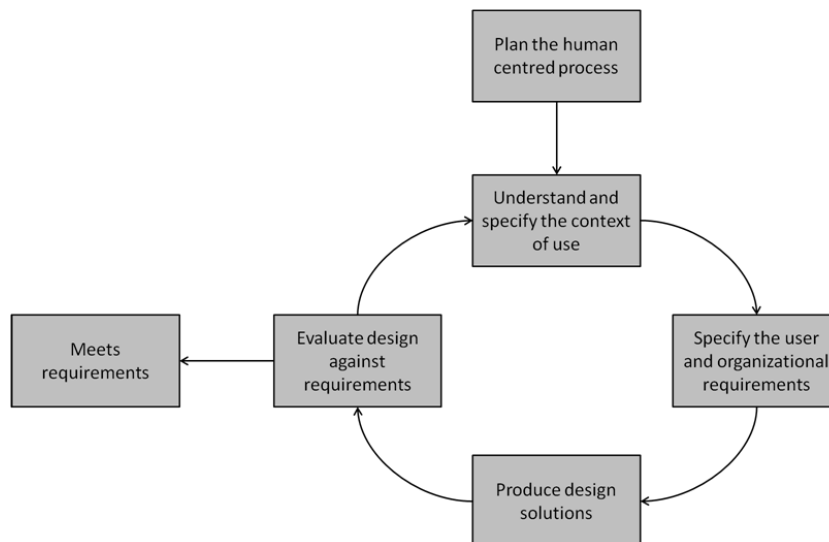


Figure 6. The human centred design cycle from the 9241-210 ISO standard, adopted from Maguire (2001).

The Present Study: Aims, Objectives and Research Questions

This study aims to develop a framework for improving older adults' technology acceptance within a case example of elderly support, and focuses on the system introduction. To recap, technology acceptance was defined in this study as the degree and manner in which target users use a certain technology and its capabilities (Petter et al., 2013), which can be interpreted as the adoption and continued adoption of technology. The first study objective involves synthesizing the currently available knowledge on influencing technology

acceptance. The results of this objective are covered in Figure 5. The second objective involves generating case specific design solutions and recommendations for the technology introduction that can be used in similar cases. Maher and De Silva Garza (1997) confirm that case based reasoning, or learning from previous design experiences, is an important aspect of design support. The third objective involves using the in-depth qualitative analysis of the case for developing new insights into the current technology acceptance theory. This is done in a bottom-up fashion by investigating the data for new factors that might influence technology acceptance or new relations between known factors (see Figure 5). For designing the introduction, a HCD approach is followed, which includes understanding the determinants of technology acceptance as found by Venkatesh et al. (2003) and Rogers (2003) in this specific case example.

The studied case is the European research project VictoryaHome, wherein a technological service is being developed to promote the (self) care of elderly and improve quality of life. A HCD approach was followed throughout the project and after performing HCD methods like focus groups, low-fidelity prototyping, storyboarding, heuristic evaluations and usability testing (Maguire, 2011a) a relatively advanced prototype has been developed. Using these methods to create a user oriented and usable product already facilitates technology acceptance. However, from our previous discussion, it was concluded that besides product characteristics more factors, such as user knowledge and behavioural beliefs, influence the acceptance of technology. Furthermore, users themselves have expressed a need for more than a usable system during early user testing by saying for example: “I think I’m a bit too old to understand all that. It’s a bit too difficult for me” (Smart Homes, 2013). Assuming that the product itself is indeed usable, this statement indicates that at least at first glance it might not be perceived as such. This is an indication that the behavioural determinant effort expectancy (Venkatesh et al., 2003) is not just influenced by

system quality. For these reasons it is proposed that a good system introduction, focussing on both cognitive and affective aspects, could by a means to positively influence the determinants of technology acceptance.

The HCD methodology will be used to investigate how the determinants of technology acceptance developed by Venkatesh et al. (2003) and Rogers (2003), presented in Figure 5, should be influenced in a way that complies to users' needs and preferences. To make sure that the introduction design is directly based on the users' needs and not heavily influenced by the researcher's ideas of a good introduction, no initial ideas of the introduction's components are specified. This fits the HCD principles where an iterative approach to design is taken. For this study that means the expected results are high level introduction components and some initial ideas on how these components should be worked out. The components will be further worked out using fitting design guidelines from literature. In following iterations, the design should be evaluated and optimised by using HCD methods that focus on the more detailed aspects of the introduction design.

Research questions.

The defined aim of this study is developing a framework for improving older adults' technology acceptance within a case example of elderly support, and with a focus on the system introduction. To reach our two remaining objectives of 1) generating case specific design solutions and recommendations for the technology introduction and 2) using the in-depth qualitative analysis of the case for developing new insights into the current technology acceptance theory, the first three phases of the HCD cycle will be followed (Figure 6). Going through a set of iterations of all four phases of the HCD cycle as is suggested by Maguire (2011a) falls out of the scope of this research, because of time issues. Research questions are asked based on these phases and the found determinants of technology acceptance as synthesized in Figure 5.

HCD phase 1: Understanding and specifying the context of use.

The first phase of the HCD cycle used for reaching our objectives is understanding and specifying the context of use. Maguire (2001b) defines the following aspects as being part of the context of use: the users, the tasks, the physical environment and the organisational environment. The physical environment is not yet defined, since the introduction to the VictoryaHome system can take place in several environments, including the users' own homes or a specially equipped demonstration space. The organisational environment is also not yet defined. Possibilities include starting a VictoryaHome company that delivers the full service, including system introduction, or get health organisations involved to partially or fully take over the delivery of services. The context of use analysis will therefore focus on getting a deep understanding of the users and their tasks. Gould and Lewis (1985) confirm the importance of an early focus on the users and their tasks. The first step for getting a deeper understanding on the users was a literature study of which the results were summarised in the introduction of this research report. Maguire and Bevan (2002) support doing secondary research to understand the users, since it gives the possibility to gain knowledge on a wide variety of users and user characteristics with relatively little effort. To get a deeper understanding of the users' needs, beliefs and their tasks, especially in relation to the defined determinants of technology acceptance, being the behavioural determinants in UTAUT (Venkatesh et al., 2003) and the knowledge needs for making the decision to adopt (Rogers, 2003), the following research questions are posed:

1. What principles knowledge do users need on the subject VictoryaHome?
2. What tasks do users have to perform to achieve the system supported user goals?
3. What persuasive information will help users to make a good decision on whether to adopt the system?
4. What UTAUT-based and general introduction needs do VictoryaHome users have?

HCD phase 2: Specifying user requirements.

Based on the results of the analysis of the context of use, the second phase of the HCD cycle can be executed, which is specifying user requirements regarding the design of the introduction. These requirements are usually largely based on the expressed user needs. Maiden (2008) defines a user requirements as: “[a requirement that] comes from a user or other type of stakeholder and expresses a property of the domain or business process that the introduction of a new system will bring about” (p.90). User requirements are thus focussed on goals that users have and not on how those goals should be achieved. Now that the meaning of a user requirement is clear the following research question can be posed:

5. What user requirements should the introduction of the VictoryaHome system support?

HCD phase 3: Producing design solutions.

When the user requirements are set, the third phase of the HCD cycle is reached, in which solutions should be thought of that meet these requirements. Here is room for more creative processes. The solutions to the user requirements can be seen as guidelines for the design of the system. The design solutions, therefore, have to be integrated. In addition to the user requirements and user preferences there is also a need to take into account design principles and guidelines from literature when formulating design solutions (Maguire & Bevan, 2002). Based on this discussion the last research question is formulated:

6. What are users' preferences for design solutions for the VictoryaHome introduction?
7. What are suitable design guidelines from literature for the VictoryaHome introduction?

Based on these design guidelines, a first version of the introduction was produced. The next section will explain what methods and what procedure were used to answer these questions.

Methods

To answer the posed research questions, the study design shown in Figure 7 was created. The design will be explained in this section by first justifying how the methods used can provide for answers to the research questions. Then the participants and used materials will be described followed by a detailed description of the used procedure. The section is concluded by describing how the data is analysed.

Justification of the Study Design

As stated in the previous section, the first three phases from the HCD cycle are performed in this study. In each of these phases different questions have to be answered to come to a good end product. For each question the method used to come to an answer is explained and defended briefly. An overview of the study design is found in Figure 7.

Knowledge on the subject VictoryaHome.

For an insight into the principles knowledge that users need concept mapping is performed. This type of knowledge is not often considered by information providers. However, Rogers (2003) states that users do benefit from having principles knowledge, knowing how a service or system works, when they are deciding if they should adopt a new technology. He furthermore states, that having the right principles knowledge can prevent people from stopping system use after they have initially adopted it. The idea that someone has on how a certain system works is called a mental model (Crandall, Klein, & Hoffman, 2006). A method for eliciting a person's mental model is concept mapping, where users present their knowledge in a diagram. Concept mapping is seen as both an effective and an efficient method for conveying a person's mental model (Edwards & Fraser, 1983). Furthermore, Markham, Mintzes, and Jones (1994) demonstrate that concept maps are fitting to base user requirements on since they can identify knowledge gaps as well as valid and

Introducing the VictoryaHome system to its older users						
HCD phase	Understanding and specifying the context of use (requirements elicitation)				Specifying user requirements	Producing design solutions
Question	Knowledge on the subject VictoryaHome	Tasks to achieve system supported user goals	Information to support the decision to adopt	User needs and preferences	User requirements for the introduction	Design guidelines for the introduction
Method	Concept mapping <i>experts and users</i>	Hierarchical Task Analysis (HTA)	Laddering interview	Semi-structured interview <i>based on UTAUT and the innovation-decision process</i>	Requirements analysis <i>Specifying findings and prioritizing using MoSCoW</i>	Combining creative solutions, user preferences and design principles from literature
Result	Expert map; and knowledge gaps with users <i>Principles knowledge</i>	Tabular representation of tasks <i>How-to knowledge</i>	Graphical representation of expressed system benefits and caveats <i>Persuasive information</i>	Tabular representation of expressed user needs	Prioritised user requirements in tabular format	System design guidelines in tabular format
Final result: first design of the VictoryaHome introduction						

Figure 7. Overview of the study design.

invalid ideas held by users on the system's work mechanisms. In order to recognize knowledge gaps, the concept maps of users will be compared to an expert concept map. To prevent the expert map from entailing irrelevant details, one agreement map is made based on the maps from several experts in different project areas. Since all experts work closely together to cooperatively develop the service, or system, Victoryahome, it is assumed that all experts have knowledge on the core principles of VictoryaHome. Furthermore, all experts have extended knowledge in their own fields of expertise. For this study, it is said that users do not need to have all the knowledge individual experts have, but would already greatly benefit from the core principles underlying VictoryaHome, that all experts are assumed to know of. It should furthermore be noted that the VictoryaHome system is a service, involving several technological devices. When speaking of the principles underlying the VictoryaHome system, it is not meant how each of these devices work specifically. What is meant is, how the entire service works with the devices being just a part of that. Furthermore, it should be noted that experts' mental models are usually associated with a better organization of available knowledge instead of more detailed knowledge (Glaser, 1987).

Tasks to achieve system supported user goals.

To understand the tasks that users need to perform to achieve the system supported user goals a Hierarchical Task Analysis (HTA) is performed. HTA is a method for analysing goals and operations by decomposing complex tasks into hierarchies of operations and sub-operations (Annett, 2004), and is often used in HCD (Vredenburg, Mao, Smith, & Carey, 2002). Annett and Duncan (1967) first proposed the hierarchical ordering of tasks because of its potential for categorizing as well as sequencing tasks which is important for understanding procedural knowledge or knowledge on how to perform a task. Besides getting a better understanding in the tasks users perform, HTA is therefore also important for understanding how-to knowledge, a type of knowledge that Rogers (2003) described to be a significant information source for users to base their decision on whether to adopt a product or not.

Stanton (2006) confirms that HTA is well suited for understanding how-to knowledge and states that it is often used for the development of training requirements, a form of education that focuses on teaching skills.

Information to support the decision to adopt.

To get a deeper understanding of the perceived usefulness of the VictoryaHome system and the persuasive information that can support people in their innovation decision process, a laddering interview is done. In a laddering interview, a person's personal values that are triggered by certain product attributes are discovered (Reynolds & Gutman, 1988). This is done by asking participants to recall attributes of a product that they find especially positive or negative (usually in relation to a different product) and then probe the respondent with questions like 'why is that important to you?' to retrieve the underlying reasons and eventually the underlying values. Van den Abeele and Zaman (2009) demonstrated that laddering is a useful method for understanding the user experience (UX) of a product, part of that being how a user experiences the product's usefulness. It is proposed that by asking people to continuously answer to the question why they find something important, a richer insight into the experienced benefits will result compared to a normal interview where people are not probed to elaborate. Another advantage of laddering is that a clear insight into the system's usefulness and the relating personal values is important information for a user in the persuasion stage of the innovation decision process, since in this stage users gather all information that they need to make a well informed decision on whether to start using a system. Knowing if the system's uses comply to their needs and if the related values comply to their own can be deciding in this process. Bourne and Jenkins (2005) verify that laddering is indeed often used for developing marketing strategies.

User needs and preferences.

To elicit technology acceptance related user needs and requirements for the introduction of the VictoryaHome system, a semi-structured interview was performed that

focused on UTAUT (Venkatesh et al., 2003) and more generally on people's introduction preferences. First of all, Woods (1997) states that using a semi-structured interview in discovering the context of use in a HCD process is a valuable methodology. Barriball and While (1994) specify that this type of interview is especially suitable for discovering perceptions and opinions and has the advantage that probing can be used to clarify those opinions. Since the variables in UTAUT are all perceptions and attitudes of the users towards a technological system, a semi-structured interview seems a valid way of discovering those. Furthermore, using open ended questions instead of i.e. a questionnaire gives the opportunity to not only discover the valence and strength of the attitudes, but also the underlying factors providing a better understanding of the attitudes. By doing a semi-structured interview it is assured that all the factors of UTAUT are discussed while still giving people the opportunity to elaborate on and explain their answers, also in relation to other general introduction related needs and preferences (Courage & Baxter, 2005).

User requirements.

For specifying the user requirements, the results of the context of use analysis are first of all specified. Maguire and Bevan (2002) state that user requirements can be drawn from the analysis of the context of use. However, Robertson and Robertson (2012) note that misunderstanding requirements is a big problem that should be avoided by writing unambiguous and testable requirements. They explain that incorporating the rationale, or the background reason, of a requirement in its formulation removes much of the ambiguity and makes the importance of a requirement clear for all the stakeholders. Furthermore, including a fit criterion, a measure, makes the requirement testable. This is especially useful in the evaluation of the requirements. In writing unambiguous and testable requirements the findings from the context of use analysis have to be interpreted and specified. It should be noted that Maguire and Bevan (2002) underline the difficulty of criterion setting and state that extensive user testing might be needed to reach suitable criteria. Based on the interpretation of the

findings different types of requirements can be obtained: functional requirements describing what a system must be able to do, non-functional requirements describing what qualities a system must have, and constraints describing limitations or restrictions on the system of the developing process (Robertson & Robertson, 2012).

When specific user requirements are obtained, they are prioritized to appropriately allocate resources. With limited resources, like time and money, usually not all requirements can be implemented (Richards, 2014). To make sure that these resources are used effectively, it is therefore important to prioritize requirements. There are several methodologies for doing this. Based on performed comparisons on prioritization techniques Table 4 was made to show the different considerations that are involved in selecting an appropriate prioritization method (Berander & Andrews, 2005; Hatton, 2008; Vestola, 2010). Based on this table it can be concluded that numerical assignment techniques, where requirements get categorized into a small number of priority groups, are most suitable for a more quick-and-dirty prioritization of requirements, since the method takes relatively little effort to execute and results into a rough prioritization. Contrarily, Analytic Hierarchy Process (AHP) and Hierarchy AHP (Karlsson, Wohlin, & Regnell, 1998; Saaty, 1987) are most fitting for a detailed prioritization for the reason that they give ratio results and are able to handle detailed requirements. AHP furthermore has the advantage that it is able to check for prioritization inconsistencies made by users. Such an inconsistency is found when a user states $A > B$ and $C > A$, but $C < B$. Considering that this research falls within the early stage of what is meant to be an iterative design process, where requirements change over iterations and need to be prioritized over and over, a quick-and-dirty method, where ease of performing the prioritization is valued more than reaching very accurate and detailed results, is viewed to be most appropriate. Therefore, the MoSCoW method, a numerical assignment technique, will be used to prioritize the requirements. The MoSCoW method categorizes requirements into the categories: Must have, Should have, Could have and Won't have (at this moment) (Tudor & Walter, 2006).

Table 4.

Characteristics of several prioritization methods based on Berander and Andrews (2005), Hatton (2008) and Vestola (2010).

	Result scale	Result granularity	Speed of analysis	Complexity of analysis	<i>N</i> requirements to be handled ³
Numerical assignment ¹ (e.g. MoSCoW)	Nominal	Coarse	Fast, Average	Easy	Small, medium, large
AHP ²	Ratio	Fine	Slow	Complex	Small
Hierarchy AHP ²	Ratio	Fine	Average	Complex	Medium, large
Cumulative voting (\$100-test)	Ratio	Fine	Fast	Complex	Small, medium
Ranking	Ordinal	Medium	Average	Easy	Small, medium

¹ Numerical assignment also deals well with additional requirements. ² AHP is suitable for more detailed requirements and includes a user consistency check making the method fault tolerant. ³ $N < 20$ is small; $20 < N < 100$ is medium; $N > 100$ is large.

Design guidelines.

Taking the user requirements and using them to develop design solutions or design guidelines is a more creative process in the HCD process. Maguire (2001a) notes for example that brainstorming is a good way to come up with design solutions for requirements in a project. Therefore did the semi-structured interview not only focus on user needs, but also on possible solutions. Another valued practice for shaping a design is the inclusion of design guidelines from literature (e.g. Maguire & Bevan, 2002). Design guidelines from literature also provide a possibility to give details to the proposed solutions in an informed way.

Participants

The user studies took place with four social groups, usually families, consisting of one or two independently living (potential) care recipients and one or two (potential) informal caregivers. The selection of groups was led by the Dutch care organisation Envida, a partner

in the VictoryaHome project, and formed a judgement sample (Marshall, 1996) of Dutch participants. This means that a sample was selected that is viewed as most productive for answering the research question. In this case the sampling method was used to try to respect the heterogeneity of users and user situations in the selection, conform to the recommendations of Newell and Gregor (2002), by taking a range of variables into account in the selection procedure. The variables taken into account were: age, gender, marital status, health problems and elderly-caregiver relation. The resulting group of care recipients consisted of two males and three females aged 59 to 92 years ($M = 79$; $SD = 13$). The group included one couple and one person with considerable health problems. Corresponding to the main research question and arguments in the introduction, also informal caregivers were selected with a relatively older age. The group of informal caregivers consisted of one male and four females aged 53 to 68 years ($M = 62$; $SD = 7$). The relationship to the care recipient was different for each group member and concerned siblings, friends, a child-parent relationship and a husband-wife relationship. It is important to note that people with (mild) cognitive impairments were not allowed to enter the study for ethical reasons, elderly are usually considered vulnerable participants that require careful attention in a study. To ensure participants' wellbeing, a pilot test was performed to check if the study design was not too straining or provoked any other significant discomforts. In the pilot test, the user study as described in the procedure section was performed. The participants were instructed to clearly indicate if they experienced any discomforts. After the test, participants were asked again if any parts of the study were uncomfortable for them, and if they had problems with the duration of the study or needed more breaks. Fortunately, no such things happened. The study design was also approved by the ethical committee of the University of Twente. Finally, participants had to have a working internet connection to be able to perform the test with a fully functioning prototype in their own home.

Apparatus and Materials

The study participants were exposed to a number of materials in the user study. All users had to fill out a paper and pencil questionnaire to retrieve their demographic details and technology experience. Moreover, previous to the concept mapping exercise all participants went through a worked out example of how to make a concept map. Additionally, users received an information sheet about the interview procedure and signed informed consent. All materials can be found in the appendices. In addition to these materials users tested a fully functioning prototype of the VictoryaHome system. Innovative assistive technologies, like the VictoryaHome system, are new, and very few people have experience with them or know what they are. To make sure the participants could give informed responses in the study, they were therefore given the system for a trial period. This way they could get familiar with the system and form an understanding of its functionalities and its potential impact on their lives.

The VictoryaHome system.

VictoryaHome is developing a technically based service to improve wellbeing and facilitate appropriate caring among independently living elderly and their caregivers. At the time of the study, a first prototype had been built that was used in the current study. The prototype incorporates a digital platform together with smart devices that were already on the market. These devices are: an all-in-one fall detector, activity monitor and personal alarm system (the belt clip produced by onCaring), an automatic pill dispenser (the Careousel produced by PharmaCell) and a mobile telepresence device (the Giraff produced by Giraff Technologies AB). The prototype furthermore included a smart phone application for family and friends (the serenity app), an online dashboard for response centre employees and a software program to control the Giraff with a PC. All devices and applications communicate with each other over the cloud.

The services that are offered have two main functions: monitoring health and safety and facilitating social contact. Informal caregivers can monitor the resident with the serenity

app on their smart phone. This app shows notifications based on the following events measured by the smart devices: missed medication, detected falls, alarm button presses, requests for social contact and low activity. The events are categorized and colour coded based on their urgency and summarised in the serenity icon that gives a quick overview of the resident's state (see Figure 8). Caregivers can then decide to virtually visit the resident using the telepresence device, the Giraff, as a response to these updates or when they feel a need for contact. The Giraff is used for video conferencing and can be remotely controlled by the caregivers to drive through the resident's house using the Giraff software on their PC. Figure 8 gives an overview of the devices that make up the VictoryaHome system, how they communicate with each other and what their main functions are. It should be noted that even though the system also supports formal caregivers, in this study only informal caregivers, friends and family, were considered.

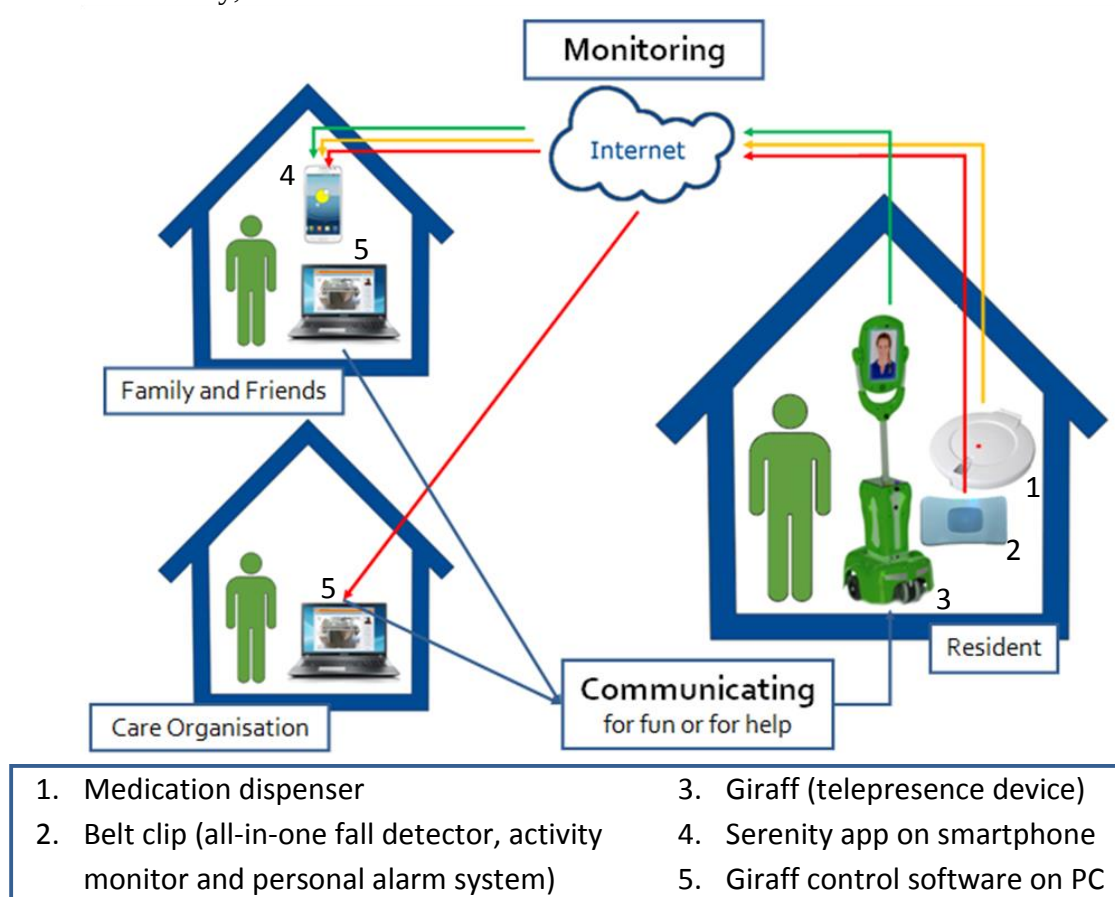


Figure 8. Overview of the VictoryaHome system architecture. Red notifications are most urgent and indicate emergencies; yellow notifications are health related, but less urgent; and green notifications are the least urgent social notifications.

Procedure

During the research, several methods were used. This section will explain the specific procedures that were performed. The methods using direct user involvement are bundled in this section as the user study. The HTA was performed separate of the user study, and was continuously updated until after all participants finished the user study.

Hierarchical Task Analysis.

To understand the tasks that users have to perform when using the VictoryaHome system, a HTA was performed. Annett (2003) has described seven principle steps for doing a HTA that were followed in this research. The purpose of analysis was already defined (1) as understanding the tasks that users perform with the VictoryaHome system. Agreement with stakeholders on task goals (2) was achieved by looking at published documents of the VictoryaHome system and retrieving the system's goals. These goals were validated by confirmation of the consortium manager of the VictoryaHome project. Next, sources of task information were identified (3). Since there were no actual users yet, information for the task analysis was searched for in the project documents where some instruction documents were available. However, since these documents were not worked out yet, direct interaction with the system by the researcher was also used as an important source of information. The final sources of information were informal discussions with users that tested the system. The information was used to make draft task decomposition diagrams (4) that were discussed with the consortium manager to make adjustments and recheck validity (5). Tasks were decomposed until the level of specific button presses, so that the entire scope of procedural knowledge that users should have to perform for all the functions of the VictoryaHome system is covered. When dealing with relatively inexperienced technology users, this is important information that at least some users cannot afford to miss. When the final version of the decomposition diagram was agreed on, significant operations were identified (6) based on

the user needs that resulted from the interview. Lastly, requirements (instead of hypotheses) important for learning and performance were generated (7).

User study.

An overview of the main activities in the user study and their approximate duration is presented in Figure 9. The user study with potential VictoryaHome users was performed in combination with the system's usability test and consisted of two sessions at the participant's home with a non-supervised trial period in between. The first session that took about three hours in total started with an introduction of the VictoryaHome project, the system and the planning for the day. When all the participants' questions about the study were answered and informed consent was signed (Appendix D) the participants started with filling in a short questionnaire on their demographic details, living and health situation and technology experience. Starting with easy questions to make users feel comfortable complies with the advice that Baarda, de Goede, and Teunissen (2005) give. After the questionnaire the usability test was performed. Participants performed several tasks with the VictoryaHome system and answered usability related questions in between the tasks. When the usability test was finished a short interview was performed on the participant's experiences during the tests and questions that they had were answered. At the end of the first session an appointment for the next session was made. The participants were instructed to write things down during the trial period that they especially appreciated about the system, things they did not appreciate and their experiences with the system in general. These instructions and information about the trial period, where participants tried the system for 9 days on average ($SD = 4$), were repeated in an information sheet that was given to the participants (Appendix E). The reflection on the system experience was meant to prepare and prime participants for the interviews in the second session. The second session that took about 2.5 hours in total consisted of a semi-structured interview, a laddering interview and a concept mapping exercise. These methods were performed after participants had the opportunity to try the system in their own situation

for some time, so that they could form an informed opinion about how it would be for them to really use the system, about the system uses and its characteristics, and to get a better understanding of what VictoryaHome entails. It was assumed that this would result in more elaborate, thoughtful and realistic responses on system use in the second session of the user study.

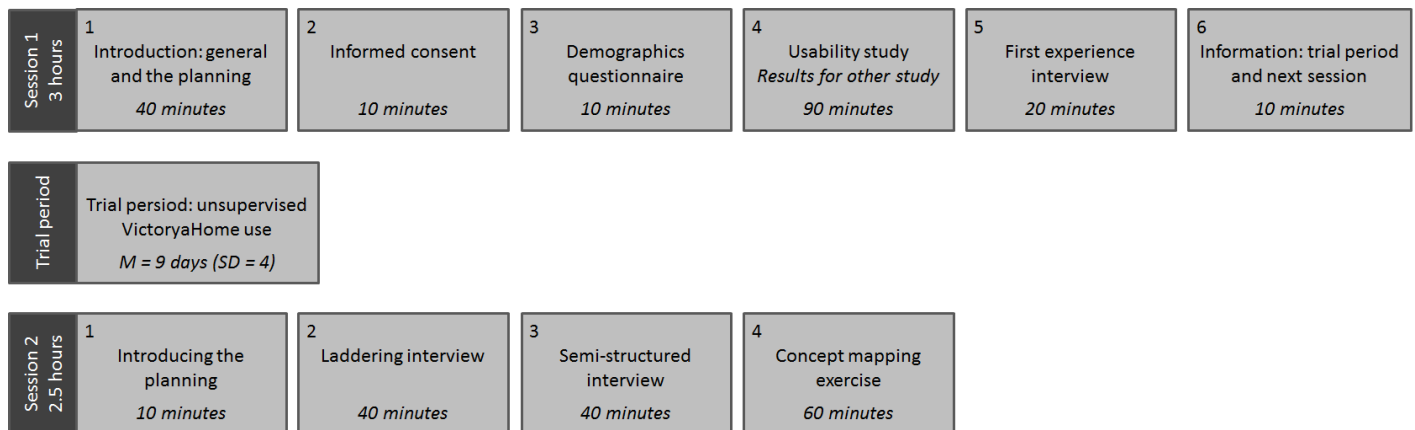


Figure 9. Graphical overview of the user study.

Laddering interview.

The second session started with the laddering interview. During the interview participants elaborated on the three things they (dis)liked most about the VictoryaHome system in order to retrieve attribute-consequence-value chains, or ladders. Such a chain was created by continuously asking the participant why a certain attribute is important to him/ her. The responses were getting more abstract until a personal value was given as an answer to the question or the person could not answer the question anymore. The cognitive process that occurs when an attribute-consequence-value chain is made can be explained with the spreading of activation theory (Grunert & Grunert, 1995). By asking the participant why a certain attribute is important to him/ her, the conceptual category of that attribute is activated and activation will spread to related conceptual categories. Asking the question ‘why is that important’ makes that causal associations are usually favoured. However, Grunert and Grunert (1995) note that when associations are weak, participants start relying on cognitive strategies turning the retrieval task into a problem solving task. To make sure this did not

happens, ensuring valid results, the interviewer tried to keep a relaxed atmosphere during the interview. Furthermore, when participants could not answer a question or when a certain topic became too sensitive the researcher applied one of Reynold and Gutman's (1988) specific interviewing techniques that can be found in the interview guide in Appendix C.

The interview was analysed following the procedure of Reynolds and Gutman (1988). The analysis started with extracting individual ladders from the interview for each participant. A content analysis over all the elements of the ladders followed. In the content analysis the elements of the ladders were first categorised as either attributes of the system, consequences of these attributes or personal values. What followed was a grouping of elements that represented something similar and labelling these groups. Ladders were then reformulated using just these labels. The direct and indirect connections between attribute, consequence and value elements in the ladders were summarized over the participants and presented in an implication matrix, which is basically an aggregation of all individual results. Based on the aggregated data in the implication matrix a hierarchical value map (HVM) was deducted and ladders were reconstructed. For a worked-out example, see Reynolds and Gutman (1988).

Semi-structured interview.

Following the laddering interview, a semi-structured interview on specific and potential technology acceptance related factors was performed. The interview covered the perceptions that the participants had of the system lead by the factors in UTAUT. In the interview it was furthermore discussed how the participants would have liked to be introduced to the system in hindsight. Topics about content and presentation were covered. The interview scheme can be found in the interview guide in Appendix C.

The interviews were analysed using the coding method as described in Baarda et al. (2005). The method followed a grounded theory perspective where themes are discovered from the interviews in a bottom-up fashion. To discover themes, all text fragments were first labelled. Labels were then grouped together with other labels that covered the same topic and

given a code name. Several iterations of structuring and grouping these codes followed. It should be noted that these groupings happened in a bottom-up fashion. However, four of the highest order categories were set, being the UTAUT behavioural determinants. Participants' elaborations during the interview could lead to other categories developing. Furthermore, other categories developed from the part of the interview that focused on other general introduction related needs and preferences.

Concept mapping.

To get an understanding of the principles knowledge, that potential VictoryaHome users should have and what knowledge they had after a short trial phase the study participants as well as the VictoryaHome experts made a concept map on VictoryaHome. All VictoryaHome work package leaders were invited to participate as experts. The work packages of the VictoryaHome project are: management, exploitation, user centred design trials, technical development and dissemination. The expert concept maps were used to get an overview of the knowledge that participants would preferably have, since Rogers (2003) found that a continued acceptance of technology benefits from users having principles knowledge. The user concept maps were used to see how their mental models compared to the reference expert maps. Before participants started with drawing up their concept map on paper, it was explained what a concept map is and how a person should make one by following the worked out example in Appendix F. Then all participants went through the different steps and made a concept map based on the question: what is VictoryaHome? The researcher guided the participants through the exercise by asking questions and probing participants to come up with more ideas. When participants found it hard to put things on paper, the researcher was allowed to write things down for them. It should be noted however, that the researcher only wrote things down that were explicitly stated by the participant and did on no account give his/ her own input.

Based on the expert concept maps one agreement map was constructed. All concepts that were found in at least two expert maps were covered in the agreement map. This procedure was followed to exclude information that was too specialist. When all but one expert did not include a concept in their map, either because they did not know about the concept or because they did not find it relevant, the concept is considered as irrelevant or too detailed and thus unnecessary for users to know as explained in the section justifying the use of concept mapping. With the selected concepts a new concept map was constructed trying to include most connections that were also found in the separate expert maps. The validity of the agreement map was ensured by involving the project manager for feedback on the first and revised versions. The propositions from the user maps were then compared to the propositions in the expert agreement map to get an understanding of the knowledge participants had about VictoryaHome at the end of the study.

Requirements analysis and design guidelines.

After reformulating the results into unambiguous user requirements, the requirements were prioritized using the MoSCoW method (Tudor & Walter, 2006). With the MoSCoW method requirements are categorized into four categories: must haves, should haves, could haves and won't haves (at this time). Following Beltman's (2013) methodology, requirements from the semi-structured interview were categorized based on the number of participants in favour of the requirement. However, in contrast to Beltman (2013) the requirements were not distributed evenly over the categories. This because it is not seen as realistic to assign 25% of the user requirements to the won't have category. Furthermore, Richards (2014) state that as a rule of thumb the distribution of requirements over the must have, should have and could have categories should be 60%, 20%, 20% respectively. Therefore, all requirements will first be categorized into these three categories following this distribution. Next, the results from the other methodologies (HTA, concept mapping and the laddering interview) that focused on the content of knowledge for users, were used to specify the requirements from the interview,

since knowledge was a topic that was only generally discussed in the semi-structured interview. The VictoryaHome consortium manager and the researcher reviewed the prioritization and made adjustments if they saw necessary. Adjustments were made for example when requirements were seen as technically too difficult to implement. This is in agreement with Tudor and Walter's (2006) notion that all stakeholders should be included in the prioritization of requirements. For each of the requirements, design solutions were then proposed. In the semi-structured interview not only user needs, but also preferred solutions were covered. These solutions were taken as the core guidelines for the design. The design guidelines were complemented with more general design guidelines from literature. Design guidelines were searched in the GoogleScholar database. Search terms for finding guidelines related specifically to the resulted design solutions for the introduction. Search terms that were added were 'elderly' or 'older adults', 'design' and 'guidelines'. If no guidelines specifically for older adults were found, general guidelines were considered. Papers were selected that specifically stated a list of guidelines relevant for the introduction design solutions. However, the search was not exhaustive.

Results

The section will start with a presentation of the knowledge that users should have about VictoryaHome and the knowledge gaps that participants had. What follows is a description of (significant) tasks that users have to perform when using the system. Then the most important persuasive information for making a decision on system adoption is presented. After the presentation of these information related results, the user needs that were deducted from the interviews are discussed. Based on these results, user requirements were deducted, these are presented together with solutions for the user requirements and design guidelines.

Principles Knowledge: What Should be Known and Knowledge Gaps

In investigating the principles knowledge involved in using the VictoryaHome system, it was first investigated what knowledge should be covered. Then it was researched what parts

of this knowledge participants had (and could communicate) after the user tests and what knowledge they were still missing. In this section the results are presented.

Expert agreement map: what should be known.

All VictoryaHome work package leaders were asked to develop concept maps in order to discover what knowledge VictoryaHome users should preferably have. The resulting expert agreement map is found in Figure 10. It can be seen that the expert agreement map has a hierarchical structure with each hierarchical layer representing a theme. The first layer in the hierarchy considers VictoryaHome as a service trying to fulfil several higher order goals. The next three layers focus on VictoryaHome as a system with specific system goals. The following layer describes the target users, while the devices that they will use are covered next. The hierarchy is completed by presenting the different measures that are taken by the system and the way these measures are communicated throughout the system. Besides the hierarchical structure, it can be seen that the concepts in the expert map are highly interlinked. The concepts in yellow were only found in one expert map, but were included for completeness after consultation with the project manager. One reason for the fact that the concept ‘activity’ was not widely used, is because at the moment of developing the separate expert maps it was not yet decided whether it was feasible to include this functionality in the system. The same holds for the panic button presses, since the panic button might overrule existing alarm systems.

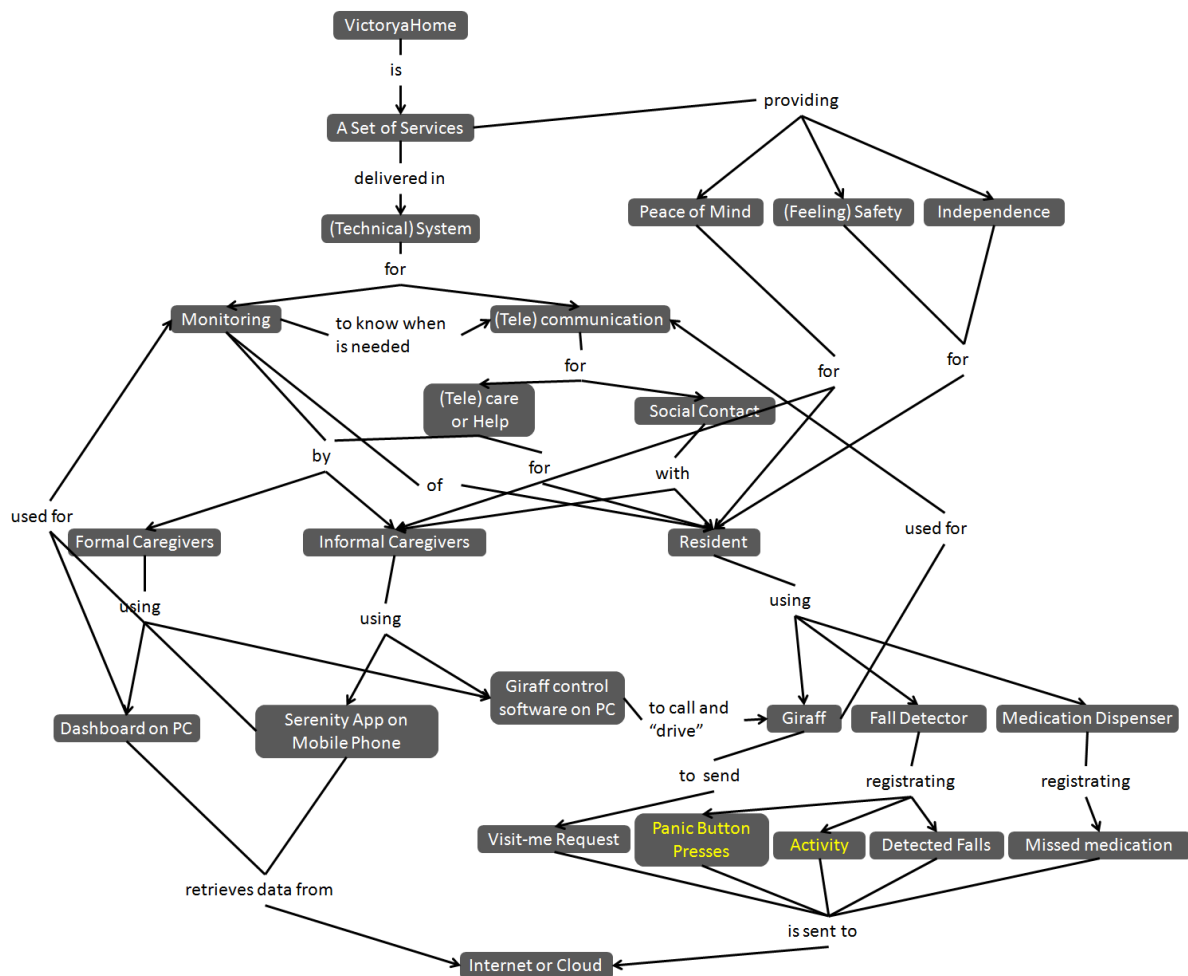


Figure 10. Expert agreement map. The concepts in yellow were found in only one expert map.

User maps: knowledge gaps and misconceptions.

The concept maps made by the participants were compared to the expert agreement map to discover important knowledge gaps. It was first of all checked what exact propositions from the expert maps were not found in the individual user maps. An overview of these results is shown in the detection matrix in Table 5. It was found that on average users had 5 ($SD = 2.4$) of the 45 expert propositions in their concept map. Furthermore, it was found that 64% of the propositions were not found in any of the participants' maps and 89% was only found in a low number of participant maps (0-3 participants). The results of the informal caregivers and the elderly were very similar, and are therefore not discussed separately.

The propositions that were not covered in any of the user maps cover several themes. Participants first of all did not mention that VictoryaHome is a service that comes with a

product and viewed VictoryaHome as just the system. Participants also mentioned fewer relations between the functions of the system. This might be due to the fact that participants in general had fewer cross links in their map. These are relations between concepts that represent different knowledge domains. Furthermore, the explicit distinction between telecommunication and social contact was not made. However, when a different structure is used in the concept map, this distinction might indeed be superfluous. Other propositions that were not mentioned are about who is involved in giving and receiving care. Even though these relations were not found, the separate concepts actually were covered in some concept maps again indicating a reduced use of cross links. Propositions containing devices that are used by formal caregivers were not mentioned, which is understandable since they were not incorporated in the test. It was also not made specific by the participants what devices were used by the resident in comparison to the informal caregivers. A reason for this might be that the resident was taken as a reference, since the tests were located at their homes. The different measures that were taken by the resident's devices were also not discussed even though participants did experience these measures during the tests. Furthermore, most higher order system goals, and who would benefit from these, were missing in the participants' maps, and finally no one could formulate how the internet plays a role in VictoryaHome.

The expert propositions that were covered by a medium number of participants (4-7 participants) seem to involve around one general theme. All these propositions were related to communicating with the Giraff and covered among others how this could be done and by whom the contact was maintained. It should be noted that this function of VictoryaHome was covered most thoroughly in the experimentation period that users had. One reason was that controlling the Giraff needed more practice than the other functions. Furthermore, some health related functions of the system could not well be tested because of safety reasons. The medication dispenser could for example not replace currently existing medication practices,

the activity monitor was not yet fully developed, and falls did (luckily) not happen during the test.

Since a point can be made that users might have used a different structure in their map resulting in different propositions, but covering the same topics as experts, the concepts used in the expert map were also compared to the concepts in the participants' maps. To see what expert concepts were and what concepts were not found, the detection matrix in Table 6 was made. It was found that on average participants had 10 ($SD = 3.8$) of 25 expert concepts in their map incorporated. Furthermore, 20% of the expert concepts were not found in any of the participants' concept maps, and 36% of the concepts were only found in a low number of participants (0-3 participants). These concepts are shown bold in Table 6. It is interesting to see that the concepts peace of mind, (feeling) safety and independence were not incorporated into the participant's user maps even though these concepts, or values, were mentioned in the laddering interview.

Eventually, the propositions in the participants' concept maps were checked on errors. Three significant inaccuracies in participants' mental models were found. First of all, one participant stated that VictoryaHome is the Giraff even though it should be clear the VictoryaHome system involves more (devices) than just the Giraff. Secondly, five of the participants stated that the Giraff controlled the medication dispenser and/ or the fall detector in some way. This is not the case, since all measures are communicated directly to the cloud. Finally, two participants did not seem to realise that a visit-me request is meant for social contact, whereas the panic button is used for emergency contact. From the analysis of errors, it also becomes clear that participants mainly focused on the Giraff. To get a better understanding of the participants' view of VictoryaHome, an overview of themes that were covered by the participants, but not by the experts, is shown in Appendix K.

Table 5.

Detection matrix showing what expert propositions were found in participants' concept maps. The first five participants are the informal caregivers. A low number of users is 0-3 participants, a medium number is 4-7 participants and a high number is 8-10 participants.

Expert propositions		participant	1	2	3	4	5	6	7	8	9	10	total users
VictoryaHome	is a set of	services											0
services	delivered in a	(technical) system	x		x	x	x						4
(technical) system	For	monitoring		x	x	x							3
(technical) system	For	(tele) communication			x	x							2
monitoring	to know when is needed	(tele) communication											0
(tele) communication	For	(tele) care or help		x								x	2
(tele) communication	For	social contact											0
social contact	With	resident			x	x		x		x		x	5
social contact	With	informal caregiver			x	x		x		x		x	5
(tele) care or help	For	resident											0
(tele) care or help	By	informal caregiver											0
(tele) care or help	By	formal caregivers											0
monitoring	By	informal caregiver			x							x	2
monitoring	By	formal caregivers			x								1
monitoring	Of	resident			x				x			x	3
formal caregivers	using	dashboard											0
formal caregivers	using	Giraff control software on PC							x	x			2
informal caregivers	using	app on mobile phone							x				1
informal caregivers	using	Giraff control software on PC							x	x			2
resident	using	Giraff											0
resident	using	fall detector											0
resident	using	medication dispenser											0
Giraff control software on PC	to call and "drive"	Giraff	x		x				x	x	x		5
Giraff	to send	visit-me request	x							x			2
fall detector	registering	panic button presses											0
fall detector	registering	activity											0
fall detector	registering	detected falls											0
medication dispenser	registering	missed medication											0
missed medication	is sent to	internet or cloud											0
detected falls	is sent to	internet or cloud											0
activity	is sent to	internet or cloud											0
panic button presses	is sent to	internet or cloud											0
visit-me request	is sent to	internet or cloud											0
serenity app on mobile phone	retrieves data from	internet or cloud											0
dashboard	retrieves data from	internet or cloud											0
Giraff	used for	(tele) communication	x	x		x		x		x	x		6
serenity app on mobile phone	used for	monitoring											0
dashboard	used for	monitoring											0
services	providing	peace of mind											0
services	providing	(feeling) safety											0
services	providing	independence									x	x	2
peace of mind	For	informal caregiver											0
peace of mind	For	resident											0
(feeling) safety	For	resident											0
independence	For	resident											0
total propositions			4	3	9	6	1	3	5	7	3	6	

Table 6.

Detection matrix showing what expert concepts were found in participants' concept maps. The first five participants are the informal caregivers.

A low number of users is 0-3 participants, a medium number is 4-7 participants and a high number is 8-10 participants.

Expert concepts	participant	1	2	3	4	5	6	7	8	9	10	total users	N of users*
VictoryaHome		x	x	x	x	x	x	x	x	x	x	10	high
Services												0	low
(Technical) System		x		x	x	x						4	medium
Peace of Mind												0	low
(Feeling) Safety												0	low
Independence										x	x	2	low
Monitoring		x	x	x	x						x	5	medium
(Tele) communication		x	x	x	x		x	x	x	x	x	9	high
(Tele) care or help		x	x						x		x	4	medium
Social Contact		x	x	x	x		x	x	x	x	x	9	high
Formal Caregivers				x	x		x	x	x			5	medium
Informal Caregivers				x	x		x	x	x		x	6	medium
Resident				x	x		x	x				4	medium
Dashboard on PC												0	low
Serenity App on Mobile Phone		x		x	x			x		x		5	medium
Giraff control software on PC		x		x	x			x	x	x		6	medium
Giraff		x	x	x	x		x	x	x	x	x	9	high
Fall detector / Detected Falls		x			x		x	x	x			5	medium
Medication Dispenser / Missed Medication		x		x	x		x	x	x	x	x	8	high
Visit-me Request		x						x	x			3	low
Internet or Cloud					x			x				2	low
Activity												0	low
Panic button presses				x				x			x	3	low
total concepts		12	6	13	14	2	9	14	11	8	10		

How-To-Knowledge: Tasks to Achieve System Supported User Goals

To get insight into the tasks that users are performing and to represent the procedural knowledge that is involved in using VictoryaHome, a HTA (Stanton, 2006) was performed. The decomposition of tasks that resulted from this analysis can be found in Appendices G and H. In the HTA, critical operations are specified. These operations were selected based on their direct relation to either safe usage of the system or to its emergency communication functionality.

There are several critical operations for the elderly residents. The operations ‘1.4 communicating detected falls’, ‘1.5 sending out an alarm’, ‘3.2 charging the belt-clip’, and ‘5.2.1 checking that the Giraff is docked’ are all important because of their relevance for communicating emergencies. The belt-clip is used to send out alarms and detect falls to the caregivers and must therefore be used properly and always be charged. Furthermore, caregivers can use the Giraff to get in touch with the resident when an emergency has taken place, making it important that the Giraff is always docked properly and charging after a visit. Operations ‘3.3.5 asking someone to change the batteries’ and ‘4.5 calling the help desk’ are related to safe usage of the system. Changing the batteries of the dispenser asks for fine motor skills and since these can deteriorate with aging (see previous section) it is important that users ask help if they cannot complete the task or hurt themselves in the process. Furthermore, when technical (or other) issues occur that prohibit proper system use, these issues must be solved, and a help desk is available for doing this. The operation ‘4.3.2.2 taking pills out manually’ is also selected, since the system has some significant usability issues concerning taking medication late. Taking the pills out of the dispenser manually is an improvised solution that needs special attention.

For informal caregivers, there are also operations that are especially important for safe usage and emergency communication. The operations related to emergency communication

are ‘2.1 making internet connection’, ‘2.2 logging into the serenity app’, ‘2.5.3 handling unsolved events’, ‘3.3.4 calling the Giraff with a password’ and ‘3.6.1 getting the Giraff docked’. For the caregiver to be able to receive notifications and updates on the resident, they must be logged in into the serenity app and a working internet connection is needed for that. When an emergency notification is received, caregivers are supposed to communicate their action to the rest of the network in the app. This has the goal of avoiding panic in the care network. Finally, when caregivers have a Giraff visit, they have the responsibility of getting the Giraff back at the charger so that it is ready for use in emergencies, since in emergencies and in emergencies only caregivers can call the Giraff with a password making it needless for the resident to answer the call. The operations ‘3.4.3 adjusting speed’, ‘3.4.6 estimating distance’, ‘3.5.5 adjusting video quality’ and ‘5.6 calling the help desk’ are all related to safe usage of the VictoryaHome system. Adjusting speed, estimating distance and adjusting video quality all contribute to safely driving the Giraff in the house of the resident without hitting objects or even the resident. Calling the helpdesk is again important for solving any issues that prevent good use of the system. Even though it is considered important for users to know how to perform all tasks after introducing the system, it is considered critical for them to be able to perform the described safety and emergency related tasks.

Persuasive Information: System Related User Values

To get a deeper understanding of the persuasive information that could help users to form an opinion about VictoryaHome, a laddering interview (Reynolds & Gutman, 1988) was performed, resulting in the HVM in Figure 11. The HVM, which again combined results from elderly and informal caregivers because of their similarity, shows several relevant things. It first of all shows what system characteristics were seen as most significant to the users, with the medication reminders, a long response time (unfortunately), the Giraff appearance and the fact that the system fits the users seen as the most important. The user values that relate to

these attributes are found in the map. Especially positive feelings like peace of mind and a feeling of being safe and a good life for the older resident are valued. However, love for family members, the system's effort in preventing loneliness and the fact that the resident feels less of a burden when using VictoryaHome are also valued by several participants. The figure finally shows how these attributes are related to the user values. Important consequences of system attributes are the high feeling of presence that comes with a Giraff visit, the fact that VictoryaHome gives insight into the resident's state, and the appropriate help that can now be given to the resident. However, the fact that the system is in many ways not perceived as practical, resulting in negative instead of positive outcomes, is a big issue for the participants. The results of the analysis steps leading to the HVM can be found in Appendices I and J.

Expressed User Needs

The first part of the semi-structured interview focused on the beliefs that users had of the system and of using the system, based on the technology acceptance related factors of UTAUT. The second part of the interview focused on the introduction preferences that users had. The complete coding scheme representing all themes that were covered in the interview together with an overview of what themes were covered by which participants is shown in Appendix L. In this section the user needs that were deducted from the coding scheme are presented, for the elderly and informal caregivers combined. An overview is given in Table 7. If these needs are categorised into the MoSCoW categories following the 60-20-20 rule (Richards, 2014), the first four needs are categorised as 'must have', the fifth and sixth needs as 'should have' and the last requirement as 'could have'. To give an insight into the rationale behind the user needs and to promote the reliability of the results, all user needs are shortly discussed.

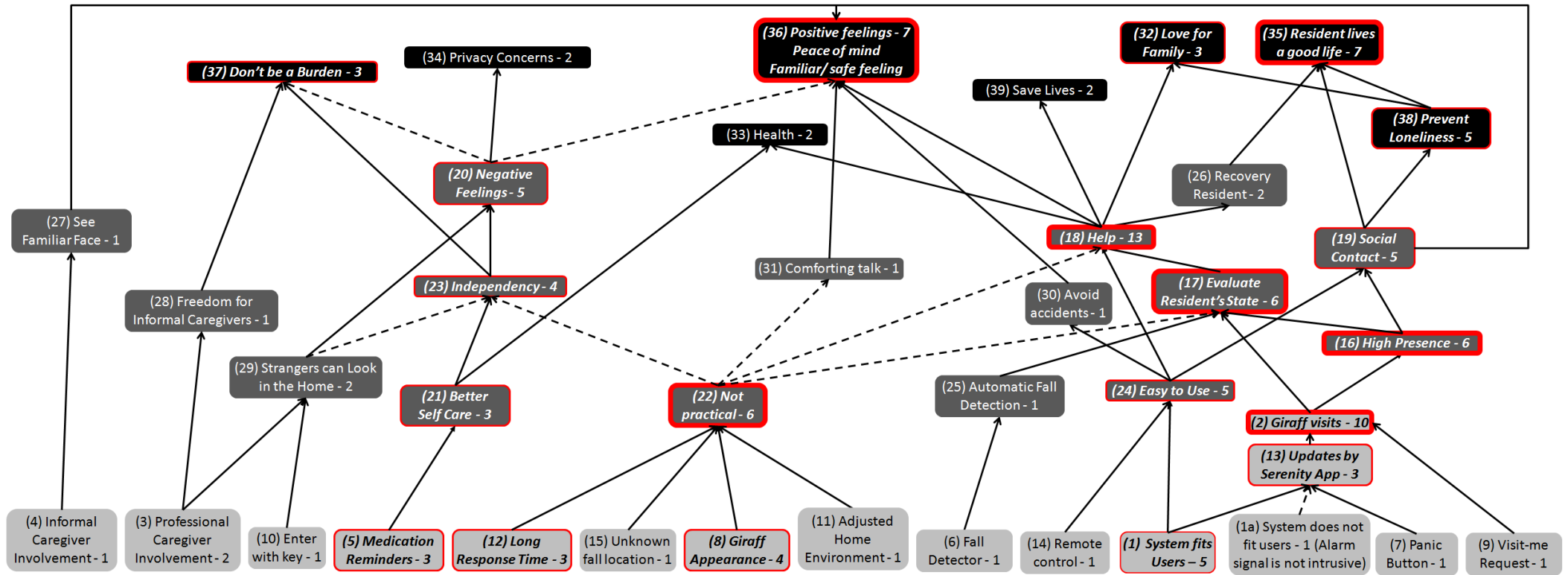


Figure 11. Hierarchical value map. Light grey boxes represent system attributes, dark grey boxes represent consequences and black boxes represent system related values. The numbers in brackets are the concept labels, whereas the numbers at the end of the concept name show how often the concept was raised. The dotted links are negative links found. Concepts that have no border were named less than three times, concepts lined with small red line were named 3 to 5 times and concepts lined with a big red line were named 6 times or more. The map summarizes 32 ladders made by 10 participants.

Table 7.

An overview of the user needs that were deducted from the interviews and the number of participants expressing these needs. The letter in front of the needs indicate the MoSCoW category it belongs to: ‘M’ meaning ‘must have’, ‘S’ ‘should have’ and ‘C’ ‘could have’. The first five users represent the informal caregivers, the remaining five represent the elderly.

User need	1	2	3	4 & 5	6	7	8	9	10	Total
1. M Learn to operate the VictoryaHome system	1	1	1	2	1	1	1	1	1	10
2. M Learn to cope with system malfunctioning	1	1	1	2	1	1	1	1	1	10
3. M Optimize and coordinate use behaviour	1	1	1		1	1	1	1	1	8
4. M Learn what VictoryaHome is and does	1		1	2	1		1		1	7
5. S Evaluate the practicality of the Giraff		1			1	1	1	1	1	6
6. S Evaluate usefulness for own situation		1	1		1	1	1	1		6
7. C Solve privacy issues	1	1			1		1			4
Total	5	6	5	3	7	5	7	5	5	

The first user need deducted from the interviews was learning how to operate the VictoryaHome system. All participants expressed they wanted this topic covered in the introduction. Furthermore, several participants also stated that they found parts of operating the system hard or thought others would find it hard, indicating a need to give attention to teaching these operations carefully. One participant stated for example: *“driving [the Giraff] for me stays [tricky], eh I’m still a woman, hahah. And I’m quite good at driving a car and handling things, but I do get panicky quickly. Ooh, you know.”* (p.3, author’s translation)ⁱ.

Secondly, all users stated they wanted to know how to deal with system malfunctions. Six participants stated that during the trial phase they encountered significant technical problems. Even though this mostly indicates that the prototype needs improvement, it has also

lead the participants to realize that these things can happen and that they do want to know how to handle such situations. A resident stated: *just practical, seeing it and then [...] that it goes wrong on purpose, for example, or by accident, but straight away. Yes, that way you remember it best. And that way you also know it can happen, or I have to do this or that when it does*” (p.10, author’s translation).ⁱⁱ A strategy to handle system malfunctions that was named by all participants was their need for a help service.

The third user need extracted from the interviews was a need to get guidance on optimizing and coordinating use behaviour. Participants acknowledged that there was not one way to use the system, that there was an entire network of users involved that had to coordinate their actions, and that decisions on how to use the system could impact the usefulness or the performance results. Two quotes supporting these statements are: *“It has to always work and for that you need caregivers to always be available. It doesn’t need to be that one person is always available, but but that, for example, three take turn or always one of them is available.”* (p.7, author’s translation)ⁱⁱⁱ, and *“My mother used to have such a such a thing [panic button] around her neck, and then she got in touch with the Public Health Service. Yes eh, she almost died and then she would still not have called. She rang my phone twice and then I knew, okay, I need to go there.”* (p.9, author’s translation)^{iv}. It is thus important that all users know what kind of behaviour is expected and needed from them, and that there is no ambiguity on what certain actions mean. Helping people to communicate their expectations and to make agreements with each other both on expected behaviour and on the meaning of behaviours can be a good way to optimise use.

Fourthly, users wanted to learn in the introduction what VictoryaHome exactly is, and what it does. They wanted to have more general information, *“well, all sorts of things, from a to z. [...] What the use is in your daily living.”* (p.8, my translation)^v, as well as more specific information on the system’s functioning, *“eh, show how the robot works. So, the screen and*

that he can walk through the room with the wheels. Eh, it also had buttons I thought. Yes well, then explain what that is. Explain that you have to dock it to charge and eh yes, actually just what you already did.” (p.1, author’s translation)^{vi}.

A fifth user need derived from the interviews is that users should be able to evaluate the practicality of the Giraff in their own situation. Several participants noted there were practical issues with using the Giraff, such as the fact that it cannot open doors and that houses might be too crowded for the quite large Giraff to move around in. One participant stated for example: *“because well, the home facilities in the homes is also nothing much, right. And the number of pieces of furniture that people have standing, my god, if you look at some people. That thing [the Giraff] will get nowhere. Every minute it will bump, it will bump his nose.”* (p.8, author’s translation)^{vii}. For many of these problems, solutions have been proposed in the project. For example, doors could be replaced by swinging doors that the Giraff can open, and high doorsteps could be accompanied with a little ramp. However, these solutions were too intrusive to implement in this test phase. On the other hand, the problem that houses might be too crowded was a problem the participants could face. However, in this test phase, participants did not experience this problem and are therefore expressing their worries for others more than stating that they experienced this problem themselves. It is therefore found important that people can experience the product in their own situation to evaluate whether their worries are grounded or that the proposed solutions are helpful and acceptable.

The penultimate user need is about people recognizing the usefulness of the system for their own situation. From the interviews, it was clear that people mentioned many more things about the system they found useful than things that they thought were useless or negative. However, when asking if people wanted to use the system, only two of them firmly agreed that they would like to use it in their personal situation. The reason for this discrepancy

becomes clear from the result that six out of ten participants stated they find the system useful for others, but not for themselves. The reasons differ. Some participants have said their health is not yet bad enough, while others stated that the help from their partner is enough for now, for example: *“Well, he did fall once in the bathroom when he got so ill, and then you would have been able to use it [VictoryaHome]. [...] would have come right away then, but I was still there.”* (p.6, author’s translation)^{viii}. It should be clear that when people think the system would not be useful for them, they should not use it. However, it is important that people make an informed decision. The introduction should give a clear picture of how the system could be used in a situation comparable with the target group’s situation to increase the likelihood that people see the use of the system for them personally.

The final user need concerns privacy. The main privacy concern that participants expressed was the characteristic of the system that some specified people would have access to a password, which they can use to control the Giraff in emergency situations. However, even though the password is meant for emergency situations, it is active always and can always be used. One worry that was expressed was: *“No, well, you just don’t know all that. You give away so much of yourself. So many weird things happen in the world. From killing someone and so on. What if someone like that is involved and then he would know all your secrets and eh he could blackmail you or whatever. No, that eh that privacy needs to be well protected.”* (p.8, author’s translation)^{ix}. However, some participants pointed out that if they were able to select caregivers they trusted to have a password, this worry would be absent. It is therefore seen as important to explain all privacy issues and collaboratively come to a situation that all users feel comfortable and safe in. The original Dutch citations are found in Appendix S.

User Requirements

It can be seen that the stated user needs align quite well with the knowledge needs as defined by Rogers (2003), that were explored in detail in the HTA results, the concept mapping results and the laddering results. First of all, users state they want to know how to operate the VictoryaHome system (user need 1.). This is one of the factors important for technology acceptance as defined by (Rogers, 2003), which was the basis for the HTA (Stanton, 2006). Solving malfunctions (user need 2.) is also covered in the HTA, since Stanton (2006) noted the importance of including exceptional and less frequent tasks in the analysis. Furthermore, learning what VictoryaHome is and does (user need 4.) maps well onto the concept mapping results and the laddering results, where the concept maps demonstrate both what VictoryaHome is and does, and the laddering results add information on the benefits of what VictoryaHome does. Furthermore, the laddering results give a deep insight in the benefits and negative aspects of VictoryaHome that were most important and relevant for the participants. This information is important for potential users when they need to evaluate if the system is suitable for them personally and their situation (user need 6.). With these mappings in mind, it is possible to specify user needs and formulate specific user requirements. The requirements are formulated in a way that they are specific and measurable as far as possible. However, it should be noted that Maguire and Bevan (2002) have stated that criterion setting, making the requirement measurable, is also an iterative process. This study being the first iteration means that the criteria used are still flexible. The requirements are shown in Table 8.

Table 8.

A list of user requirements for the introduction of the VictoryaHome system. The requirements are categorised based on the user needs, but incorporate the results of all methods used. Also presented are short descriptions of the design solutions proposed for each requirement based on the interviews and literature. The underlined italic terms are strategies for meeting the requirements that users proposed in the interviews.

After the system introduction:	Design solution
Must have: learn to operate the VictoryaHome system;	
Must have: learn to cope with system malfunctioning	
1. Users want to be able to independently perform all tasks that are specified as important in the HTA	The user will receive a training where he/ she solves different tasks independently. Solving the tasks is <u>hands-on</u> with a <u>manual</u> (giving a step-by-step explanation) as reference. A
2. Users want to be able to independently perform 80% of all tasks as defined in the HTA	<u>personal instructor</u> will assist the user and explain operations if needed.
Must have: optimize and coordinate use behaviour	
3. Users want to know what kind of behaviour they can expect from other users in the care network	With guidance of VictoryaHome personnel, users will discuss what kind of behaviours and reactions they expect to perform and expect
4. Users want to know what kind of behaviour other users in the care network expect from them to ensure good system functioning	from each other. Based on this discussion, <u>agreements</u> will be made on how to use the system. VictoryaHome will initiate <u>evaluations</u> and help adjust the agreements if needed.
Must have: learn what VictoryaHome is and does	
5. Users want to be able to understand 80% of the knowledge represented in the expert map	Users will watch a <u>video</u> that demonstrates and explains VictoryaHome. A discussion of the video and questions afterwards will facilitate
6. Users want to be able to correctly state the role of the Giraff in relation to other devices	active learning and correct misconceptions. The discussion will be based on an infographic that summarizes the expert concept map. The

7. Users want to know the difference between a visit-me request and a panic button press	difference between a visit-me request and a panic button press is given special attention and explained with the infographic.
Should have: evaluate the practicality of the Giraff	
8. Users want to understand if the system is able to function to their wishes (is practical) in their own living situation	The system will be <i>tried out in the user's own situation</i> . Several scenarios will be gone through to make sure the functionality of the system can be properly assessed.
Should have: evaluate usefulness for own situation	
9. Users want to know all positive and negative attributes, consequences and values related to VictoryaHome that were named more than twice in the laddering analysis	Users will watch a <i>video</i> that demonstrates the functioning of VictoryaHome in a real setting and that pays attention to the personal consequences and values related to using the system. In the movie a representative model will demonstrate system use to increase relatedness. A discussion afterwards focuses on questions and issues that are not clear.
10. Users want to understand how the system can be useful for people like them and their situation	The system will then be <i>tested in users' own situation</i> with <i>evaluations</i> to discuss and possibly resolve problems related to the system's usefulness.
Could have: solve privacy issues	
11. Users want to understand what privacy issues are related to system use	After watching the video giving users an understanding of VictoryaHome, privacy issues will be explained and discussed. In the
12. Users want to protect their privacy as much as possible and to the extent they feel comfortable	discussion, users' concerns will be extracted and <i>agreements</i> made to resolve the concerns when possible.

Design Solutions

The solutions proposed for solving these requirements are based on users' preferences and specified by the researcher, and can be found in Table 8. These solutions are combined into the following concrete introduction components: 1) a training, where users have hands-on experience with the system in their own homes, 2) a user manual, 3) an informational and motivational video, 4) discussions leading to agreements on resolving privacy issues and for coordinating use behaviour, and 5) check-ups on those agreements and on user experiences more generally. However, long-term check-ups and evaluations fall out of the scope of this research, since it is not part of the system introduction. The four remaining design introduction components were made into a tangible introduction design. Snippets of the designs can be found in Figure 12. The complete documents are found in Appendices M to R. The designs of the four implementation components were directly based on the results of the context of use analysis (the expert agreement map, the HTA and the HVM), and design guidelines from literature. Design guidelines from literature were searched that related specifically to the resulting introduction components, and if available focused on older adults. The guidelines that focus on older adults take a lot of the factors on age related decline, as summarised in Appendix A, into account. An overview of the found guidelines is presented in Table 9.

The informational and motivational video (Appendix R) is mainly based on the laddering results in the HVM and the expert agreement map. With writing the script for the video, the most important values and consequences from the HVM in Figure 11 were taken into account. Two example sentences from the script demonstrate this. The first example sentence 'This way she can live independently while feeling safe' relates to the values 'independency' and 'positive feelings/ safe feeling'. The second example sentence 'This way, they make sure that Ans will always receive help quickly', relates to the consequence 'giving

help', which was also often found in participants' ladders. The influence of the expert agreement map (Figure 10) is mostly seen in the structure of the scenario's. One scenario focuses on the monitoring function of VictoryaHome, and two scenarios focus on telecommunication with the Giraff (one on social communication and one on communication to provide help). Furthermore, all three types of primary users play a role (elderly, informal caregivers and professional caregivers), and all used devices are shown. The video also follows several guidelines from Table 9. For example, the social learning theory is applied by using representative actors that perform all the tasks. Furthermore, the application setting is mirrored to increase the relevance for the actual decisions and tasks users have to make and perform.

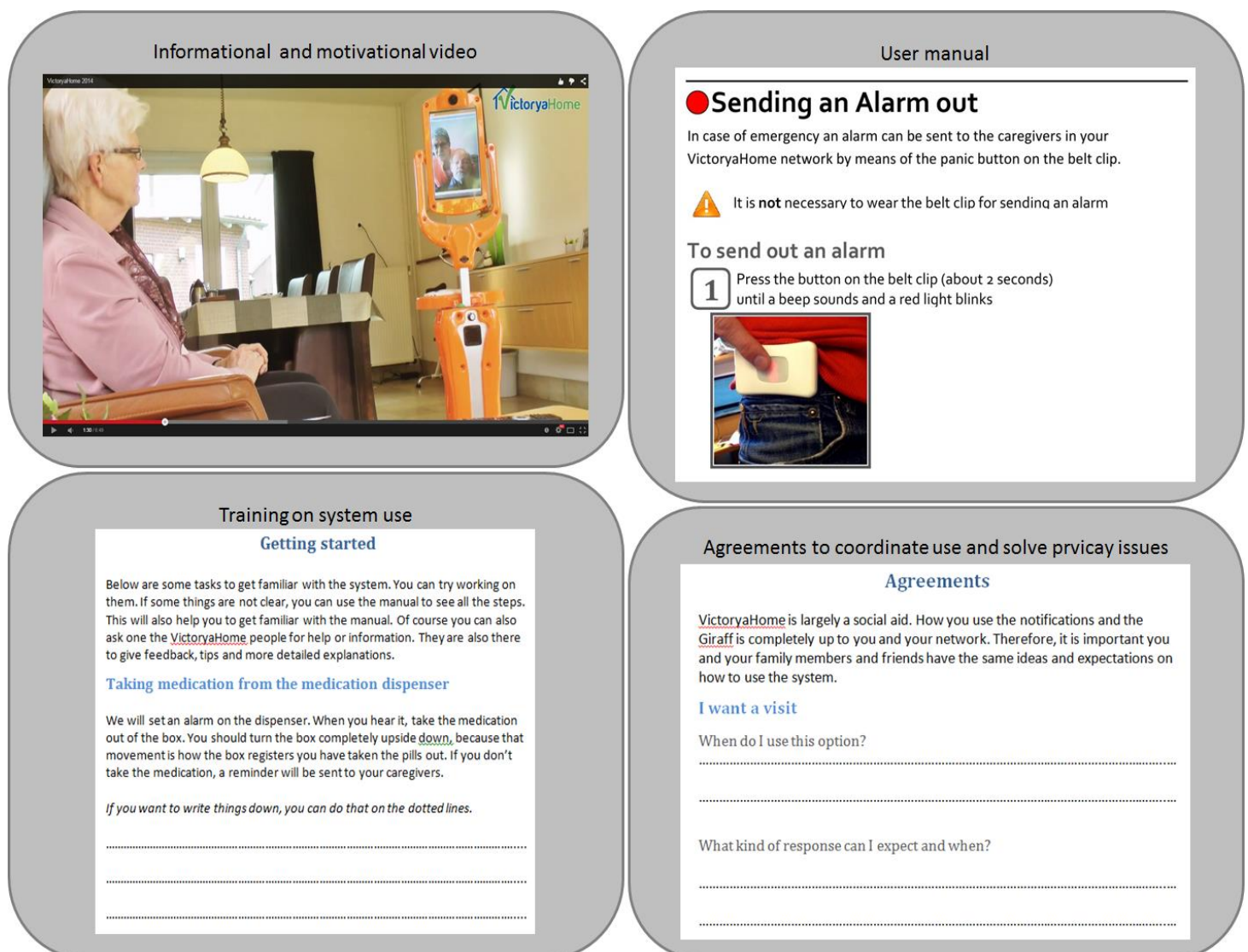


Figure 12. Several snippets showing the resulting designs of the introduction components. Full versions are found in Appendices M to R.

The user manual is directly related to the results of the HTA (Appendix G and H), and all tasks from the HTA are explained. Critical tasks that were discussed in the results section are accompanied with the orange triangular ‘important’ symbol that is shown in Figure 12. For the design, guidelines from Table 9 were again applied. For example, the introduction of the manual provides motivational information to encourage elderly in using the manual. Furthermore, pictures and screenshots were added in the manual to reduce working memory demands, a sans serif font of 14 points was selected to support elderly with poor vision, and pictures were closely aligned with relevant text. The manuals for elderly users and their informal caregivers are found in Appendices M and N.

The training, where users have hands-on experience with the system in their own home, is based on the tasks resulting from the HTA and the knowledge represented in the expert agreement map. In the training, the video is shown first to teach users about VictoryaHome. This lesson is continued with an infographic based on the expert agreement map that is discussed together with the users. Then users independently practice tasks from the HTA. They can ask for assistance and use the manual as guidance. Guidelines from Table 9 that were applied are, for example: working on one task at a time, giving sufficient time to complete tasks, offering explanatory feedback, and giving positive reinforcement during the training to reduce possible anxiety. Hand-outs for the training are found in Appendices O and P. Instructions for trainers are found in Appendix Q.

The discussions that lead to making agreements on resolving privacy issues and on coordinating use behaviour between users were based on the HTA. Based on tasks from the HTA that were considered privacy sensitive or that could be interpreted differently by different users, an overview for the discussion themes was made. For these discussions guidelines from Table 9 were used, such as pre-training, where key concepts are explained beforehand, and giving elderly the possibility to take notes. See appendices O and P.

Table 9.

Guidelines for designing the introduction of the VictoryaHome system for older adults based on the proposed solutions.

Solution	Source	Guideline
Guidelines on teaching methods and settings		
Training	Burke & Hutchins (2007)	Use active training methods (like practice, feedback, and dialogue) to enhance long-term maintenance of skills
Training	Mayhorn, Stronge, Mc Laughlin & Rogers (2004)	Give older adults the opportunity to practice each task component
Training	Jones & Bayen (1998)	Work on one task at a time to reduce distractions
Training	Jones & Bayen (1998); Mayhorn et al. (2004); Burke & Hutchins (2007); Clark & Mayer (2008)	Distribute learning and practice over time for a better long-term retention
Training, discussion, video	Jones & Bayen (1998)	Take cognitive slowing into account and allow sufficient time and pauses to process information, finish tasks and take notes
Training, discussion	Jones & Bayen (1998)	Try to eliminate disturbances (like noises) and try to schedule training in the morning for older adults to have the least problems with their reduced inhibition skills
Guidelines on types of information and their structuring		
Training, discussion, manual	Jones & Bayen (1998); Clark & Mayer (2008)	Segmenting: break-up the instruction into small units to reduce the amount of cognitive processing resources required by helping people "chunk" the material
Training, discussion, manual	Jones & Bayen (1998); Mayhorn et al. (2004)	Use advance organizers to give a structured overview of the content to reduce processing resources needed. In the material use related titles and subheadings and the same layout for comparable chunks
Training, discussion, manual, video	Clark & Mayer (2008)	Pre-training: explain key concepts prior to the full process or task associated with the concepts.
Training, manual, video	Van Horen, Jansen, Maes, Noordman (2001); Mayhorn et al. (2004)	Include specific goal and identification information, since it is important for older adults to know why an action needs to be performed and which entity to perform it with.
Manual	Van Horen, et al. (2001)	Include consequence information. Users want to know whether they performed actions correctly or not and can move on to the next step

Guidelines on deeper learning		
Training	Clark & Mayer (2008)	Offer explanatory feedback: provide tailored explanations for all correct and incorrect answers.
Training, discussion, video	Jones & Bayen (1998)	Include discussions to elaborate on the information being learned. This facilitates "deep processing" and the later retrieval of information
Training, discussion, manual, video	Burke & Hutchins (2007); Clark & Mayer (2008)	Minimize extraneous work: avoid behavioural engagement that adds irrelevant mental load that conflicts with the learning objectives.
Guidelines on multimedia use		
Training, discussion	Jones & Bayen (1998)	Provide hand outs to use as a reference and reduce memory load. Paper hand outs prevent problems with scrolling on a PC and glare
Manual, video	Jones & Bayen (1998)	Select font styles and sizes that are easy to read (sans-serif fonts and a font size of 14 points are recommended)
Manual, video	Jones & Bayen (1998); Clark & Mayer (2008)	Includes relevant visuals and words rather than words alone. Adding illustrations to instructional text decreases processing demands on working memory.
Manual	Clark & Mayer (2008)	Align text in close proximity to visuals
Guidelines on personalisation to the situation of use		
Training, discussion, manual, video	Burke & Hutchins (2007); Clark & Mayer (2008)	Mirror the application environment: training goals, materials and environment should be closely relevant to that of the actual task
Training, discussion, video	Clark & Mayer (2008)	Personalisation: get learners socially engaged through conversational language and learning agents.
Manual	Loorbach, Karreman, & Steehouder (2007)	Use motivational information to increase users' attention, users' confidence, and to emphasize that information is relevant for particular users
Video	Jones & Bayen (1998); Bandura (1986)	Social learning: model the behaviour to be learned using models that are similar to the observer. People can then make decisions about the performance of the behaviour.
Guidelines on emotion control		
Training	Bell & Kozlowski (2008); Napp (2008)	Use positive reinforcement to decrease anxiety

Discussion

The aim of this study was to develop a framework for improving older adults' technology acceptance within the VictoryaHome case example of elderly support, that focuses on the system introduction. In this study, the currently available knowledge on influencing technology acceptance was synthesized first. Then, a HCD approach was followed in order to generate case specific design solutions. These design solutions followed from the user requirements, based on the semi-structured interview on general user needs, knowledge needs and the behavioural determinants of technology acceptance (Venkatesh et al., 2003). The requirements were specified with the analyses on the knowledge types: principles knowledge, how-to knowledge and persuasive information (Rogers, 2003). The resulting design solutions, together with design guidelines from literature, were used to develop a tangible evidence-based introduction design for the VictoryaHome system. Furthermore, the analysis resulted in new insights into the current technology acceptance theory. This new technology acceptance framework is shown in Figure 13 and shows both the specific design solutions (introduction activities) and the new insights into existing technology acceptance theory. The measures indicated in the figure can be used to test the framework. In this chapter the most important results will be interpreted and synthesized first. The framework in Figure 13 can be seen as a summary of the most important finding. A discussion of the implications of the findings follows. Then, the limitations of the research will be discussed. Ideas for future research are given next, and the chapter is ended with a general conclusion.

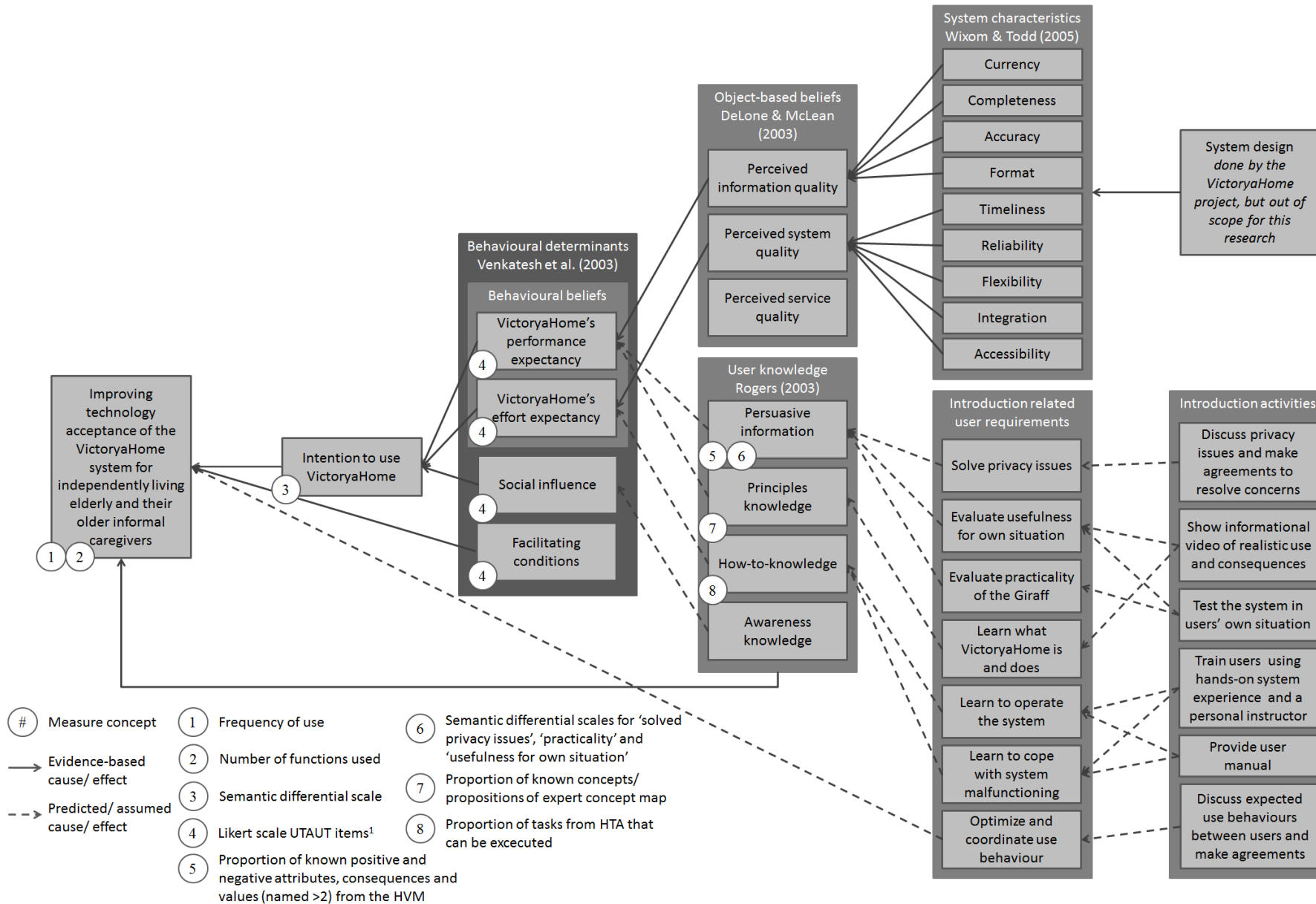


Figure 13. Framework for improving older adults' technology acceptance within the VictoryaHome case example of elderly support, and with a focus on the system introduction. The framework is presented as an action-effect diagram (Reed et al., 2014). ¹ Adopted from Im, Hong, & Kang (2011)

Interpretation of the Results.

The results are interpreted on two levels. The first level that will be discussed, covers the macro level findings, and focuses the impact of the needs analysis on higher level theories of technology acceptance and human centred design. The second level, covering the micro level findings, is more concerned with the results that are directly related to implementing assistive technologies like the system of this case.

Macro Level Findings.

On a higher level of abstraction, this study produced several important findings as well. The study first of all shows how UTAUT (Venkatesh et al, 2003) and the innovation decision model (Rogers, 2003) could be integrated. The study furthermore gives support for the theory of Wixom and Todd (2005) that emphasized separating object based attitudes from behavioural attitudes. The study finally resulted in the hypothesis that the coordination of use behaviour could be an important additional factor explaining technology acceptance when the technology involves more than one user.

Integration of UTAUT and the innovation decision model.

This study gave a first insight into the way two well-known models on technology acceptance could be integrated. This study was based on UTAUT (Venkatesh et al., 2003) and the innovation decision model (Rogers, 2003), two models of technology acceptance. Users were questioned on the factors that are the building blocks of these models and user needs were deducted. Based on the resulting user needs, the hypothesis can be made that meeting the information needs as described in the innovation decision model (Rogers, 2003) can result in optimising the UTAUT (Venkatesh et al., 2003) factors, in the way illustrated in Figure 13. The reasoning for this is outlined in the following three paragraphs.

First of all, providing the users with how-to knowledge could lead to a more positive effort expectancy. Users stated they wanted to get a personal explanation on how the system

works even though they thought that the system was easy to use. This indicates that the perception of how easy it is to use a system might not only rely on system characteristics, but on knowledge on how to use the system as well. Users also stated for example that they were afraid they would do something wrong when they had to operate specific parts independently. The confirmation that instruction can give can therefore also influence effort expectancy.

Secondly, providing users with good persuasive information and principles knowledge could lead to a more optimal performance expectancy. It was found that users want to be able to evaluate the usefulness of the system for them personally and that they want to evaluate how practical the system is in reality. To support users in these needs, persuasive information should be given about the advantages and disadvantages for the specific user. To do this, it was proposed that it is best that people experience the system in their own situation, a term that Rogers (2003) included in his innovation decision model as trialability. Having knowledge about the usefulness in a user's actual situation could lead to having realistic expectancies, which could positively influence performance expectancy. Broadbent et al. (2009) noted that letting elderly experience an assistive robot helped elderly who did not think the robot would be useful for them, change their mind after interaction. Principles knowledge could also support people to have realistic expectations. By explaining how the system functions, users can get a better insight into the possibilities and the limitations of a certain system. This reasoning also complies with Szajna and Scamell's (1993) findings that realistic user expectations have a positive influence on their system perceptions, and thus that managing user expectations might be a very important addition to just trying to optimise the system. Ryker, Nath, and Henson (1997) add that for achieving satisfaction with system use, it is important that these expectations are managed by people internal to the system's underlying organisation, like peers or staff from the service delivering organisation, instead of external sources.

Finally, this study did not focus on awareness information. However, it can be hypothesized that this type of information can impact the experienced social influence. In this study, participants mostly stated they did not have a clear idea of what their social environment would think of the system, since it is so new. In other words, their environment is not aware of the technology yet. Targeting the social environment for (positive) awareness about an innovation, as well as the actual target user group, might therefore be a good strategy to improve experienced social influence.

Distinguishing object based and behavioural attitudes.

The theory of Wixom and Todd (2005) that it is important to distinguish object based attitudes from behavioural attitudes in explaining the intention to use a technology receives support from these research results. Several studies have found that user satisfaction, or how people perceive a product, is not a good predictor of system use (e.g. Melone, 1990). Wixom and Todd (2005) explain this by stating that the effect of object based attitudes on system use is mediated by behavioural attitudes, as in UTAUT (Venkatesh et al., 2003). This mediating effect is demonstrated in Figure 13. In this research, this relation is clearly found. In general, people had a very positive opinion about the VictoryaHome system and saw many advantages. However, when they were asked if they would want to use the system themselves, most participants stated they did not. Reasons varied, but all came down to ‘the system is useful, but not for me’. This finding is very important when UTAUT (Venkatesh et al., 2003) is being applied. In this study it was found that when participants generalize about advantage, meaning that participants say that something is useful for others or people in general, they are usually expressing object based attitudes in a person-context. Only when people talk about advantages for their own situation, they should be interpreted as clear indications for behavioural attitudes. A study in which this confusion is also found is the study of Rahimpour et al. (2008) who investigated the perceived usefulness of a home

telecare system. The results show a mixture of advantages for a participant's own situation and advantages for people in general. Even though both types of information are useful, a clear distinction is necessary because of their different predictive value for actual system use.

Coordinating use behaviour as an additional determinant of technology acceptance.

The needs analysis that was performed in this study results in the hypothesis that the coordination of use behaviour between system users, or the perception of this coordination, could be an additional determinant of technology acceptance. That is why the factor 'coordinating use behaviour' is directly linked to technology acceptance in Figure 13. Coordinating use behaviour is an expressed user need that does not clearly fit UTAUT (Venkatesh et al., 2003) or the innovation decision model (Rogers, 2003). It means that users want to know what kind of behaviour they can expect from their fellow users and what these users expect from them. An example is that elderly residents wanted to know how and when their informal caregivers would get in touch with them after they had sent them a visit-me request. These issues arise when multiple users work together with the same system. A theory that can provide more insight in this issue is Malone and Crowston's (1994) coordination theory that explains that for coordination (in this case the coordination of use behaviour), the dependencies among activities should be managed. Indeed for an elderly to achieve the goal of having a visit, they are dependent on the informal caregiver to get in touch with them after they have sent him or her a visit-me request. The experience of coordination between users is only relevant for systems that involve multiple users. This might be a reason that this factor is not yet included into models of technology acceptance. However, with the increased use of multiple user systems and groupware (software that helps several users reach a shared goal), this factor is highly relevant. This study gives a first indication that coordination between use behaviour, or the perception of this coordination, should be incorporated into models on technology acceptance for technology where several users cooperate.

Micro Level Findings.

The most important micro level results are the specific design solutions for a system introduction. These design solutions are: 1) discussing privacy issues and making agreements to resolve them, 2) the informational and motivational video showing realistic system use and consequences, 3) testing the system in the users' own situation, 4) training users, giving them hands-on experience and help from a personal instructor, 5) the user manual, and 6) the discussion of expected use behaviour leading to behaviour agreements between users. These specific design solutions are supposed to affect technology acceptance through the factors in Figure 13. How these design solutions are incorporated into one coherent introduction design is variable. The introduction design, consisting of four introduction components, presented in this study is just one example. This study resulted in more micro level findings than just these design solutions.

First of all, the results of this study support Annett's (2003) statement that it is important to include tasks in a hierarchical task analysis that are uncommon. In this study, tasks that are safety and emergency related were initially seen as highly relevant and important. This still holds. However, from the need analysis it was concluded that users, besides knowing how to operate the system under normal conditions, highly valued what to do in case of system malfunctioning, which is a much less common situation. All participants noted the importance of a high quality help service, and many thought knowing how to contact the help service was the most important information they should receive. This is in agreement with the findings from Rahimpour et al. (2008) and Steele et al. (2009) who also found that elderly users highly valued user support. This does clarify that users not necessarily want to know how they can personally solve the uncommon problem of system malfunctioning, but they want to know what they should do in such a situation. This is exactly the kind of information that is covered in the HTA.

Secondly, this study resulted in a deeper understanding on themes related to the perceived usefulness of similar types of assistive technologies, since participants had the chance to actually experience the system in their own situation. Many of the advantages found in this study confirm the findings of others. Rahimpour et al. (2008) found for example that elderly thought peace of mind and avoiding the feeling of being alone were main advantages of a home telecare system. The results from the laddering interview confirm these findings, since positive feelings, of which peace of mind, were named in 7 of the participants' ladders, and preventing loneliness was named in 5 ladders. This study furthermore adds support, since these laddering interviews were held after users had some initial experience with the system, confirming that users not only thought these were advantages of the conceptual idea of a home telecare system, but still valued these aspects after initial system use. Findings of Steele et al. (2009) are also confirmed. They asked elderly about their opinion on a potential wireless sensor network to monitor them, and found that elderly highly valued the impact such a system can have on staying independent (named by this study's participants in 4 ladders), and on maintaining quality of life (named in 7 ladders) by giving help in emergencies (named in 13 ladders). However, this the laddering results add the insight that experiencing the technology and the technology's characteristics can interact with views on system usefulness. The main result is that participants experienced many system characteristics as not practical in use. As can be seen in the HVM in Figure 11, the consequence of not being practical (named in 6 ladders) that following certain system characteristics, was directly linked with a negative impact on the experienced independence and the ability to give or receive help in emergencies, and indirectly on experiencing positive feelings like peace of mind and on a good quality of life for the resident. It can thus be concluded that the advantages of assistive technologies that were found by others are again found important. However, experiencing the

system can lead to people doubting if these advantages hold in a specific technological instantiation.

Implications for Practice

The current study also has several implications for practice. First of all, this study gives recommendation for how HCD can be used in the design of the introduction of assistive technology. HCD is a well-known method for the development of technological systems and similar methods have also been followed for designing computer training or user support. However, this study differentiates itself from these types of studies by taking on the entire initial introduction of a system, thereby designing for more than good system interaction. A different prioritization of applying HCD methods might stem from such a comprehensive approach. In practice, the resources for the development of a system and its introduction are often limited. In hindsight, this study gives insight into what activities are most critical. It is suggested that when it is not yet clear what components the introduction should entail (i.e. should the focus be on instruction or on motivating users), as was the case in this study, the analysis of the context of use at the first iteration should not have to be that detailed as done in this study. Getting insight into the users based on literature, and getting familiar with the tasks and knowledge by personal experience and researching project documents is suggested to be sufficient at this stage. However, studying the needs of users by performing the semi-structured interviews has been critical in this study, forming the basis for the development of the final introduction design, and is advised not to be missed. It is suggested that based on the prioritization of the requirements resulting from these needs, the methods used for the context of use in the next iteration can be specified. Richards (2014) has suggested to follow a 60% 20% 20% distribution for a MoSCoW requirements prioritization. This might indeed be optimal for supporting users, and in this study the resources were there stick to this distribution. However, for other situations this distribution might be too optimistic

considering the available resources. With less resources available, this study might had to focus on the most important user need, which was learning how to operate the system. With this in mind the second iteration context of use analysis should still include the HTA, and might straight away focus on more methods directly related to designing instructions. The, in this study performed, laddering interviews and concept mapping might then be of lower priority.

Besides learning from the process, organisations and designers can also learn from the results of this study. The study results can be used to get a deeper understanding in the factors related to implementing assistive technology. The found user needs are for example probably also relevant in different, but similar, cases. In addition, the results from the laddering interview are also relevant for other assistive technologies for elderly. Furthermore, the results involve a finalized first design of a product introduction and a clear set of guidelines that were used to come to this end product. The end product can be used as inspiration for other designers that have to design for a similar scenario. This learning from past experiences as a designer is what Maher and De Silva Garza (1997) consider case based reasoning in design, which is an important method to support design. One things that for example can be learned, relates to the user need to evaluate the usefulness of a product for their own situation. Rogers (2003) already introduced the concept of trialability, and indeed users did indicate that they preferred to try the system in their own homes. However, it was also found that showing a video that demonstrates a realistic use case, can also be of great use for people to evaluate a system's relevant uses. This method might be utilized when testing the system is not feasible. Another thing that can be learned from this study, is that users not only want to be instructed on normal system functioning, but on system malfunctioning as well. Practitioners might look at the designed manual and training to see how such uncommon situations can be implemented into user support. On a more detailed level, practitioners might use this

introduction design to get inspiration on how to implement the guidelines that are presented in Table 9. For example, the manual demonstrates how similar chunks of information have the same layout, or how motivational information is included at the introduction section of the manual.

For Smart Homes, the organisation that supported this research and provided the VictoryaHome case, the results have straightforward implications. They can use the results of the study to introduce the VictoryaHome system to the intended users. Using an evidence based introduction heightens the likeliness of the introduction being effective and reliable. Furthermore, having a designed introduction can promote that the system will be introduced to all users in a similar fashion. Standardization of such a process will ensure that a certain standard of quality will be maintained. Furthermore, they could use the task analysis as a basis for future usability testing or investigating what tasks are especially prone to errors and could benefit from redesign.

Study Limitations

First of all, the current small sample size of elderly residents ($N = 5$) and older informal caregivers ($N = 5$) seems to limit the generalizability of the results, since many population characteristics will not be covered in such a small sample. It should be mentioned that in this research it was noted that elderly and their caregivers mostly gave similar answers and held similar opinions, which was the reason that the results for the two samples are not presented or considered separately. Even though a sample size of ten is still considered small, Marshall (1996) emphasizes that a study needs to just have a large enough sample to answer the research question appropriately, and that for a very detailed study the sample size might be in single figures. This study focussed on a broad topic, involving many facets, and wished to discover important general guidelines that could be further investigated and tested in other research. Therefore, it can be said that Marshall's (1996) statement holds for this research.

Marshall (1996) furthermore states that a sample usually has enough subjects when a certain extent of data saturation is found. This means that adding subjects to the sample does not lead to discovering new themes or user requirements. This data saturation was indeed found in the interview on discovering user needs, of which the results formed the main framework for defining the user requirements. This is demonstrated by the fact that not one user need was addressed by one participant only, and even the user need that was expressed by the fewest participants was shared by four out of ten participants. This means for adding the last three participants, deducting user needs did not result in new needs. It must be noted that this might be due to the fact that the user needs that were deducted from the coding scheme were defined as global higher order needs, which is however in line with the goals of the research.

A more significant problem for the representativeness of the results is the exclusion criterion that was used in this study, ruling out elderly participants that did not have a working internet connection, and thus probably little technology experience. This is a problem, since people with a working internet connection in general also use it, meaning they have at least a considerable amount of experience with modern communication technologies. This was confirmed by the fact that all elderly residents in our sample owned an iPad. Even though the level of experience with modern technology, like computers, is rising among elderly (Czaja et al., 2006), it is important to also include people with less experience in the sample. This is important, since technology experience significantly influences technology acceptance and interaction (Venkatesh et al., 2003; Napp, 2008), and technology experience is still very diverse among elderly (Gaul & Ziefle, 2009). Other user characteristics that were seen as important for this study (e.g. gender, age and health problems) were included in the judgement sample. However, in this research it was not feasible to provide elderly without much technology experience with a temporary internet connection. In order to keep the transferability of the results high it was agreed that all tests should take place in the user's

own home. Transferability means that (relevant aspects of) the results from this study can be transferred to similar situations and by keeping the study context closely related to actual use situations transferability is promoted. Therefore, the results of this study should not be directly generalized to elderly with a very low level of technology experience.

A final limitation of this study is the fact that economic factors could not be taken into account in the context of use analysis. Since the VictoryaHome system is still in development, the economic (and organizational) factors related to product implementation are not yet clear. This means for example that there is no price indication for consumers. Different scenarios that greatly influence costs are possible. One possibility could be that users buy the complete system from an independent company. However, it is also likely that the system will be leased from a care organisation, decreasing costs and incorporating the implementation with other care. It might even be the case that (in certain situations) insurance companies will take on all or parts of the costs. The exclusion of these factors can have serious consequences. Both Rahimpour et al. (2008) and Steele et al. (2009) state for example, that cost is the main concern elderly expressed with adopting smart home technology. Excluding these factors from the investigation, does not mean that participants did not form their own ideas either consciously or subconsciously. Subsequently, these ideas could influence other reactions. An example clarifies this issue. A certain user thinks that system 'A' has advantages, but also some significant issues. When he is asked if he would use this system, and it is mentioned that the system is free, he might overlook the issues and agree to using the system. However, when that same question is asked in the case that the system would cost him a significant amount of money, the negative aspects (issues + costs) might outbalance the advantages, and the user would not agree to using the system. Thus, when the costs are not made explicit, users' might still have ideas on what such a system would cost which could influence their responses in the interview.

Future Research

The results of the present study open windows for new research. First of all, the resulting user requirements represented in the framework to improve older adults' technology acceptance (Figure 13) can be interpreted as hypotheses for new research to support or reject. Explorative and rich qualitative methods are often used to generate theory instead of testing hypotheses (Marshall, 1996). In this study, these methods were used to formulate evidence-based user and design requirements in a bottom-up fashion. The requirements found can be regarded as 'new theory' or new hypotheses that need to be tested. Two ways of testing the hypotheses or requirements can be followed. First of all, it is known that HCD is an iterative design process (e.g. Maguire, 2001a). However, due to limited resources this study only involved the first three phases of the first iteration of the HCD cycle. Therefore, the current design should be evaluated. This evaluation will probably lead to additional requirements, requirement adjustment and requirement specification (i.e. more evidence based and reliable requirement criteria) (Maguire & Bevan, 2002). In several iterations, the requirements and the design are updated until a satisfactory level is reached. Next to investigating the user requirements, design guidelines and design principles by means of iteration, research in other contexts (for example using other types of technology) or research using experimental research designs can provide insight into the generalizability and sustainability of the results found.

Secondly, it would be good to extend the line of research and investigate how other parts of the implementation can be optimised. Cooper and Zmud (1990) have developed a model describing the stages of IT implementation. The introduction of the system to its end users can be seen as part of the adoption and adaptation phase. However, for example the adoption phase and the preceding initiation phase need more research on how they can be optimized. Rogers' (2003) awareness knowledge seems relevant for these phases.

Finally, another line of research could focus on investigating the viability of the proposed theoretical extensions that were derived from the study results and presented in the framework of improving technology acceptance in Figure 13. It was proposed that UTAUT (Venkatesh et al., 2003) and the innovation decision model (Rogers, 2003) could be integrated in a way that factors from the innovation decision model could influence factors in UTAUT. Secondly, it was proposed that for systems that have multiple users working together, UTAUT should be extended with the factor ‘perceived coordination of use behaviours’. Experimental research is necessary to test these statements. The concept measures included in the framework in Figure 13 can be used in the design of such experimental studies.

Conclusion

This research focused on evidence-based design for introducing assistive technology to older end users. By using a wide variety of qualitative methods, a rich insight and deep understanding of the studied case is generated. This information has led to the development of a case specific framework for improving older adults’ technology acceptance, including both detailed information on specific design solutions and more general insights into technology acceptance theory. Even though, these findings should be validated by more experimental studies and in other contexts, the new insights that emerged from the data demonstrate the value of doing in-depth qualitative research.

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Appendix A: Overview of age related functional decline

An overview of age related functional decline that can effect technology interaction, adopted from Mead, Lamsom, & Rogers (2002) and Harte et al. (2014).

Ability	Age-related change	Circumstances that likely create difficulty
Vision		
Colour vision	Difficulty discriminating certain wavelengths, particularly blue-greens.	- Discriminating colours and contrast on a screen, particularly in low luminance settings.
Contrast sensitivity	Increase in minimum luminance contrast needed to resolve high spatial frequency patterns.	- Reading small, decorative or poorly weighted fonts. - Distinguishing between similarly shaped software icons on screens or icons on labels.
Glare sensitivity	Increased susceptibility to glare or decreased ability to focus vision when competing light sources are present in the environment	- Coping with glare on a screen or maintaining concentration when glare from external sources are present in the environment.
Temporal resolution	Increase in minimum detectable temporal frequency (flash rate).	- Reading scrolling text.
Visual acuity	Decreased ability to resolve small details.	- Taking in information from a large field of vision, lack of peripheral vision could have implications for flashing warnings.
Visual selection	Difficulty selecting relevant information in a display that contains relevant and irrelevant information.	
Audition		
Auditory frequency range	Decline in sensitivity to high frequencies.	- Perceiving beeps or alarms that reside above 2 kHz.
Auditory sensitivity	Decreased ability to distinguish among tones.	- Perceiving low amplitude beeps. - Discriminating acoustic cues that are short in duration.
Auditory selection	Decreased ability to separate speech from background noise.	- Perceiving verbal feedback that is not clear and reasonably paced. - Trying to localise sounds.
Touch		

Spatial acuity deterioration	Decreased ability to discriminate tactile gaps and bumps as well as the orientation and direction of lines or surfaces	- Attempting to manipulate small components such as buttons, knobs, levers and battery compartments. - Perceiving stimuli such as vibration feedback.
Fingertip sense deterioration	An increased tactile threshold for light touch and vibration sense	- Distinguishing between tactile gaps, bumps and surfaces.

Cognition

Working memory	Reduced capacity to maintain information in active memory.	- The display and interface is cluttered or overly complex.
Spatial visualization	Reduced ability to hold and operate on spatial representations in working memory.	- Feedback is not presented clearly or intuitively. - There is no adequate labelling or instructional support.
Language comprehension	Decreased ability to process complex text.	- Manipulating controls gives unexpected results.
Episodic memory	Poorer explicit memory for specific events and their contexts. Slower acquisition of new knowledge.	- They are asked to remember difficult or complex operational routines. - Navigation and menu structures are used that rely on working memory
Semantic and procedural memory	Previously acquired general knowledge and skills are well maintained. Slower acquisition of new skills.	

Psychomotor performance

Fine motor control	Decreased ability to manipulate very small controls, because loss of control on e.g. grip, dexterity, coordination, manipulation and mobility.	- Pressing buttons which require a deal of force that exceeds the capability or comfort of the user. - Attempting to press buttons which are close together or are small.
Noise to force ratio	Decline in accuracy of rapid movements.	- Gripping heavy or cumbersome objects, particularly in one hand. - Attempting to reach with the thumb across an interface to manipulate controls when holding a device in one hand. - Making certain gestures when interacting with touchscreens (<i>i.e.</i>, pinches).

Appendix B: Personas for the elderly resident users

VictoryaHome personas for the elderly resident users developed by Smart Homes (2010).

Aalbert**Short description**

Aalbert is a 75 year old male. He lives alone independently and has some age related physical problems. Aalbert has three children, two sons and one daughter, who all live far away.

What Aalbert enjoys

Albert enjoys playing cards with visitors when they come, chatting and watching television.

What Aalbert misses and likes to do again

Aalbert misses being able to do things he used to do, such as going on a holiday, as everything has gotten harder due to limited mobility. He misses his wife and has become quite lonely as he is not able to get out much. He does not like to answer the phone unless he knows who is calling. Aalbert misses having his family around as they all live quite far away. He speaks to them regularly and they do try to help him when possible.

Aalbert's worries

One of Aalbert's main concerns in terms of health is having a stroke. He worries that he won't be able to call for help and will be helpless for a long time since he does not often have visitors.

Nature of Aalbert's physical problems

Aalbert suffers from mobility issues and has had two falls. He has a weak heart and lungs. Therefore he gets tired quickly.

View of Aalbert's relatives

Aalbert's relatives would like him to develop some communication with his grandchildren.

Brenda**Short description**

Brenda is an 85 year old female. She lives alone independently and has some age related physical problems, diabetes and she has started forgetting things. Brenda has one daughter living nearby.

What Brenda enjoys

Brenda enjoys listening to music.

What Brenda misses and likes to do again

Brenda really misses knitting and reading. She used to enjoy these activities, but her eyesight has deteriorated over recent years making reading almost impossible. She sometimes uses audio books, but finds that technology difficult to use.

Brenda's worries

Brenda's worry is that she cannot stay independent and that she would need help when she wants to go out. Also she worries about her eyesight getting worse

Nature of Brenda's physical problems

Brenda has limited mobility, uses a Zimmer frame and has a mobility scooter. She finds walking difficult and cannot walk very far because of getting short of breath. She relies on public transportation and taxis to travel long distances.

Nature of Brenda's medical needs

Brenda takes many medicines for her diabetes and related problems, such as high blood pressure. Exertion causes her breathlessness. Brenda's doctor has advised her to purchase equipment for taking her own blood pressure.

Nature of Brenda's cognitive problems

Brenda has started to forget things, such as the time. She also often forgets whether she has taken her medication, which has caused health problems that led to her being hospitalised several times.

View of Aalbert's relatives

Brenda relies on her daughter a lot. She visits Brenda every day and often does jobs around the house. She worries about her mother forgetting her medication.

Carol

Short description

Carol is an 82 year old female. She lives independently with her husband. They live in a large house in a rural area. Carol has some age related physical problems. The couple has two children. One of them lives nearby and the other one lives abroad. Carol also has a good relationship with her grandchildren who visit frequently.

What Carol enjoys

Carol loves to play the piano and to listen to the radio. She reads a newspaper every day. Also, she helps with local church activities and uses a computer to perform administrative tasks for the church.

What Carol misses and likes to do again

Carol has limited function in one hand. So she can't play the piano as well as she used to, and now she only plays for herself at home, whereas she used to play in the church before. She also finds it more difficult to type and click the mouse because of her hand, but she manages. Carol has recently had her knee replaced and is convalescing. She usually attends a gentle 'keep fit' class, but currently finds it difficult to walk or stand for long periods.

Carol's worries

At the moment Carol's husband helps her with the things she can't do herself anymore because of her physical problems (e.g. kneeling down to set the video recorder), and likewise she helps him with the things he can't do, like reminding him to take his medication. They make a good team. Carol is worried about what might happen if one of them fell ill or if she had another fall. Carol does all the cooking and worries that her diabetic husband would not be able to cook nutritional meals for himself if something happened to her.

Nature of Carol's physical problems

Carol has a damaged hand caused by a bad fall. Three of her fingers don't work, but she is quite determined to do things herself rather than to ask for help. She also just had her knee replaced and thinks the other knee might need to be replaced soon. Carol can occasionally be forgetful or get her words muddled up, but thinks this is normal for her age and makes notes in her diary or calendar to remind her.

View of Carol's relatives

They think the couple copes very well, but are concerned that if they deteriorate they might get trouble managing the very large house.

Dafne

Short description

Dafne is a 78 year old female. She lives alone independently and has mobility problems. She visits a day care centre three days a week and has no children.

What Dafne enjoys

Dafne is used to living alone, but always looks forward to the days where she goes to the day care centre where she has a lot of friends. She enjoys listening to music from her younger days and she gets involved in all the activities at the day care centre, especially crafts.

What Dafne misses and likes to do again

Dafne used to love going shopping.

Dafne's worries

Dafne is worried she might have a fall when she is on her own and might not be able to use the personal alarm which she wears around her neck.

Nature of Dafne's physical problems

Dafne finds dressing and washing difficult due to mobility problems and has caregivers come to her home daily to help her. They also do light housework. Meals are brought in by a special private service for the days Dafne is at home. She reheats these in the microwave.

View of Dafne's day care staff

They are worried something will go wrong when she is home alone, that she will fall. Also, Dafne doesn't like drinking too much water since that makes her go to the toilet too often. As a result she often gets dehydrated which makes her weak.

Appendix C: Interview guide

Interview guide that was used during the tests. The instructions for the usability tests are excluded from the guide, since this method was not used in this research..

DAY 1: Session 1 ~ 3 hours

1.1 Introduction ~ 40 minutes

Before going to the users make sure you have read the instructions. Do not forget to bring the documents listed in these instructions, pen and paper and two devices to record audio so you can interview two users at the same time.

Furthermore, make sure you already have names, email addresses and pictures of the users, so you can personalize the system and make an account for the Giraff pilot prior to your visit.

Finally, the user's well-being is the most important! If you notice that the interview or a task is making the participant feel too uncomfortable, tired, etc. you should check this with the participant and if necessary propose a break or reschedule.

1.1.1 Introduction ~ 30 minutes

- Greeting and proposing to take a seat for an introduction and explanation of today
- Introducing one selves
- Introducing the project:
 - European research project with partners from different countries, industries, care organisations, and research centres
 - Support people living the way they want and helping people to take care of each other
 - monitoring: fall detection and medication dispenser
 - communication: Giraff and app (visit me + serenity icon)
 - Explain workflow related to fall detection, medication dispenser, visit me requests and serenity icon. What happens and why?
(take your time to explain the VictoryaHome concept and show the devices that you are talking about)
- Explain role and importance of participant:
 - System tries to support target users' needs (= participant)
 - Users' experiences, opinions, feelings, comments are needed for a good fit
 - Improvements are made based on your experience. This is a prototype!
 - Participation will include: trying the system, performing tasks, answering questions in between and afterwards
- Explain what participating to the research involves (informed consent = summary):
 - Anonymity and confidentiality
 - Audio-recordings, making notes (+ pictures if participant agrees)
 - Participation is voluntary – you can always quit!
 - Notify us when you want to stop the experiment (or take a break)
 - Contact Herjan van den Heuvel when you reconsider participation after we have left

- However, already published results cannot be withdrawn
- Procedure:
 - Signing informed consent (~5 min)
 - Short survey (~5 min)
 - Testing the system: performing a few tasks (~ 2 hours)
 - Discuss impressions of today (~ 20 min)
 - Leave the system at home for a few days to experiment (~ 3 days)
 - Pick the system up and do an elaborate interview on experiences (~ 2.5 hours)

1.1.2. Informed consent ~ 5 minutes

- Signing informed consent: [VH-WP3-Phase-3.3 03 Pre-session Informed Consent](#)

1.1.3. Survey general information ~ 5 minutes

- Filling out one-page survey: [VH-WP3-Phase-3.3 04 Pre-session Questionnaire](#)

1.2 Performing tasks ~ 2 hours

--- Excluded from user guide ---

1.3 Debriefing ~ 20 minutes

- **Start audio recording!**
- Give the user time to process his/her thoughts and tell about his/her experiences by asking something like: “And, what did you think of today?” or “how did it go?”
- Tell that you have three general questions about the system, but that a more in-depth interview will be held with them after they have tried the system for a few days on their own.
 - *The users should be probed to give an elaborate and clear answer (see interview instructions for day 4 for possible probes).*

Researcher’s note: attitude (affective attitude, perceived enjoyment, anxiety)

1. What is your first impression of the system? What things did you like about the system and what didn’t you like? Why?
(Make sure that all users name at least three things that are liked and three things that are disliked)

2. What feelings did you experience when using the system?
(If you have observed the feelings that the user experienced already or if they have expressed it at another moment you can skip this question and add a note in the observation sheet)

3. What concerns do you have on using the system?

- Now, explain how the next few days will look like:

- Try the system yourself with the manuals that we leave behind
 - Set fake medication times and fill the dispenser with fake medicine
 - Explain the user can try to ‘forget’ his/ her medicine
 - Explain the user can use the panic button or fake a fall
- If there are problems or questions contact ‘.....’ (repeated in info letter)
- Explain when you are coming back
- Explain that at the last day of the try outs, an elaborate interview will take place taking about 2.5 hours
- We are asking you to think of some aspects already, while using the system (repeated in info letter)
- Give the users the right manuals and information letter and provide them some time to take a look:
 - VH-WP3-Phase-3.3 08 In-session Information Letter
 - VH-WP3-Phase-3.3 User Manuals (preferably printed in colour and laminated / plasticized)
- Ask if user has any questions, comments or concerns and respond to these.
- Thank users for today and for their participation.

DAY 4: Session 2 ~ 2.5 hours

2.1 Introduction ~ 15 minutes

- Greeting and proposing to take a seat for an introduction and explanation of today.
- Informal question on how everything went.
- Explaining the course of today:
 - Interview
 - Concept mapping exercise
 - De-installing the system
- Does the user have any questions beforehand?

2.2 Interview ~ 1 hour

2.2.1 Laddering Interview ~ 20 minutes

Background information and instructions for evaluator:

Laddering is a certain interviewing technique that is used to discover users’ values concerning a certain product and to discover how that product ‘scores’ on these values. For VictoryaHome knowing users’ values is important for several reasons. First of all, it gives important input for the planned developments by making sure that the developments will match the ultimate user goals on this product type. Second of all, knowing users’ values should be used with the product implementation to improve technology acceptance.

There are several ways a laddering interview can be performed. However, all methods are based on the following three steps and continually asking a question like “why is that important to you?”. These steps are described here following an example:

1. Discover important system attributes: e.g. system appearance. Users could say something like: “I don’t like the appearance of the Giraff. It’s too big and too bright; it stands out too much.”

→ Why is it important to you that the Giraff is not too big or bright?

2. Discover consequences of these attributes: e.g. gets other people's attention. Users could say something like: "Well, I don't like the Giraff to stand out. Then everyone will notice it and ask questions about it."

→ Why is it important to you that people will not notice the Giraff or ask questions?

3. Discover values: e.g. stigmatization. Users could say something like: "When they ask all those questions I have to explain what it's for. And then people will think that I need help."

→ Why is important to you that people do not think you need help?

4. Discover higher order values (if possible): e.g. be independent. Users could say something like: "I don't like that others think I'm helpless. I still live independently at the moment and so far it's going great! I don't even want to think about not being able to take care of myself anymore"

There is no clear rule on when you should stop asking for higher order values. Of course you want to go to the highest level in the value-hierarchy, finding the most abstract values. However, it is important to notice people should not rationalize too much by trying to find arguments for their behaviour. Furthermore, when the topic is sensitive, people might feel uncomfortable going to a higher order level. You can notice that this problem occurs when people suddenly stop going to a higher level value and insist on staying at the same level. There are some advices known from literature on how you could probe people to go to a higher order value level while minimizing the just called problems:

- *Evoking a situational context:* This technique consists on asking questions taking into account a specific situation. Respondents feel more comfortable in answering questions that are linked to a real context or event.
- *Laddering works best when respondents are providing associations while thinking of a realistic occasion in which they would use the product;*
- *Postulating the absence of a product:* this technique is used to "unblock" respondents when they cannot move beyond a certain level, and to encourage them to consider what it would be like to lack a product, assuming that the respondent will use "substitution" arguments when imagining him/herself without a product's characteristic, or without the product or without a consequence of use;
- *Negative laddering:* This technique is particularly relevant when respondents cannot articulate why they do the things they do. Instead of asking them why they act or think in a certain way, the respondents are asked why they wouldn't act or wouldn't think that other way;
- *Age-regression contrast probe:* Moving respondents backward in time is another effective device for encouraging respondents to remind of their past habits and compare them with their current life;
- *Third-person probe:* This technique is used to make respondents feel more comfortable to express their opinion. When respondents find it difficult to identify their own motives, or to articulate them, we can ask how others they know might feel in similar circumstances. In fact, this way they verbalize their own way of acting and feeling;
- *Redirecting techniques (silence and communication check):* These techniques consist of directing the answer to the respondent again. Silence on the part of the interviewer can be used to make the respondent keep trying to look for a more appropriate or definite answer without further interferences. Communication

check simply refers to repeating back what the respondent has said and asking for clarification, essentially asking for a more precise expression of the concept.

In this interview the attributes (and maybe sometimes already consequences or values) are discovered by discussing the things that people wrote down as answer to the question: “What are things you particularly like or find useful and what are things you particularly do not like about VictoryaHome?” When people did not think about this beforehand, the question should be asked again and then attributes can be thought of on the spot in a short brainstorm session (~5 minutes).

When people think of too many attributes, they should be asked to list 3-5 attributes that are most important for them. These attributes could be either positive or negative. Only for these attributes the laddering will be performed by continuingly asking “Why is that important for you?”.

It is important that you do not stop the laddering too quickly. Even though asking ‘why is that important to you?’ might seem very counter intuitive, it is important that you continue until people start rationalizing or cannot go to a higher order value anymore even though you have tried to reformulate the question using the strategies listed above. So, only the user (indirectly) decides when to stop laddering. For example a user could say taking medicine is important to him/ her because it will keep his/ her blood sugar from rising. Even though this seems very logical, you have to ask further: ‘why is it important to you that your blood sugar does not rise?’. Because these questions can be a bit strange, it is important that you inform the users about the repetitiveness of the ‘why’ questions and that these questions might seem strange.

Performing laddering interview

- Explain the laddering technique:
 - o Purpose: to discover values related to product.
 - o Method: first go through your list of things you liked or did not like about VictoryaHome (when you have not made a list: we will think of things now).
 - o Then continue by repetitively asking “why” to get higher up value hierarchy.
- **Start audio recordings!**
- Ask the question (and repeat): What are things that you particularly like or find useful and things that you particularly do not like about VictoryaHome?
- Go through their list and/or brainstorm with user to come up with system attributes.
- Discover consequences and values by laddering (asking ‘why’) for 3-5 of the most important attributes.

2.2.2 Interview on Technology Acceptance ~ 45 minutes

Unified Theory of Acceptance and Use of Technology (UTAUT)

Background information and instructions for evaluator: *with this interview we are trying to discover the users’ opinions, needs and values concerning the VictoryaHome system. Therefore questions are formulated based on known factors that*

influence technology acceptance in general and with older adults specifically. It is important that all these topics are being discussed to improve VictoryaHome and to match its users.

*The formulated questions are to be used as guidance. **When you notice that a question is already answered in a previous question, you do not have to ask it again.** Just make sure answers to all the questions are given somehow and try to keep the conversation flowing and relaxed. For you to be able to realize if a question is answered already, it is important you read all the questions once or twice beforehand!*

It is also important that it is really clear what the user means with a certain answer. Therefore, if an answer is vague or very limited (missing the context for a proper interpretation) you should probe the user with statements like:

- *I did not fully understand what you meant with '...'. Can you maybe 'explain it to me again' / 'describe a situation where this would happen' / 'give an example'?*
- *You were saying '...'. Can you 'tell me more about it' / 'think of more ...'?*

Perceived usefulness

1. Let's consider the specific functions of the VictoryaHome system separately: medication reminders, fall detection, sending 'visit me' requests and the serenity icon. Can you state for these four functions if they will be useful for you and why?
2. Are there functionalities you would like to work differently? If so, how?

Perceived ease of use

3. How difficult or easy was it for you to work with the system?
4. How difficult or easy was it for you to learn the system?
5. What functionalities did you find difficult to use and which ones were easy? Why?
6. What can make it easier for you to work with or learn the system?

Social influence

7. What will people in your direct environment think about VictoryaHome?
8. What will they think about you using the system?
 - *If it's not clear who is mean with 'your direct environment', state first that he/she can think of family, friends, neighbours and other people that are important to him/her. If people still find it hard to answer, tell them to think of one or two specific people that are important to them and to tell you their probable opinions.*

Facilitating conditions

Perceived behavioural control

9. How secure do you feel about using the system? Did you have the knowledge and resources to work with the system?

Compatibility (and perceived adaptivity)

10. How do you think VictoryaHome fits in your way of living? Will it complement your current life style or would it be hard to integrate/ need many life style changes?
11. What changes in lifestyle would VH bring to you? Is that good or bad?
12. Do you think VH is able to cope with changes in your life style? For example, changes in your health? If so → how?

Facilitating conditions ~ 15 minutes

Instructions and training

13. What did you think about the instructions that were given to you? What was good and what can be improved?

- *With instructions is meant: the verbal explanations about what the system does and the written instructions on how the system works*

14. Would you be willing to do a training?

15. In hindsight, how would your ideal instruction look like? If you have a concrete idea right away you can tell it now otherwise we can construct it together by using some more specific questions.

- What medium should be used? A manual, demonstration, training or a combination?
- What types of information should be used? Hands-on experience (exercises), text (speech or written), pictures or diagrams, videos?
- How should the content be structured? What content (information or exercise) do you want as an introduction, what do you want in the main part and what to conclude? Can you state 'chapters' for the main part?
- How should the instruction be organized/ planned? How long will it take? Does it take one day or spread over several days? Is the instruction done in your own home, in a classroom or remotely (e.g. virtually)? Is it with more users at the same time or individually?

2.2.3 Other known factors influencing technology acceptance

Background information and instructions for evaluator: *Ask the users' opinions on the VictoryaHome system based on the following themes **if they are not yet (fully) discussed in previous parts of the interview** (laddering and/ or UTAUT questions). This is important since these topics have proven to be of concern to older adults in the implementation of similar products. Take your time first to check if the topics have been discussed.*

Independent living

16. How do you think VH can facilitate independent living? (And is that positively, negatively or neutrally valued?)

Health

17. How do you think VH can help keeping people healthy? (And is that positively, negatively or neutrally valued?)

Social impact

18. How do you think VH will change your social relationships with your formal and informal caregivers? (And is that positively, negatively or neutrally valued?)
19. How did you perceive the virtual visits? Did it feel like the person calling was really there? And in comparison to a phone call or 'real' visit?

Privacy and confidentiality

20. What kind of impact do you think VH has on your privacy? (And is that positively, negatively or neutrally valued?)
21. What data of yours do you think the VH keeps track of? And do you have any concerns considering the tracking of those data? (Are you worried about confidentiality?)

System reliability

22. What is your opinion on system reliability? What aspects should always work for the system to be safe (enough)? What should happen when something stops working?

2.3 Concept mapping ~ 1 hour

Background information and instructions for evaluator:

Users are asked to make a concept map on VictoryaHome. By letting them make a concept map, it is discovered what knowledge and beliefs they have on VictoryaHome (what mental models they have). The knowledge and beliefs that users have on the VictoryaHome system can be used to check for knowledge gaps and to see on what topics (better) instructions and introduction is needed.

Concept maps consist of concepts, linking phrases and propositions. A concept is a word (or a couple of words) that describe objects and events. Linking phrases are used to show how two concepts are related to each other. The two related concepts together with the linking phrase form a proposition (a sentence that can be true or false).

It is really important with concept mapping that the evaluator give **no** input since we are discovering the knowledge and beliefs **of the user** and not of the evaluator. Therefore, you should be really careful with giving examples. Preferably you use no examples at all and if really necessary you could use examples from a different subject area.

It is possible that users find it difficult to structure the map or think of concepts or linking words. You could then stimulate users by asking questions, like:

- How do you think these concepts are related to each other?
- What do all these concepts that you have grouped together have in common?
- If you think of how you have used the system the last couple of days, what ideas or words come to mind then?

If a user explains something using free language you can discover important concepts and links that you then can repeat to the user. You should realize that you could also steer the user with the type of questions that you ask. Therefore you should try to just ask questions that are very general or elaborate on things the user has said already.

Another way you could help users is by also visualizing yourself the things that users say. For example if they say some concepts belong together, you will write them down close to each other. However, here it is especially important that **all the input comes from the users**. You are just helping doubtful users putting things on paper.

2.3.1 Exercise instructions

- Explain the purpose of the exercise:
 - To find out what you have learned about the system, in order for us to improve the instructions for target users.
- Explain exercise:
 - You are going to make a concept map.
 - Use VH-WP3-Phase-3.3_09_Day_4_Concept_Mapping_Exercise
 - Explain the key parts of a concept map (concepts, linking words and propositions) using the example concept map.
- Go through the steps of making a concept map using the ‘what is a bird?’ concept map.
- Now provide a pen and lots of paper.
- Start with brainstorming for key concepts (10-20) ~ 10 minutes.
- It is really important that **all input comes from the user** since their knowledge is of key importance.

Appendix D: Informed consent

English version of the informed consent form.

VictoryaHome – Informed consent

This text aims to inform you about the research you are participating in.

You are participating voluntarily in a research session in the context of the VictoryaHome project. The research will take several days. On the first and last day you will be asked to participate in a half-day session to test the VictoryaHome system and to do an interview. Remember: you can stop your participation at any time when you do not feel like continuing anymore.

The aim of the project is to help and enable people to live their lives the way they want, and to help people care for each other in a more pleasant manner. You are participating in a user session to better understand your needs and ideas of our proposed products and services.

The information that will be shared today will be used in a confidential and anonymous manner. No personal details will be reported nor used in any of the documentation or communication. The information will be used in analysis and will appear in reports or presentations – but always in a manner that it can not be traced back to your identity.

It might be the case that we take some pictures during the session. These pictures might be used in project reports or demo material. Please indicate when you do not want to be in these pictures. Furthermore, the interviews will be audio-taped.

The VictoryaHome project is supported by the European AAL Programme. When you would like more information, please ask your trial leader.

By signing with your name below, you declare that you participate voluntarily and have no more questions at the moment. If you would appreciate a copy of this document, just ask the session leader.

“I have read and understand all the information on this form and agree.”

Name:

Date:

Signature:



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Appendix E: Between sessions information letter

English version of the informatin letter participants got after the first session (smaller font).

VictoryaHome – Information letter



Thank you very much for your participation in the VictoryaHome project. We hope you have enjoyed trying out the system so far. The next couple of days we will leave the system in your home, so you can get more familiar with the system, and can try the system without us looking over your shoulder.

As we have explained before, you are testing a prototype. You are helping us to improve the system by showing us how you, a possible end user, interact with the system, and by telling us about your experiences. Today we have observed your system interactions. After a few days of playing with the system on your own, we will come back to ask you questions. To get the most out of this interview, we are asking you to use your time experimenting with the system to think about some questions and **write things down**, so we can talk about your thoughts later.

First of all, we ask you to try to come up with **things that you particularly like or find useful** and **things that you particularly do not like about VictoryaHome**. This can go from specific attributes (like the Giraff's colour) to functions (like video calling) and can be related to each of the devices that belong to the VictoryaHome system. If you write these things down, we will use this list in the final interview.

Secondly, we ask you to imagine that you have purchased the system and that it will be introduced to you for the first time. **What kind of instructions or training would you like to get?** You can think of things like: 'what kind of information do you need?', 'how should this information and/or exercises be organised (what comes first)?', 'how should the information be presented (pictures, video, live demo)?', etc.

Finally, we ask you to give some thought to the question: **What is VictoryaHome?** Try to think of concepts that describe VictoryaHome's goals, functions, system parts, etc. and try to think of how these concepts are related.

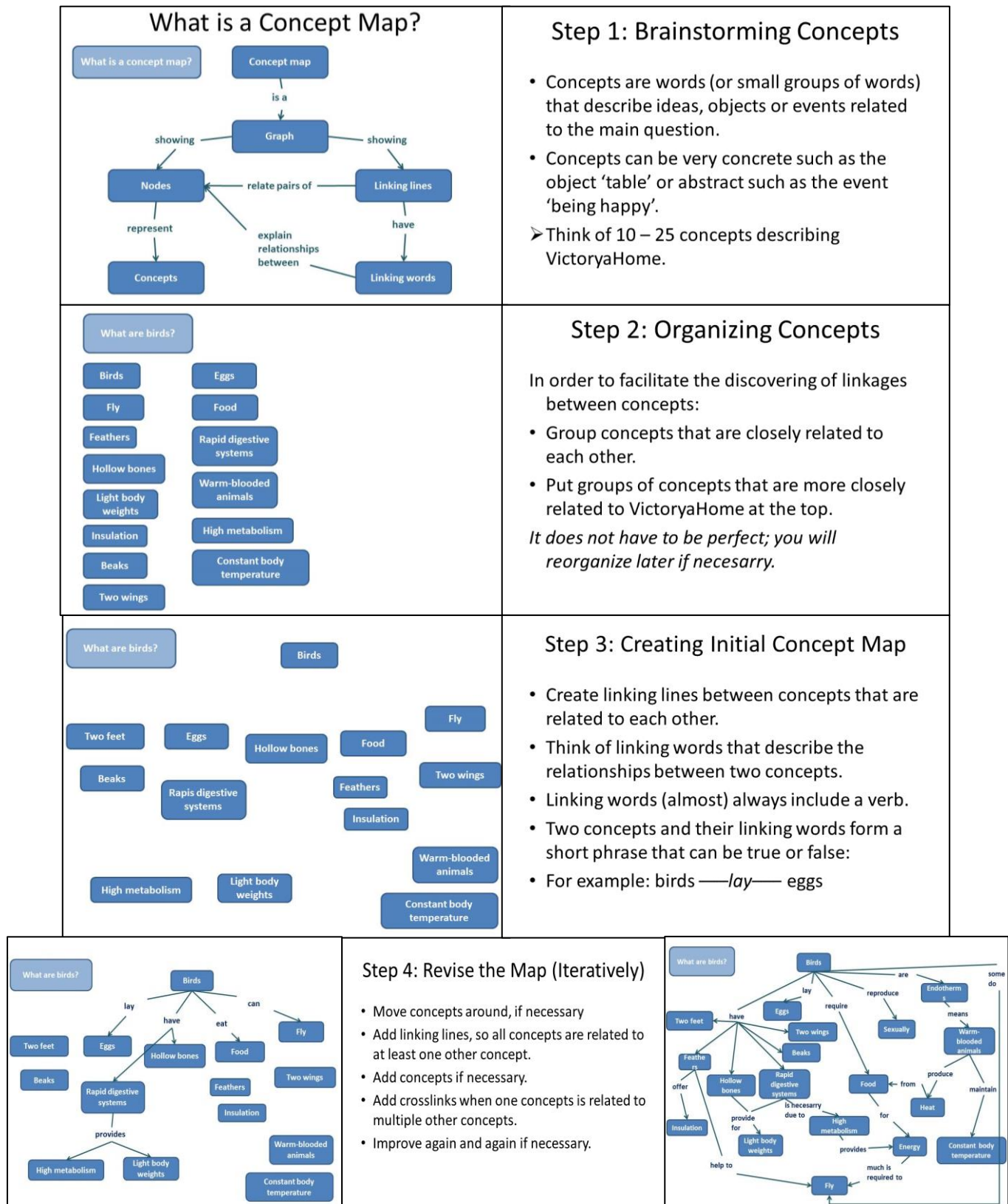
Remember, we want to know **your thoughts** on these topics and not the thoughts of your family or friends. For our research, it is really important that you brainstorm **individually**.

In the final interview, we will get back to all these topics. We will ask you some questions and we will have a final exercise. Of course, this will be explained in more detail in our next visit. We wish you a lot of fun trying out the system! If you have any questions or problems you can contact **via phone number** ...

We will see you in a couple of days!

Appendix F: Concept mapping exercise

English version of the concept mapping exercise (presented as PowerPoint slides).



Appendix G: Tabular task decomposition for the elderly resident users

Task decomposition for the elderly resident in tabular format. Critical operations are shown italic and are underlined.

0. Use VictoryaHome

Plan 0.: Do 1 continuously, do 2 when contacted and do 3 and 4 when needed

1. Update your network

Plan 1.: 1.1. - 1.5. if desired/ needed; 1.2 - 1.3 - 1.4 continuously

1.1. Request a visit

Plan 1.1.: 1.1.1. - 1.1.2. - 1.1.3. - 1.1.4. in that order

1.1.1. Activate the Giraff screen

Plan 1.1.1.: 1.1.1.1. or 1.1.1.2.

1.1.1.1. Press the green button on the Giraff

1.1.1.2. Press the green button on the remote control

1.1.2. Select a caregiver to send request to

1.1.2.1. Tap the picture of the selected caregiver

1.1.3. Confirm the request

1.1.3.1. Tap the picture of the selected caregiver again

1.1.4. Check if request has been sent

Plan 1.1.4.: 1.1.4.1. and/ or 1.1.4.2.

1.1.4.1. See the message "sent" on the screen

1.1.4.2. See a yellow envelope on the picture of the selected caregiver

1.2. Communicate medication intake

Plan 1.2.: 1.2.1. - 1.2.2. - 1.2.3. in that order

1.2.1. Hear medication reminder from the dispenser

1.2.2. Take medication from the dispenser

1.2.2.1. Turn the dispenser completely upside down to get pills out and register intake

1.2.3. Swallow pills

1.3. Communicate activity status

Plan 1.3.: 1.3.1. - 1.3.2. in that order

1.3.1. Check that the belt-clip is connected to wifi

1.3.1.1. See the connection light blinking blue

1.3.2. Wear the belt-clip on the waist so that the clip is open (only then measurements start)

1.4. Communicate detected fallsPlan 1.4.: 1.4.1. - 1.4.2. in that order1.4.1. Check that the belt-clip is connected to wifi1.4.1.1. See the connection light is blinking blue1.4.2. Wear the belt-clip on the waist so that the clip is open (only then measurements start)1.5. Send out an alarmPlan 1.5.: 1.5.1. - 1.5.2. in that order1.5.1. Hold panic button pressed for a few seconds1.5.2. Check that a beep is heard and the red light on the button is blinking

2. Have a virtual visit

Plan 2.: first 2.1. then 2.2. and if answered 2.3.; 2.4. if desired; end with 2.5.

2.1. Recognize an incoming call

Pan 2.1.: 2.1.1. and/ or 2.1.2. in any order

2.1.1. Hear ringing sound

2.1.2. See that the screen has flipped showing the name of the person calling

2.2. Respond to incoming call

Plan 2.2.: 2.2.1. or 2.2.2.

2.2.1. Answer call

Plan 2.2.1.: 2.2.1.1. or 2.2.1.2. or 2.2.1.3.

2.2.1.1. Press the green button on the remote control

2.2.1.2. Press the green button on the Giraff

2.2.1.3. Tap the green button on the screen

2.2.2. Decline call

Plan 2.2.2.: 2.2.2.1. or 2.2.2.2. or 2.2.2.3.

2.2.2.1. Press the red button on the remote control

2.2.2.2. Press the red button on the Giraff

2.2.2.3. Tap the red button on the screen

2.3. Have a chat

2.4. Adjust the volume

Plan 2.4.: 2.4.1. or 2.4.2. depending on desire. 2.4.3. if others cannot be done

2.4.1. Turn the volume up

Plan 2.4.1.: 2.4.1.1. or 2.4.1.2.

2.4.1.1. Turn the knob on the Giraff clockwise

2.4.1.2. Hold the button with a "+" on the remote control pressed

2.4.2. Turn the volume down

Plan 2.4.2.: 2.4.2.1. or 2.4.2.2.

2.4.2.1. Turn the knob on the Giraff counter clockwise

2.4.2.2. Hold the button with a "-" on the remote control pressed

2.4.3. Ask the caller to adjust their microphone volume

2.5. End call

Plan 2.5.: first 2.5.1. then 2.5.2. or 2.5.3.

2.5.1. Check that Giraff is against the charger

Plan 2.5.1.: 2.5.1.1. and/ or 2.5.1.2.

2.5.1.1. Hear short sound meaning that the Giraff got against the charger

2.5.1.2. See that the charging light is green

2.5.2. End call yourself

Plan 2.5.2.: 2.5.2.1. or 2.5.2.2.

2.5.2.1. Press the red button on the remote control

2.5.2.2. Press the red button on the Giraff

2.5.3. Ask or let the caller to end the call

3. Charge devices

Plan 3.: 3.1 - 3.2 - 3.3 in any order when the device needs charging; 3.1. when there is reason to think the Giraff is not charging or when battery light is red; 3.2. preferably each night or when battery light is red; 3.3. when caregivers receive a message that batteries are low

3.1. Charge the Giraff

Plan 3.1.: 3.1.1. - 3.1.2. - 3.1.3. in that order

3.1.1. Check if the charger is plugged into a (wall) socket

3.1.2. Let a caregiver drive the Giraff against the charger

3.1.3. Check that the metal plates of the Giraff touch the metal ends of the charger

3.1.3.1. See that the charging light is green

3.2. Charge the belt-clip

Plan 3.2.: 3.2.1. - 3.2.2. in that order

3.2.1. Plug the charging cable into the belt-clip and a (wall) socket

3.2.2. Check that the belt-clip is charging

3.2.2.1. See that the charging light is green

3.3. Change the batteries of the medication dispenser

Plan 3.3.: Do 3.3.1. and 3.3.2. first in any order. Then do 3.3.3. and 3.3.4. in that order. Do

3.3.5. when help is needed

3.3.1. Receive a message from your network that the batteries are low

3.3.2. Get four AA batteries

3.3.3. Open the lid of the battery compartment

3.3.4. Change the batteries

3.3.5. Ask someone to change the batteries

4. Solve (technical) problems

Plan 4.: Do 4.1. - 4.2. - 4.3. - 4.4. in any order when needed. Do 4.5. when others don't work or are no solution

4.1. Get the Giraff at its charging station yourself

Plan 4.1.: 4.1.1. - 4.1.2. - 4.1.3. - 4.1.4. in that order

4.1.1. Turn the brakes of the Giraff off

Plan 4.1.1.: Do 4.1.1.1.; if this is false do 4.1.1.2.

4.1.1.1. Check if the power light is off

4.1.1.2. Turn the Giraff off

Plan 4.1.1.2.: 4.1.1.2.1. - 4.1.1.2.2. in that order

4.1.1.2.1. Push the power button of the Giraff

4.1.1.2.2. See if the power light is off

4.1.2. Push the Giraff against the charger with the metal plates of the Giraff touching the metal ends of the charger

4.1.3. Turn the Giraff on

Plan 4.1.3.: 4.1.3.1. - 4.1.3.2. in that order

4.1.3.1. Push the power button of the Giraff

4.1.3.2. See if the power light is green

4.1.4. Check if the Giraff is charging

4.1.4.1. See if the charging light is green

4.2. Reset the Giraff

Plan 4.2.: 4.2.1. - 4.2.2. in that order

4.2.1. Turn the Giraff off

Plan 4.2.1.: 4.2.1.1. - 4.2.1.2. in that order

4.2.1.1. Push the power button

4.2.1.2. See if the power light is off

4.2.2. Turn the Giraff on

Plan 4.2.2.: 4.2.2.1. - 4.2.2.2. in that order

4.2.2.1. Push the power button

4.2.2.2. See if the power light is on

4.3. Take missed medication

Plan 4.3.: 4.3.1. - 4.3.2. - 4.3.3. in that order

4.3.1. Check if time for the next dose is yet to come

4.3.2. Take pills out of the dispenser

Plan 4.3.2.: if 4.3.1. is true do 4.3.2.1.; if false and pills cannot be missed do 4.3.2.2.

4.3.2.1. Take pills out as normal

4.3.2.1.1. Turn dispenser completely upside down

4.3.2.2. Take pills out "manually"

Plan 4.3.2.2.: 4.3.2.2.1. - 4.3.2.2.2. in that order; if not possible do 4.3.2.2.3.

4.3.2.2.1. Open the dispenser

4.3.2.2.2. Take pills out of the compartment left of the opening

4.3.2.2.3. Ask someone to help

4.3.3. Swallow pills

4.4. Reset the router

Plan 4.4.: 4.4.1. - 4.4.2. - 4.4.3. in that order

4.4.1. Turn the router off

4.4.1.1. Push the power button of the router

4.4.2. Wait about 30 seconds

4.4.3. Turn the router on

4.4.3.1. Push the power button

4.5. Call the help desk

Appendix H: Tabular task decomposition for informal caregivers

Task decomposition for the informal caregivers in tabular format. Critical operations are shown italic and are underlined.

0. Use VictoryaHome

Plan 0.: first do 1.; then continuously do 2.; based on 2. or when desired do 3.; when dispenser is empty do 4.; and when needed do 5.

1. Set up the system

Plan 1.: 1.1. - 1.2. in any order

1.1. Set up the serenity app

Plan 1.1.: 1.1.1. - 1.1.2. - 1.1.3. in that order. 1.1.1. not strictly necessary

1.1.1. Check if the smart phone meets the requirements

Plan 1.1.1.: Do 1.1.1.1. - 1.1.1.2. in any order. If no knowledge how to, do 1.1.1.3.

1.1.1.1. Check (online) if phone type has a resolution between 400x800 and 4128x3096 pixels

1.1.1.2. Check at the phone information if it has an Android Operating System between version 2.2 and 4.2

1.1.1.3. Call help service for help

1.1.2. Install the serenity app

Plan 1.1.2.: 1.1.2.1. - 1.1.2.2. - 1.1.2.3. in that order

1.1.2.1. Open the App store

Plan 1.1.2.1.: 1.1.2.1.1. - 1.1.2.1.2. - 1.1.2.1.3. - 1.1.2.1.4. in that order

1.1.2.1.1. Tap "apps" on the homepage

1.1.2.1.2. Tap the "apps" tab

1.1.2.1.3. Search for the play store icon

1.1.2.1.4. Tap the play store icon

1.1.2.2. Find the serenity app

Plan 1.1.2.2.: 1.1.2.2.1. - 1.1.2.2.2. - 1.1.2.2.3. - 1.1.2.2.4. in that order

1.1.2.2.1. Press the magnifying glass symbol

1.1.2.2.2. Type "VictoryaHome"

1.1.2.2.3. Tap the magnifying glass on the keyboard to search

1.1.2.2.4. Tap the VictoryaHome app in the search results

1.1.2.3. Install the serenity app

Plan 1.1.2.3.: 1.1.2.3.1. - 1.1.2.3.2. in that order

1.1.2.3.1. Tap "install"

1.1.2.3.2. Tap "accept"

1.1.3. Create the serenity icon

Plan 1.1.3.: 1.1.3.1. - 1.1.3.2. - 1.1.3.3. - 1.1.3.4. in that order

1.1.3.1. Tap "apps" on the homepage

1.1.3.2. Tap the "widgets" tab

1.1.3.3. Search for the VictoryaHome widget

1.1.3.4. Hold the VictoryaHome widget pressed and drag it to the preferred page and place

1.2. Install the Giraff pilot software

Plan 1.2.: 1.2.1. - 1.2.2. - 1.2.3. in that order

1.2.1. Download the Giraff pilot software

Plan 1.2.1.: 1.2.1.1. - 1.2.1.2. - 1.2.1.3. in that order

1.2.1.1. Open your web browser

1.2.1.2. Enter the provided download link

1.2.1.3. Press enter to automatically start the download

1.2.2. Open the downloaded file

Plan 1.2.2.: 1.2.2.1. - 1.2.2.2. in that order

1.2.2.1. Open the "downloads" folder

1.2.2.2. Double click the Giraff .exe file

1.2.3. Install the file

Plan 1.2.3.: 1.2.3.1. - 1.2.3.2. - 1.2.3.3. in that order; 1.2.3.2. excluded in case there is no security on the PC

1.2.3.1. Click "run" in the popped up window

1.2.3.2. Click "yes" to the question if you want to allow the program to make changes to your computer

1.2.3.3. Follow the installation instructions

Plan 1.2.3.3.: 1.2.3.3.1. only if desired; 1.2.3.3.2. - 1.2.3.3.3. - 1.2.3.3.4. in that order

1.2.3.3.1. Change the selection to adjust standard settings

1.2.3.3.2. Click "next" in the first window

1.2.3.3.3. Click "next" in the second window

1.2.3.3.4. Click "finish" in the final window

2. Monitor with serenity app

Plan 2.: First do 2.1. - 2.2. in that order; then 2.3. - 2.4. and 2.5. in any order. Give priority to 2.5.; do 2.4. when you change availability and/ or location; do 2.3. only when desired

2.1. Make internet connection

Plan 2.1.: first do 2.1.1.; then do 2.1.2. or if there is no wifi available 2.1.3.

2.1.1. Check if there is internet connection

2.1.1.1. See if the network symbol in the widget is white (connection) or black with a red cross (no connection)

2.1.2. Connect to wifi

2.1.3. Connect to a mobile network

2.2. Log in

Plan 2.2.: If 2.2.1. is false continue with 2.2.2. - 2.2.3. - 2.2.4 - 2.2.5. in that order. If true just do 2.2.2.

2.2.1. Check if the app is logged in

2.2.1.1. See if the serenity icon is grey (not logged in) or not

2.2.2. Tap the widget

2.2.3. Enter your e-mail address

Plan 2.2.3.: 2.2.3.1. - 2.2.3.2. in that order

2.2.3.1. Tap above the blue line under e-mail address

2.2.3.2. Type your e-mail address

2.2.4. Enter your password

Plan 2.2.4.: 2.2.4.1. - 2.2.4.2. in that order

2.2.4.1. Tap above the blue line under password

2.2.4.2. Type your password

2.2.5. Tap the "log in" button

2.3. Adjust settings

Plan 2.3.: first 2.3.1.; then 2.3.2. and/ or 2.3.3.

2.3.1. Tap "settings" in the homepage

2.3.2. Change your password

Plan 2.3.2.: 2.3.2.1. - 2.3.2.2. - 2.3.2.3. - 2.3.2.4. - 2.3.2.5. in that order

2.3.2.1. Tap "change password"

2.3.2.2. Enter old password

Plan 2.3.2.2.: 2.3.2.2.1. - 2.3.2.2.2. in that order

2.3.2.2.1. Tap above the blue line under old password

2.3.2.2.2. Type old password

2.3.2.3. Enter new password

Plan 2.3.2.3.: 2.3.2.3.1. - 2.3.2.3.2. in that order

2.3.2.3.1. Tap above the blue line under new password

2.3.2.3.2. Type the new password

2.3.2.4. Enter new password again

Plan 2.3.2.4.: 2.3.2.4.1. - 2.3.2.4.2. in that order

2.3.2.4.1. Tap above the blue line under confirm new password

2.3.2.4.2. Type new password

2.3.2.5. Tap "change password"

2.3.3. Change resident information

Plan 2.3.3.: 2.3.3.1. - 2.3.3.2. - 2.3.3.3. - 2.3.3.4. in that order

2.3.3.1. Tap "change resident information"

2.3.3.2. Tap "change info" next to the person you wish to edit

2.3.3.3. Change the resident's information

Plan 2.3.3.3.: any of 2.3.3.3.1. - 2.3.3.3.2. - 2.3.3.3.3. in any order

2.3.3.3.1. Change his/ her name

Plan 2.3.3.3.1.: 2.3.3.3.1.1. - 2.3.3.3.1.2. - 2.3.3.3.1.3. in that order

2.3.3.3.1.1. Tap behind the name above the blue line

2.3.3.3.1.2. Delete the current name

2.3.3.3.1.3. Type new name

2.3.3.3.2. Change his/ her picture

Plan 2.3.3.3.2.: 2.3.3.3.2.1. - 2.3.3.3.2.2. - 2.3.3.3.2.3. in that order

2.3.3.3.2.1. Tap "choose picture"

2.3.3.3.2.2. Select the medium where the picture is saved

2.3.3.3.2.3. Tap the picture you want

2.3.3.3.3. Change his/ her phone number

Plan 2.3.3.3.3.: 2.3.3.3.3.1. - 2.3.3.3.3.2. - 2.3.3.3.3.3. in that order

2.3.3.3.3.1. Tap the above the blue line behind the current
phone number

2.3.3.3.3.2. Delete the current phone number

2.3.3.3.3.3. Type the new phone number

2.3.3.4. Tap "apply changes"

2.4. Show availability

Plan 2.4.: first 2.4.1.; then if available 2.4.2.

2.4.1. Set availability

Plan 2.4.1.: 2.4.1.1. - 2.4.1.2. in that order

2.4.1.1. Tap "yes/ no" for the drop-down menu

2.4.1.2. Tap your selection (yes or no)

2.4.2. Set location

Plan 2.4.2.: 2.4.2.1. - 2.4.2.2. in that order

2.4.2.1. Tap the location for the drop down menu

2.4.2.2. Tap the selected location

2.5. Handle resident updates

Plan 2.5.: Always do 2.5.1.; in an urgent situation always continue with 2.5.2. and 2.5.3; otherwise this is optional; Do 2.5.4. when desired

2.5.1. Interpret the serenity icon

Plan 2.5.1.: 2.5.1.1. - 2.5.1.2. in any order

2.5.1.1. Interpret the severity of events

Plan 2.5.1.1.: 2.5.1.1.1. - 2.5.1.1.2. - 2.5.1.1.3. in any order

2.5.1.1.1. See that a green icon means not urgent

2.5.1.1.2. See that a yellow icon means warning

2.5.1.1.3. See that a red icon means urgent

2.5.1.2. See that the number in the icon represents the number of registered

2.5.2. Open the app

2.5.2.1. Tap the serenity icon

2.5.3. Handle unsolved events

Plan 2.5.3.: 2.5.3.2. - 2.5.3.2. - 2.5.3.3. in that order

2.5.3.1. Tap the serenity icon next to the resident

2.5.3.2. Read details on unsolved events

2.5.3.3. Communicate action to other caregivers

Plan 2.5.3.3.: 2.5.3.3.1. only when action button is not visible; then 2.5.3.3.2. -

2.5.3.3.3. in that order

2.5.3.3.1. Swipe events to the left to see "action" button

2.5.3.3.2. Tap "action"

2.5.3.3.3. Tap the selected action

2.5.4. Check the event history

Plan 2.5.4.: 2.5.4.1. - 2.5.4.2. - 2.5.4.3. - 2.5.4.4. in that order; finish with 2.5.4.5. if desired

2.5.4.1. Tap the serenity icon next to the resident

2.5.4.2. Tap "history"

2.5.4.3. Select a date

Plan 2.5.4.3.: 2.5.4.3.1. - 2.5.4.3.2. - 2.5.4.3.3. in that order

2.5.4.3.1. Tap the calendar icon

2.5.4.3.2. Set a date

Plan 2.5.4.3.2.: 2.5.4.3.2.1. - 2.5.4.3.2.2. - 2.5.4.3.2.3. in any order

2.5.4.3.2.1. Select the day by swiping up or down

2.5.4.3.2.2. Select the month by swiping up or down

2.5.4.3.2.3. Select the year by swiping up or down

2.5.4.3.3. Tap "set"

2.5.4.4. Tap "see history"

2.5.4.5. Check the details of a specific event

Plan 2.5.4.5.: 2.5.4.5.1. - 2.5.4.5.2. - 2.5.4.5.3. in that order

2.5.4.5.1. Tap "details" of the selected event

2.5.4.5.2. Read the details

2.5.4.5.3. Tap "OK"

3. Have a virtual visit

Plan 3.: first do 3.1.; if necessary do 3.2.; then do 3.3.; then do 3.4. and 3.5. in any order and if desired; end with 3.6.

3.1. Log into the Giraff pilot software

Plan 3.1.: first 3.1.1.; then 3.1.2. - 3.1.3. - 3.1.4. in any order; finish with 3.1.5.

3.1.1. Open the Giraff pilot software

Plan 3.1.1.: 3.1.1.1. - 3.1.1.2. in that order

3.1.1.1. Locate the software on your computer

3.1.1.2. Double click the program

3.1.2. Select your language

Plan 3.1.2.: 3.1.2.1. - 3.1.2.2. in that order

3.1.2.1. Click the arrow next to the currently selected language

3.1.2.2. Click the preferred language from the drop down menu

3.1.3. Enter your e-mail address

Plan 3.1.3.: 3.1.3.1. - 3.1.3.2. in that order

3.1.3.1. Click in the box under e-mail address

3.1.3.2. Type your e-mail address

3.1.4. Enter your password

Plan 3.1.4.: 3.1.4.1. - 3.1.4.2. in that order

3.1.4.1. Click in the box under password

3.1.4.2. Type your password

3.1.5. Click "log in"

3.2. Set up program settings

Plan 3.2.: 3.2.1. - 3.2.2. in any order

3.2.1. Set video settings

Plan 3.2.1.: first 3.2.1.1.; then if desired 3.2.1.2. and 3.2.1.3. in that order; note 3.2.1.2. only possible when two or more cameras are connected

3.2.1.1. Connect a webcam to the program

Plan 3.2.1.1.: if 3.2.1.1.1. is yes stop task; if no do 3.2.1.1.2. and then
3.2.1.1.1.; if still no do 3.2.1.1.3.

3.2.1.1.1. Check if there is a webcam image (indicating a connected
camera)

3.2.1.1.2. Close other programs using the webcam

3.2.1.1.3. Connect a webcam to your computer

3.2.1.2. Select your preferred camera

Plan 3.2.1.2.: first 3.2.1.2.1.; if no window pops up do 3.2.1.2.2.; then do
3.2.1.2.3. and 3.2.1.2.4.

3.2.1.2.1. Click "camera"

3.2.1.2.2. Click the green V in the task bar

3.2.1.2.3. Click the preferred camera

3.2.1.2.4. Click "OK"

3.2.1.3. Improve image

Plan 3.2.1.3.: 3.2.1.3.1. - 3.2.1.3.2. in that order

3.2.1.3.1. Click "video"

3.2.1.3.2. Change settings in the webcam dependent window

3.2.2. Set audio setting

Plan 3.2.2.: first do 3.2.2.1.; then when window does not pop up do 3.2.2.2.; then do if
desired 3.2.2.3 and/ or 3.2.2.4. in any order

3.2.2.1. Click "audio"

3.2.2.2. Click the green V in the task bar

3.2.2.3. Adjust microphone settings

Plan 3.2.2.3.: if there is no internal microphone or when another one is
preferred start with 3.2.2.3.1.; then do 3.2.2.3.2. if desired and when at least
two microphones are connected; then do 3.2.2.3.3. if desired; do 3.2.2.3.4.
when in doubt of microphone functioning

3.2.2.3.1. Connect a microphone to your computer

3.2.2.3.2. Select your preferred microphone

Plan 3.2.2.3.2.: 3.2.2.3.2.1. - 3.2.2.3.2.2. in any order

3.2.2.3.2.1. Click the triangle next to the currently selected
microphone

3.2.2.3.2.2. Click the preferred microphone

3.2.2.3.3. Adjust the microphone volume

3.2.2.3.3.1. Click and hold the bar on the left and pull it up
(increasing the volume) or down (lowering the volume)

3.2.2.3.4. Check if the microphone is functioning

Plan 3.2.2.3.4.: 3.2.2.3.4.1. - 3.2.2.3.4.2. - 3.2.2.3.4.3. - 3.2.2.3.4.4. in that order

3.2.2.3.4.1. Plug in headphones (to avoid echo)

3.2.2.3.4.2. Click "hear how I sound"

3.2.2.3.4.3. Speak

3.2.2.3.4.4. Click "stop hearing myself"

3.2.2.4. Adjust speaker settings

Plan 3.2.2.4.: if there are no internal speakers in the PC or when others are preferred start with 3.2.2.4.1.; then do 3.2.2.4.2. when desired and when at least two sets of speakers are connected; then do 3.2.2.4.3. when desired; do 3.2.2.4.4. when in doubt of functioning or to test settings

3.2.2.4.1. Connect speakers or headphones to your computer

3.2.2.4.2. Select the preferred speakers or headphones

Plan 3.2.2.4.2.: 3.2.2.4.2.1. - 3.2.2.4.2.2. in that order

3.2.2.4.2.1. Click the triangle next to the currently selected speakers

3.2.2.4.2.2. Click the preferred speakers (or headphones)

3.2.2.4.3. Adjust the volume

Plan 3.2.2.4.3.: 3.2.2.4.3.1. and/ or 3.2.2.4.3.2.

3.2.2.4.3.1. Adjust the volume in the program

3.2.2.4.3.1.1. Click and hold the bar on the right and pull it up (increasing the volume) or down (lowering the volume)

3.2.2.4.3.2. Adjust the volume of your computer

Plan 3.2.2.4.3.2.: 3.2.2.4.3.2.1. - 3.2.2.4.3.2.2. in that order

3.2.2.4.3.2.1. Click the speaker icon in your task bar

3.2.2.4.3.2.2. Click and hold the bar and pull it up (increasing the volume) or down (lowering the volume)

3.2.2.4.4. Check the sound

3.2.2.4.4.1. Click "play test sound"

3.3. Calling a Giraff

Plan 3.3.: start with 3.3.1. and 3.3.2.; if 3.3.1. is true do 3.3.3. or 3.3.4.; 3.3.4. should only be done in emergencies

3.3.1. Check if the Giraff is available

3.3.1.1. See a green circle next to the Giraff

3.3.2. Click the name of the Giraff

3.3.3. Click "knock"

3.3.4. Call the Giraff with password

Plan 3.3.4.: 3.3.4.1. - 3.3.4.2. - 3.3.4.3. in that order

3.3.4.1. Click "with password"

3.3.4.2. Type your password

3.3.4.3. Click "OK"

3.4. Drive the Giraff

Plan 3.4.: first 3.4.1.; then 3.4.2. - 3.4.3. - 3.4.4. - 3.4.5. - 3.4.6. in any order and only if desired

3.4.1. Undock the Giraff

3.4.1.1. Click "click here to undock"

3.4.2. Move the Giraff

Plan 3.4.2.: 3.4.2.1. - 3.4.2.2. - 3.4.2.3. - 3.4.2.4. in that order

3.4.2.1. Position the mouse cursor where you want the Giraff to go

3.4.2.2. Hold the left mouse button pressed

3.4.2.3. Move the mouse cursor to adjust the route

3.4.2.4. Let the mouse button go to stop

3.4.3. Adjust speed

3.4.3.1. Move the mouse cursor closer to the Giraff (slowing down) or further away (speeding up)

3.4.4. Turn

Plan 3.4.4.: 3.4.4.1. when a 180 degrees turn is wanted; for other turns 3.4.4.2.

3.4.4.1. Click the "u-turn" button

3.4.4.2. Double click the direction the Giraff should face

3.4.5. Drive backwards

3.4.5.1. Click the "back-up" button

3.4.6. Estimate distance

Plan 3.4.6.: 3.4.6.1.; and if needed 3.4.6.2.

3.4.6.1. Look at the distance between an object and the feet of the Giraff

3.4.6.2. Scroll the mouse wheel downwards to see the feet

3.5. Optimize the virtual visit

Plan 3.5.: 3.5.1. - 3.5.2. - 3.5.3. - 3.5.4. - 3.5.5. - 3.5.6. if desired and in any order

3.5.1. Adjust the volume

Plan 3.5.1.: 3.5.1.1. if desired by resident; 3.5.1.2. if desired by caregiver

3.5.1.1. Adjust the microphone volume

Plan 3.5.1.1.: 3.5.1.1.1. - 3.5.1.1.2. in that order. Repeat if necessary

3.5.1.1.1. Check sound volume at resident side

3.5.1.1.2. Drag the button under "volume microphone" left (lowering the volume) or right (raising the volume)

3.5.1.2. Adjust the speaker volume

Plan 3.5.1.2.: first 3.5.1.2.1.; then 3.5.1.2.2. and/ or 3.5.1.2.3. Repeat if necessary

3.5.1.2.1. Check the volume heard

3.5.1.2.2. Drag the button under "speaker volume" left (lowering the volume) or right (raising the volume)

3.5.1.2.3. Adjust PC volume

Plan 3.5.1.2.3.: 3.5.1.2.3.1. - 3.5.1.2.3.2. in that order

3.5.1.2.3.1. Click the speaker icon on the task bar

3.5.1.2.3.2. Drag the bar up (increasing the volume) or down (lowering the volume)

3.5.2. Go to the resident's eye level

3.5.2.1. Click the button next to "sit" to lower the screen or next to "stand" to raise the screen

3.5.3. (De)activate night vision

Plan 3.5.3.: 3.5.3.1. - 3.5.3.2. in that order

3.5.3.1. Check if there is enough light in the resident's house

3.5.3.2. Click the button next to "on" (activating night vision) or next to "off" (deactivating night vision)

3.5.4. Adjust the viewing angle

3.5.4.1. Scroll up (camera pointing upwards) or down (camera pointing downwards)

3.5.5. Adjust video quality

Plan 3.5.5.: first 3.5.5.1.; if based on this the frames per second (F/s) > 35 do 3.5.5.2.; if F/s < 15 do 3.5.5.3.; if F/s is between 15 and 35 do nothing

3.5.5.1. Check the frame rate

3.5.5.2. Click the button under "video quality" right (increasing the quality) of the currently selected one

3.5.5.3. Click the button under "video quality" left (increasing the quality) of the currently selected one

3.5.6. Zoom

3.5.6.1. Hold "Ctrl" pressed and scroll up (zoom in) or down (zoom out)

3.6. End the virtual visit

Plan 3.6.: 3.6.1. - 3.6.2. in that order!

3.6.1. Get the Giraff docked

Plan 3.6.1.: 3.6.1.1. or 3.6.1.2.; end with 3.6.1.3.

3.6.1.1. Dock manually

3.6.1.1.1. Drive metal plates of Giraff against ends of the charger

3.6.1.2. Use the docking assistant

Plan 3.6.1.2.: 3.6.1.2.1. - 3.6.1.2.2. - 3.6.1.2.3. - 3.6.1.2.4. in that order; if needed end with 3.6.1.2.5.

3.6.1.2.1. Click on the target on top of the docking station with the right mouse button

3.6.1.2.2. Click "docking assistant"

3.6.1.2.3. Double click the green square when it's located around the target

3.6.1.2.4. Hold left mouse button pressed

3.6.1.2.5. Adjust manually

3.6.1.3. Check if Giraff is docked properly

Plan 3.6.1.3.: 3.6.1.3.1. and/ or 3.6.1.3.2.

3.6.1.3.1. Hear docking sound

3.6.1.3.2. See message "click here to undock"

3.6.2. Click "hang up"

4. Prepare medication

Plan 4.: 4.1. - 4.2. - 4.3. - 4.4. - 4.5. in that order

4.1. Obtain the medication schedule

4.2. Obtain medication

4.3. Fill medication dispenser

Plan 4.3.: 4.3.1. - 4.3.2. - 4.3.3. in that order

4.3.1. Open the dispenser

4.3.2. Place pills for the first intake moment in the compartment slightly right of the opening

4.3.3. Continue placing pills for one intake moment in the compartments counterclockwise

4.4. Set alarms

Plan 4.4.: 4.4.1. - 4.4.2. - 4.4.3. - 4.4.4. - 4.4.5. in that order

4.4.1. Confirm with care organization that they have set the times correctly

- 4.4.2. Hold button 2 pressed until "SMS" shows on the screen
- 4.4.3. Check for the message "RX OK" after releasing the button
- 4.4.4. Check that the device beeps
- 4.4.5. Check that the screen shows the time

4.5. Close the medication dispenser

5. Solve (technical) problems

Plan 5.: 5.1. - 5.2. - 5.3. - 5.4. - 5.5. all only when necessary; when they don't solve problem or are too hard do 5.6.

5.1. Reset the router

Plan 5.1.: 5.1.1. - 5.1.2. - 5.1.3. in that order

- 5.1.1. Turn the router off
 - 5.1.1.1. Push the power button of the router
- 5.1.2. Wait about 30 seconds
- 5.1.3. Turn the router on
 - 5.1.3.1. Push the power button

5.2. Get the Giraff against the charger after the call has ended

Plan 5.2.: if visit ended by accident do 5.2.1.; if visit ended because docking was too hard do 5.2.2.; if visit ended because the battery died do 5.2.3.

5.2.1. Get the Giraff against the charger yourself again

Plan 5.2.1.: 5.2.1.1. - 5.2.1.2. in that order

- 5.2.1.1. Call the Giraff again
 - 5.2.1.1.1. Go to task 3.3.
- 5.2.1.2. Dock the Giraff again
 - 5.2.1.2.1. Go to task 3.6.1.

5.2.2. Let someone else dock the Giraff

Plan 5.2.2.: 5.2.2.1. - 5.2.2.2. in that order

- 5.2.2.1. Contact someone else from the resident's network
- 5.2.2.2. Ask that person to call the resident and dock the Giraff

5.2.3. Help the resident docking

Plan 5.2.3.: 5.2.3.1. - 5.2.3.2. - 5.2.3.3. in that order

- 5.2.3.1. Get in touch with resident (e.g. call)
- 5.2.3.2. Instruct the resident to push the Giraff against the charger

Plan 5.2.3.2.: 5.2.3.2.1. - 5.2.3.2.2. in that order. Repeat if needed

- 5.2.3.2.1. Instruct to push until the metal plates of the Giraff touch the metal ends of the charger
- 5.2.3.2.2. Instruct to check if the charging light is green

5.2.2.3. Instruct the resident to turn the Giraff on

Plan 5.2.3.3.: 5.2.3.3.1. - 5.2.3.3.2. in that order

5.2.3.3.1. Instruct to push the power button

5.2.3.3.2. Instruct to check if the power light is green and screen works

5.3. Resolve echo

Plan 5.3.: 5.3.1. - 5.3.2. in that order

5.3.1. Plug in headphones

5.3.2. Select headphones as speaker option

5.3.2.1. Go to task 3.2.2.4.2.

5.4. Resolve the delay in video feedback (during Giraff visit)

5.4.1. Lower video quality

5.4.1.1. Go to task 3.5.5.

5.5. Restart the serenity app after the app has stopped working

Plan 5.5.: first 5.5.1.; if this does not work 5.5.2.

5.5.1. Log in again

5.5.1.1. Go to task 2.2.

5.5.2. Force the app to stop

5.6. Call the help service

Appendix I: Participants' attribute – consequence – value ladders

Attribute – consequence – value ladders that were deducted from the laddering interviews.

The first 5 participants are the informal caregivers. The remaining 5 participants are the older residents. The numbers in brackets represent the label after content analysis (meaning of the labels are found in the implication matrix in Appendix X). When a participant started from one attribute, but created two ladders the two ladders are presented in the same column.

pp. Ladders

1	A - videoconferencing (2) C - feeling of presence (16) C - being aware of resident's state (17) C - give help when needed (18) V - love for family (32)	A - settings are configured for caregiver (1) A - system is set for inexperienced users (1) A - system (interactions) function properly (1) C - receive notifications (13) C - make contact / Giraff visit (2) C - take action if needed (fall or missed medication) (18) V - healthy resident (33)	A - clearly audible notifications in app (1) C - get notified in case of emergency (13) C - make contact/ Giraff visit (2) C - evaluate the situation (17) C - take appropriate action (18) C - prevent discomfort (20) C - get resident back to normal (26) V - resident lives a pleasant life (35)
2	A - ask for social contact (9) A - video conferencing (2) C - have contact despite obstacles (19) V - prevent loneliness (38)	A - login with password (10) A - login without direct permission (10) C - people involved must be trusted (29) C - ensure no visits in personal and/ or vulnerable situations (23) C - resident's own control is endangered (23) V - privacy is endangered (34)	A - well adjusted home environment needed (11) C - Giraff accessibility is needed (22) C - give help in emergencies (18)
3	A - video conferencing (2) C - extra information on resident's state (17) C - better assess physical and psychological state (17) C - give and adjust care (18)	A - system properties prevent quick contact (12) C - no quick response in emergencies (18) V - time loss can cost lives (39)	A - Giraff is too big (8) A - screen looks down on resident (8) C - Giraff is too present in the home (22) C - resident has no control

	V - prevent loneliness (38) V - love for family (32)	A - system properties prevent quick contact (12) C - resident has to wait (23) C - resident does not feel taken seriously (20) C - need for social contact not fulfilled (19) V - bad for psychological health (35)	over Giraff (23) C - strengthens stigma of resident as underdog (20) C - resident is frightened (20) V - resident does not feel safe (36) A - Giraff is too big (8) C - difficult to manoeuvre in the house (22) C - difficult to reach resident in emergencies (22) C - impaired assessment of the situation (17) C - impaired response time (18) V - can cost lives (39)
4; 5	A – videoconferencing (2) C - high presence (16) C - evaluate resident's state (17) C - check if everything is OK (17) V - serenity for the caregiver (36) V - love for family (32)	A - Giraff can drive (2) C - you can drive to see things (16) C - feels like a real visit (16) V - prevent loneliness (38) V - resident feels good (35)	A - emergency signal is just one beep (1) C - you don't hear an emergency signal (24) C - you don't respond in an emergency (18)
	A - video conferencing (2) C - high presence (16) C - social contact (19) V - feels trusting (36) V - prevent loneliness (38)		A - medication reminders (5) C - self care is promoted (21) C - reduced house visits (23) V - resident is no burden (37) A - medication reminders (5) C - self care is promoted (21) V - keep resident healthy (33)
6	A - few, big, clear buttons (1) C - easy to use (24) C - quick action (18) V - peace of mind (36) V - feeling safe (36)	A - care organisation involved (3) A - 24/7 available (3) C - informal caregivers have more freedom (28) V - resident is no burden (37) A - care organisation involved (3) A - shift workers (3) C - varying employees can look in your home (29) C - negative feelings (20) V - privacy concerns (34)	

7	A - settings are configured for the resident (1) A - simple to use and learn (1) C - system is usable in emergencies (24) C - help is received in emergencies (18)	A - Giraff is too big (8) C - takes up too much space (22) C - not practical (22)	A - fall detection (6) C - measures falls automatically (25) C - quick awareness for caregivers (17) C - quick help in emergencies (18)
8	A - video conferencing (2) C - feeling of presence (16) C - have 'real' human contact despite obstacles (19) C - sociability (19) V - prevent loneliness (18) V - good mood (35)	A - alarm button (7) C - caregivers become aware of emergency (13) C - caregivers take appropriate action (18) C - get back to normal (26) V - function 'normally' (35) V - enjoy life (35)	A - Giraff ringtone is loud (1) C - people with hearing problems can still hear it (24) C - request for contact does not get missed (19) C - communication (19) V - good mood (35)
9	A - informal caregivers involved (4) C - see familiar face (27) V - relieved from fear to use the system/ fear of unfamiliar people (36)	A - medication reminders (5) C - self care is promoted (21) C - medication is taken more constantly (21) C - better medication effects (21)	A - time between visit request and visit is long (12) C - negative feelings (20) V - feel like a burden (37)
10	A - Giraff is too wide (8) C - difficult to manoeuvre when there is little space (22) C - resident cannot easily make space (22) C - collisions can occur (22) C - Giraff cannot reach the resident (2) C - resident cannot see the caregiver (2) C - conversation is nicer with video (16) V - videoconferencing makes you feel good to take on the day (35)	A - has a remote control (14) C - you don't need to get up to answer a call (24) C - getting up is difficult (24) C - no need for hurrying (24) C - don't hurt yourself in the rush (30) C - avoid accidents (30) V - stay safe (36)	A - alarm gives no information on resident's location (15) C - Giraff has to search all rooms (22) C - takes much time to reach the resident (22) C - comforting talk will be late (31) C - action is taken late (18) V - no comforting feeling or serenity (36)

The implication matrix deducted from the participant's ladders after content analysis. The numbers before the comma represent the number of direct links between two concepts. The numbers after the comma represent the number of indirect links between two concepts.

[illegible]

Appendix K: Additional themes found in participants' concept maps

Themes covered in the concept maps of the participants, but not in the maps of the experts and the propositions that formed the basis for the deduction of the themes. The propositions are translated from Dutch.

1. Specific attributes or parts of the Giraff		
robot	is	mobile
robot	is	big
robot	has	colour
robot	has	technical parts
technical parts	are	screen
technical parts	are	wheels
technical parts	are	buttons
technical parts	are	remote control
technical parts	are	sound
technical parts	are	camera
robot (internet)	has	colour
robot (internet)	has	size
robot (internet)	has	sound
robot (internet)	has	camera
robot (internet)	has	screen
robot (internet)	has	buttons
device	with a	outstanding appearance
outstanding appearance	because of	colour
outstanding appearance	because of	size
size	is	big
device	with	remote control
robot	with	wheels
Giraff	is	ugly
device	can	high/ low
high/ low	is	nice
device	is	big obstacle
2. Focus on the importance of video and mobility when communicating by Giraff		
Giraff	can	walk around
Giraff	can	Seeing
communicate	is	remotely seeing and hearing
contact	via	image and sound
image and sound	is	modern times
image and sound	is achieved by	program
image and sound	is achieved by	tablet/ screen
Giraff and phone	provided with	camera to see

3. Importance of and focus on usability		
VictoryaHome	offers	ease
ease	gives	contact, remotely
ease	gives	control, remotely
Giraff	with	usability
usability	reaches	ideology
4. Specific procedures that users undertake while working with the system		
seeking contact	needs	red button
red button	then shows	screen
screen	then presses	contact
contact	then shows	image
care giver	evaluates	kind of help needed
log in	on	phone/ tablet
internet	to control	Giraff
5. Opportunities for future development		
international	asks for	functioning
log in	because of	borderland
log in	goes badly on	app
app	adjusting for	phone/ tablet
control	for	docking click
device	has	expansion opportunities
expansion opportunities	is	the future
6. Focus on VictoryaHome as an alarm system		
care giver (home care institution etc.)	receives	alarm
communicate	is	warn
warn	by	medication dispenser
alarm	to	family
alarm	to	professionals
7. Other goals and functions of VictoryaHome or other relations between goals		
Giraff	enables	control, remotely
Giraff	is a	ideology
Giraff	with	functioning
functioning	reaches	ideology
Giraff	is a	aid
Giraff	is a	house mate
care	can resolve	loneliness
ideology	is	Facebook for elderly
European contact	also solves	loneliness
Giraff and phone	aid	wellbeing and social contact
regie	is	comforting
comforting	is	social contact
social contact	gives	control

	regie victory	gives gives in-	victory dependency
8.	The importance of user support		
	VictoryaHome support	gives by	support friendly people
9.	Focus on VictoryaHome as a project or (future company) and related activities		
	VictoryaHome international international VictoryaHome pilots friendly people company VictoryaHome company company company company company company company company company VictoryaHome company company	represents gives new ideas can reach works on together with that are enthusiastically controls is a tests with figures out figures out figures out figures out improves starting a is a performs sells	company Facebook for elderly European contact pilots Envida programming software program company people (target group) how what what we can do with it if it meets our expectations new product new product company new product new product
10.	Social contact is also for formal caregivers		
	contact caregiver (home care institution etc.) social contact	is being maintained by seeks with	home care institution contact care institutions

Appendix L: Interview coding scheme and detection matrix

Coding scheme and detection matrix of the interviews. The sign of the detection number indicates whether the code is positive (+), negative (-) or neutral (no sign). The first five participants are informal caregivers. The latter five are elderly residents.

User requirements and preferences	pp.	1	2	3	4 & 5	6	7	8	9	10	Total
1. Behavioural intention											
1.1.I would use VictoryaHome		+1								+1	+2
2. Effort expectancy											
2.1.Easy to use and learn		+1	+1	+1	+1	+1	+1	+1	+1	+1	+10
2.2.Not much action is needed											
2.2.1. Caregiver just prepares the dispenser						+1					+1
2.2.2. Remote control reduces effort						+1				+1	+2
2.2.3. Resident can do little with the system			-1	-1				-1	-1		-4
2.3.Aspects of using VictoryaHome are hard											
2.3.1. Driving the Giraff				-1		-1	-1	-1	-1	-1	-6
2.3.2. Setting settings		-1									-1
2.3.3. Significant technical problems		-1	-1	-1				-1	-1	-1	-6
2.4.The Giraff is not practical											
2.4.1. Giraff cannot go through closed doors			-1					-1	-1		-3
2.4.2. Houses are too crowded for the Giraff to move			-1			-1	-1	-1			-4
2.4.3. Giraff is a big obstacle						-1	-1	-1	-1	-1	-5
2.5.Necessary use behaviour difficult to maintain											
2.5.1. The belt clip must always be worn			-1			-1				-1	-3
2.5.2. The care network needs to be available immediately							-1	-1	-1		-3
3. Performance expectancy											
3.1.Parts of VictoryaHome are not useful or have a negative effect											
3.1.1. Negative views on the dispenser							-1			-1	-2
3.1.2. Giraff has no added value								-1			-1
3.1.3. Jobs in healthcare are taken over				-1				-1			-2
3.1.5. Just fun, not useful			-1			-1	-1				-3
3.1.6. So easy that it takes control away from the elderly			-1					-1	-1	-1	-4
3.2.Privacy issues											
3.2.1. Data storage is no problem		1		1		1	1	1	1	1	7

3.2.2. Strangers can look inside	-1	-1		-1	-1		-4
3.2.3. People given a password by me are trusted	1			1	1	1	5
3.2.4. When you need help you are willing to give up a bit of privacy	1	1		1	1		4
3.3.The specific functions of the VictoryaHome devices are useful							
3.3.1. App gives insight in resident's state and coordination with the network	+1	+1	+1				+3
3.3.2. Fall detector is useful	+1	+1	+1	+1	+1	+1	+6
3.3.3. Positive aspects of the dispenser	+1	+1	+1	+1	+1	+1	+7
3.4.3. Video conferencing is useful in care contexts	+1	+1			+1		+3
3.4.4. Visit-me requests are useful	+1				+1	+1	+4
3.4.The system could be improved to increase its usefulness							
3.4.1. System should function on iOS		-1			-1		-2
3.4.2. App can't update the resident on when they can expect a visit	-1			-1		-1	-3
3.5.2. Providing the services without the system would be better						-1	-1
3.5.3. VictoryaHome (minus app) cannot be used outside		-1		-1		-1	-3
3.5.Usefulness of the system is more important than its appearance	1			1	1		3
3.6.Usefulness of VictoryaHome differs, because of differing users and use patterns							
3.6.1. Caregiver network should ensure a quick response	1			1	1	1	5
3.6.2. Elderly might differ in their use of the devices		1				1	3
3.7.VictoryaHome could help achieve higher order goals							
3.7.1. More caregiver involvement	+1	+1					+2
3.7.2. Staying healthy	+1	+1	+1	+1	+1	+1	+8
3.7.3. Increasing the duration of independent living by keeping an eye on the resident	+1	+1	+1	+1	+1	+1	+8
3.7.4. Richer communication by video conferencing	+1	+1	+1	+2	+1	+1	+10
3.8 VictoryaHome is only useful for specific people – not us							
3.8.1. For weak and frail elderly that	-1	-1		-1	-1	-1	-6

don't have enough communication channels – not us										
3.8.2. Not usable for people that are too ill	1				1		1		3	
3.8.3. People that live together can already help each other					-1	-1			-2	
4 Social influence										
4.1.I don't care about others' opinions							1	1		2
4.2.Network has negative opinions										
4.2.1. Negative opinions on the system itself	-1				-1		-1		-1	-4
4.2.2. The system is not suitable for us					-1	-1			-1	-3
4.2. Network has positive opinions										
4.3.1. The system is valuable and/ or fun	+1	+1			+1			+1	+1	+5
4.2.2. The system has potential for us		+1				+1		+1		+3
4.3. Network is neutral					1					1
4.4. Network has to overcome the "newness" of VictoryaHome to form an opinion	1	1			1		1		1	5
5 Facilitating conditions										
5.1.Help service	1	1	1	2	1	1	1	1	1	10
5.2.Ready-for-use system delivery						1				1
5.3.Future payments							1	1	1	3
5.4.Smartphone use as a precondition	-1			-2						-3
6 Specific introduction requirements										
6.1. Learn how to use the VictoryaHome system	1	1	1	2	1	1	1		1	9
6.1.1. Manual	1		1	1	1	1			1	6
6.1.2. Hands on experience with a private tutor	1	1	1	2	1	1	1		1	9
6.1.3. Personally given instructions	1				1	1	1		1	5
6.1.4. In own situation									1	1
6.1.5. In a safe situation			1	1						2
6.2. Learn how to solve system malfunction	1	1	1	2	1	1	1	1	1	10
6.2.1. Help service	1	1	1	2	1	1	1	1	1	10
6.2.2. Learn the meaning of device lights and take actions		1			1	1		1	1	5
6.3. Learn what VictoryaHome is and does	1		1	2	1		1		1	7
6.3.1. Movie	1		1	2					1	5
6.4. Be guided through the first period of system use	1	1	1		1					4
6.4.1. Evaluation check ups			1							1
6.4.2. User agreements			1							1
6.5. Introduction was fine as it was	1	1			1			1	1	5

Appendix M: User manual for elderly residents

The user manual for the elderly resident users based on the HTA results and with the design guidelines implemented

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Introduction

1

This guide is meant to explain how the VictoryaHome system is used. The manual starts with an overview of the system. The chapters following the system overview show how the system should be used. The step-by-step instructions are structured based on the tasks that the system supports. The manual concludes with problems you might be able to solve by yourself.

When you use the manual for the first time, you could have a good look at the contents page to see everything that is possible with the system. Doing this might give you a better understanding of what the system is for. When you want to know more, you could start by reading the explaining text under each paragraph title. Later if you want to perform a specific task or have forgotten how something worked again, just look the task up and follow the instructions.

It might seem overwhelming or even scary to start using the system and it can be hard sometimes. However, (with some effort) most users do succeed and there is always the option to ask for some assistance.

The manual has a lot of Figures so you can see where to focus your attention. Red circles in the Figures indicate where you should focus your attention and/or where you should press or click on the screen. Quotes used in step-by-step instructions indicate a button or text on the screen with this text.



This symbol precedes important information, so special care is advised.

System Overview

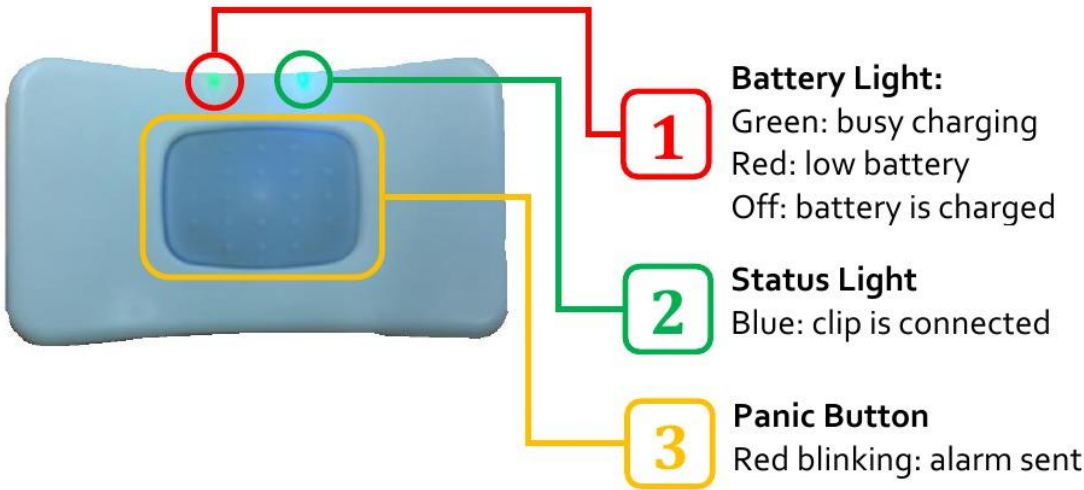
2

The VictoryaHome system consists of several devices for you and your family, friends and caregivers. The devices that you will have in your possession are shown in the images. This way you know what names are used in this guide for all the devices and you can check if you have everything.

The images straight away show all the status indicators. Status indicators give you information on what the device is doing. All these lights and their meanings might seem a bit hard to grasp, but don't worry. If you take a minute to look at your device with this guide next to it, they will become clear. And you don't need them so often anyway. In this guide, the indicators are sometimes used as a check for certain actions, for example to see if you plugged a charger in correctly. They can also be used to recognize problems, which is handled in the final chapter of this guide.

 The VictoryaHome system needs a working internet connection

Belt Clip Status Indicators





Giraff Status Indicators

Power Button

To turn the Giraff on or off

1

Battery Light:

Green: battery is charged

Orange: battery is half full

Red: low battery

2

Charger Light:

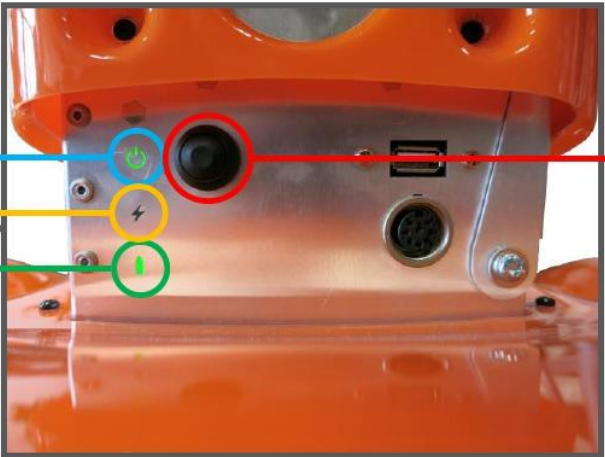
Green: battery is charging

3

Power Light:

Green: Giraff is on

4



Medication Dispenser Status Indicators



Medication Light

Red blinking: time to take medication

Note: a sound will also ring

1

Updating your Network 3

With VictoryaHome you can easily keep your social and your care network informed. The people that are connected to the service, your VictoryaHome network, will receive messages on their phone showing if you are doing well or if you need anything, for example help in an emergency or just a chat. The different updates are categorized and colour coded. This not only helps your contacts to get a quick overview, but also helps you to decide what people from your VictoryaHome network should receive what updates. What you have to do to keep your VictoryaHome network updated is shown in this chapter.

Meaning of the update colour codes



Social updates



Warnings



Emergencies

● Requesting a Visit

With the Giraff it is possible to send a request for a visit to one of the people in your VictoryaHome network. Only people that have stated they are available can be selected. When your request has been received, that person will get in touch with you.



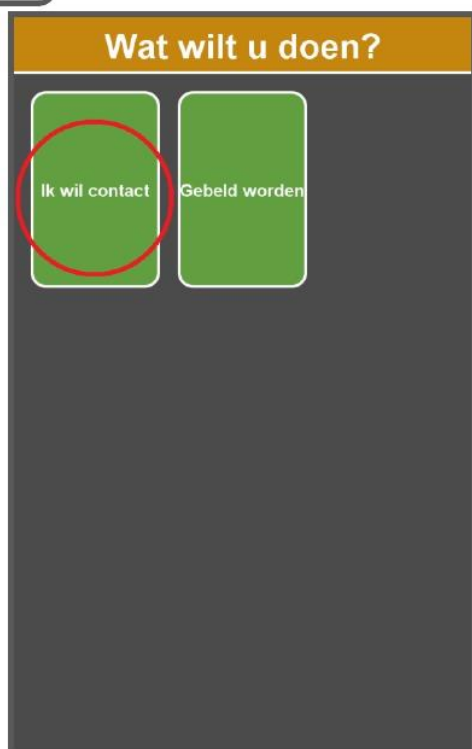
A 'visit-me' request is **not** an alarm

To send a 'visit-me' request



Activate and flip the screen of the Giraff by pressing the **green button** on the Giraff or on the remote control

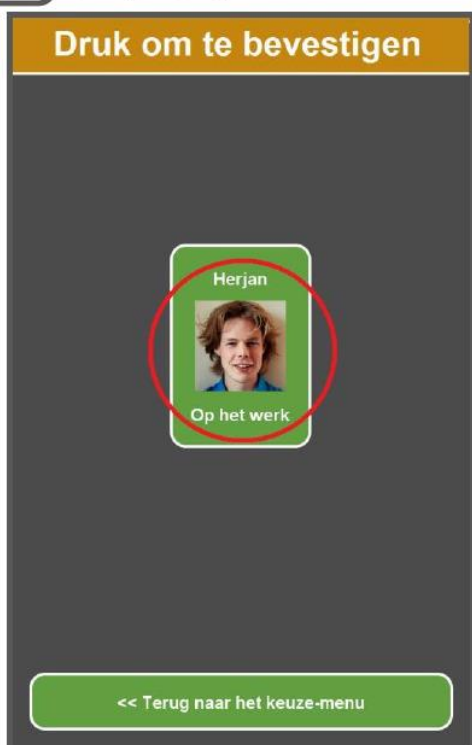
2 Tap 'I want contact'



3 Tap the person you want to send a request, here Herjan



4 Tap the selected person (Herjan) again



5 You're request is being sent



6 You're request has now been sent successfully



7 A yellow envelope indicates a sent request



● Medication Reminders

The medication dispenser will remind you when it is time to take medication by sending out an alarm. The dispenser also recognizes if a portion is taken out of the box or if it is still in there and thus forgotten. **A portion is registered as taken when the dispenser is turned upside down.** If a portion of medication is still in the box ten minutes after the alarm first went off, a message is sent to the informal caregivers in your VictoryaHome network. This way they can help reminding you to still take the medication.

To take medication using the dispenser

- 1** It is time for medication when the dispenser rings and the red light blinks
- 2** Turn the dispenser upside down for the pills to fall out



● Measuring Activity & ● Detecting Falls

When worn, the belt clip is able to measure activity and detect falls. When the activity of the person wearing the belt clip is low, a notification is sent to the informal caregivers in your VictoryaHome network. When a fall is detected, an emergency message is automatically sent to all informal caregivers and, if indicated, to professional caregivers. The belt clip has a mechanism that recognizes if it is being worn.



The belt clip **has to be worn** to measure activity and falls.

To activate fall detection and activity measuring

- 1** Wear the belt clip on your waist to get correct measurements, for example, as in the Figure.



● Sending an Alarm out

In case of emergency an alarm can be sent to the caregivers in your VictoryaHome network by means of the panic button on the belt clip.



It is **not** necessary to wear the belt clip for sending an alarm

To send out an alarm

- 1 Press the button on the belt clip (about 2 seconds) until a beep sounds and a red light blinks



Having a Virtual Visit

4

People from your VictoryaHome network can visit you virtually with the Giraff, for example in response to one of the updates. During a virtual Giraff visit you can just sit down and have a chat. The person you are having a conversation with controls the Giraff. So when you for example cannot see the other person well, just ask that person to change position or camera settings. This chapter describes the things you can do when getting a Giraff call.

Answering a Giraff Call

When someone wants to pay you a virtual visit, they call the Giraff. This is just like when they would call your phone. When you notice the Giraff is being called, you can choose to answer or decline the call.

It is possible to give certain people in your VictoryaHome network a password or 'key', with which they can control the Giraff without your direct permission. This option makes that people can 'enter' your house with the Giraff to quickly assess the situation and take action in emergencies. You decide who gets a password.



Calling the Giraff with a password is meant for emergencies only

To answer an incoming Giraff call

- 1 You recognize an incoming call by the screen flipping showing the caller's name and a ringing sound



- 2 To **answer** the call, press the **green button** on the Giraff or the remote control. To **decline**, press the **red button**.



Adjusting the Volume

There are two ways of changing the volume in a Giraff conversation. First of all, it is possible for the interlocutor to adjust how loud you are hearing them, by changing their microphone volume. However, you can also change the volume yourself.

To change the volume

- 1 Turn the volume knob (see Figure) counter clockwise to turn the volume down and clockwise to turn it up. Or use the remote control.



Ending a Giraff Visit

When a Giraff visit is coming to an end it is important that the Giraff is driven back against the charger first. The person that is visiting you should do this. You can hear by a short sound that the Giraff is put against the charger successfully. Now you can end the visit by pressing **the red button** on the Giraff or the remote control. However, it is even easier if your conversation partner just ends the call when he/ she has driven to the charger.



The Giraff should be driven against the charger before ending the visit

Charging

5

The devices in the VictoryaHome system work with electricity and therefore have to be charged. This chapter gives information on how to charge them.

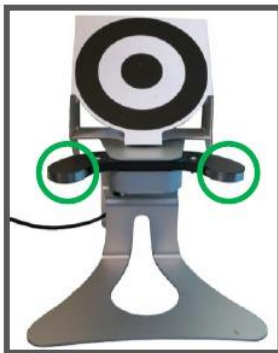
Charging the Giraff

The Giraff is positioned against its charger when not in use. Since the Giraff can only be controlled remotely, it is important that **the person controlling the**

Giraff always drives the Giraff back to its charger. Therefore, when the battery is low during a virtual visit, the person controlling the Giraff gets notified. The Giraff cannot be easily pushed against the charger. This is because for safety reasons the brakes of the Giraff are on when the Giraff is turned on.

To charge the Giraff

- 1 The the two metal plates of the Giraff must be touching the metal ends of the charger. The charger must be plugged into a wall socket.



Charging the Belt Clip

The belt clip plays an important role in sending out emergency messages, demonstrating the importance of not running out of battery unexpectedly. It is therefore **advised to charge the belt clip every night**. You should also charge the belt clip when the battery light is red, which indicates a low battery. Your VictoryaHome network will also get informed when the battery is low, so they can remind you to charge it.

To charge the belt clip

- 1 Plug in the power cable and connect it to a wall socket. The battery light turns green when charging and will go off when fully charged.



Changing Batteries of the Medication Dispenser

The medication dispenser functions on 4x AA alkaline batteries. When the batteries are low, your VictoryaHome network will get updated. They can come over to change the batteries or, if possible, inform you to change them.

To change the batteries of the dispenser

- 1** Open the lid of the battery compartment. Watch out: the lid has cables connected to the box. Then replace the old batteries with new ones. Note: the box starts beeping when upside down. You can ignore this.



Solving Problems

6

Situations can occur that deviate from the standard usage scenarios. In this chapter some of these situations are described together with how to solve them yourself. Remember, if a different problem occurs or solving the problem yourself is not successful, you can always contact the VictoryaHome help service.



The VictoryaHome help service is reached by **<to be filled out>**

The Giraff Visit Ended before the Giraff was back at his Charger

It can happen that a call is ended (by accident) before the Giraff was driven back to its charger. Since the Giraff has its brakes on when it is turned on, you cannot push the Giraff to the charger yourself. Therefore, the best way to solve this problem is to get in touch with an available person in your VictoryaHome network and **ask him/ her to call the Giraff to drive it back to the charger.**

If this is not possible for some reason you can get the brakes off and push the Giraff against the charger yourself. There are two ways to do this:

1. Turn the Giraff off by 1) pushing the power button (*see System Overview to locate the power button*) or 2) letting the battery die. The lights next to the power button turn off and the brakes will off.
2. Push the Giraff against the charger. Make sure that the two metal plates of the Giraff are touching the charger.
3. Turn the Giraff back on by pushing the power button again. Check to see if the 'charging light' is burning (*see System Overview to locate the 'charging light'*)

The Giraff Battery Died during a Visit

When the battery of the Giraff has died, the Giraff is turned off. This means that the brakes are also off. So now you can just **push the Giraff against the charger**. Make sure that the two metal plates of the Giraff are touching the charger. When the Giraff is charging you can push the **power button** (see *System Overview* to locate the power button) to turn the Giraff on.

I Forgot my Medication, but now the next Dose has Shown up already

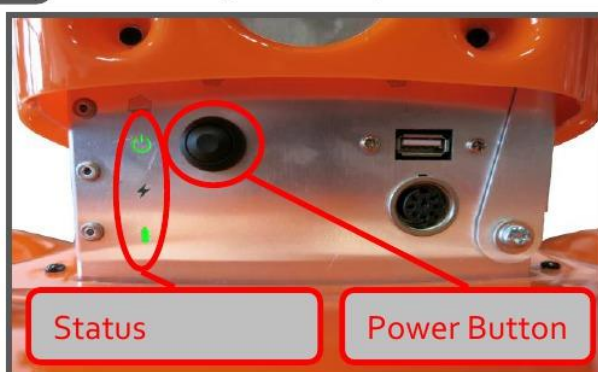
When the medication dispenser sends out an alarm to take medication, the dose that should be taken is positioned under the opening of the box. If you forget to take your medication, the dose stays in that position until it is time for your next dose. Then the news dose comes up and the missed dose goes back into the box. **You can therefore only take missed medication before it is time for the new dose.** If it is really important to take the missed medication, you can ask a caregiver to open the dispenser and take the pills out manually.

The Giraff is Acting Weird

If the Giraff is not working as normal, try resetting it. If the problem persists after resetting, call the help service.

To reset the Giraff

- 1 Press the power button to turn the Giraff off. Wait until the status indicators go off and push the button again to turn the Giraff back on.



Internet is not Working in my House

When internet is not working in your house, the devices cannot send messages to your VictoryaHome network and you cannot receive Giraff calls. Often the internet connection can be fixed by resetting the router. This is your 'internet box'. If the problem persists after resetting, call the help service.

To reset the router

- 1 Push the power button to turn the router off. Then wait about 30 sec and push the button again to turn it back on.



Appendix N: User manual for informal caregivers

The user manual for the informal caregivers users based on the HTA results and with the design guidelines implemented

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Introduction

1

This guide is meant to explain how the VictoryaHome system is used. The manual starts with an overview of the system. The chapters following the system overview show how the system should be used. The step-by-step instructions are structured based on the tasks that the system supports. The manual concludes with problems you might be able to solve by yourself.

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Installation 2

To make use of the VictoryaHome services, you have to install the VictoryaHome serenity app on your smartphone and the Giraff Pilot software on your PC. In this chapter the installation process is described.

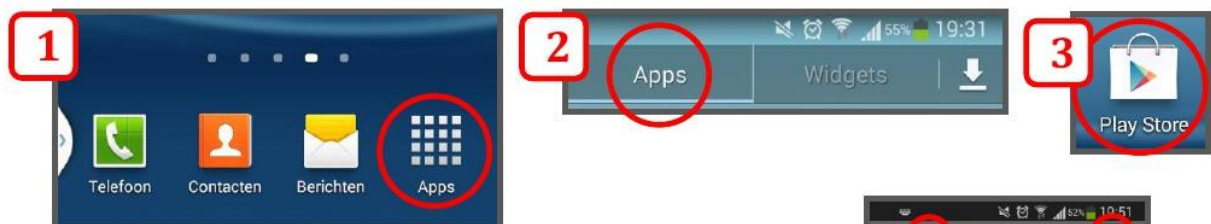
Mobile Serenity App

The serenity app is used to receive updates on your VictoryaHome resident and to communicate actions towards the rest of the care network. The app should work on each Android phone. However, to assure optimal performance of the app, your phone should meet the following requirements:

- A resolution between 480x800 and 4128x3096 pixels
- An Android operating system between version 2.2 and version 4.2

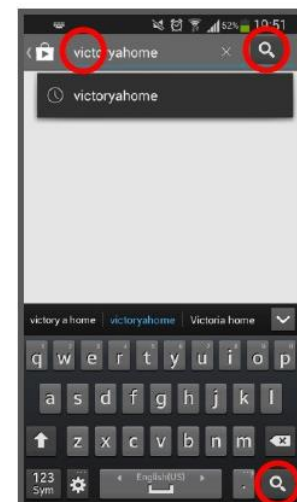
To install the serenity app

- 1 Open the 'App store' by
 - 1) opening the 'Apps' from your homepage,
 - 2) pressing the 'Apps' tab,
 - 3) looking for the 'Play Store' icon and pressing it.



- 2 Find the VictoryaHome serenity app by first pressing the magnifying glass in the upper right corner. Then you can type VictoryaHome. Finally, you search by pressing the magnifying glass in your keyboard to search.

- 3 Now install the app by first pressing on the app in the search results. Then press 'install' and finish with pressing 'accept'.



To create the serenity icon

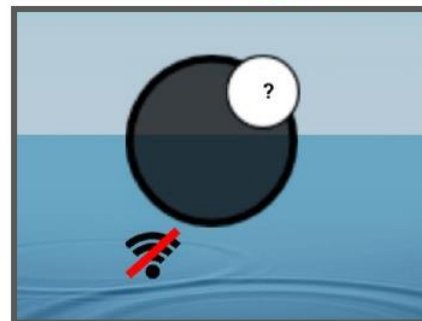
1 Press 'apps'



2 Press the 'widget' tab and search for the VictoryaHome widget



3 Hold the VictoryaHome widget pressed and drag it to the preferred place. The widget that you placed shows the serenity icon.



Giraff Pilot Software

The Giraff Pilot is used to make Giraff visits.

To install the Giraff Pilot

- 1** Download the Giraff Pilot by typing the following link in your web browser and pressing 'enter'. The software will download automatically.
Download link: www.giraff.org/pilot_2.5.1.7mm.exe
- 2** Open the downloaded file (pilot_2.5.1.7mm.exe) by double clicking it. The file is located in your 'downloads' folder.
- 3** Click 'run' in the window that has popped up to start the installation. Your PC might ask if you want to allow the program to make changes to your computer. Click 'yes'.
- 4** You will now be guided through the installation and settings process in three windows. Read the text and change the selections if you want to adjust the standard settings. Otherwise click 'next' in the first window, 'next' in the second window and 'finish' in the final window. The program has now been installed.

Monitoring Serenity App 3

With the serenity app you get information on how your VictoryaHome resident is doing. Depending on the role you play in their care network, you get notified for social updates, warnings and/ or emergencies.

Setting Up and Logging In

When you start using the app, you might want to change some initial settings. You can change your password and fill in details about the resident. Especially filling in a correct phone number is important since this number will be used when you use the app to call the resident in emergencies.

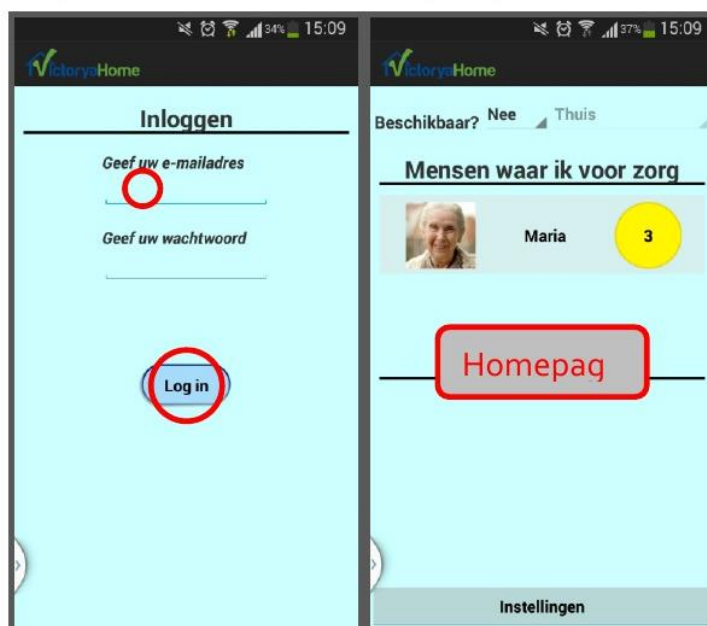
Furthermore, it is important to note that **you will only receive notifications on the resident when you are logged in**. After you login once, you will stay logged in. However, it sometimes happens that you get logged out after the app crashes. So please check this. Furthermore, you need connection with the internet to receive notifications.



You must have **internet connection** and be **logged in** to the app to monitor

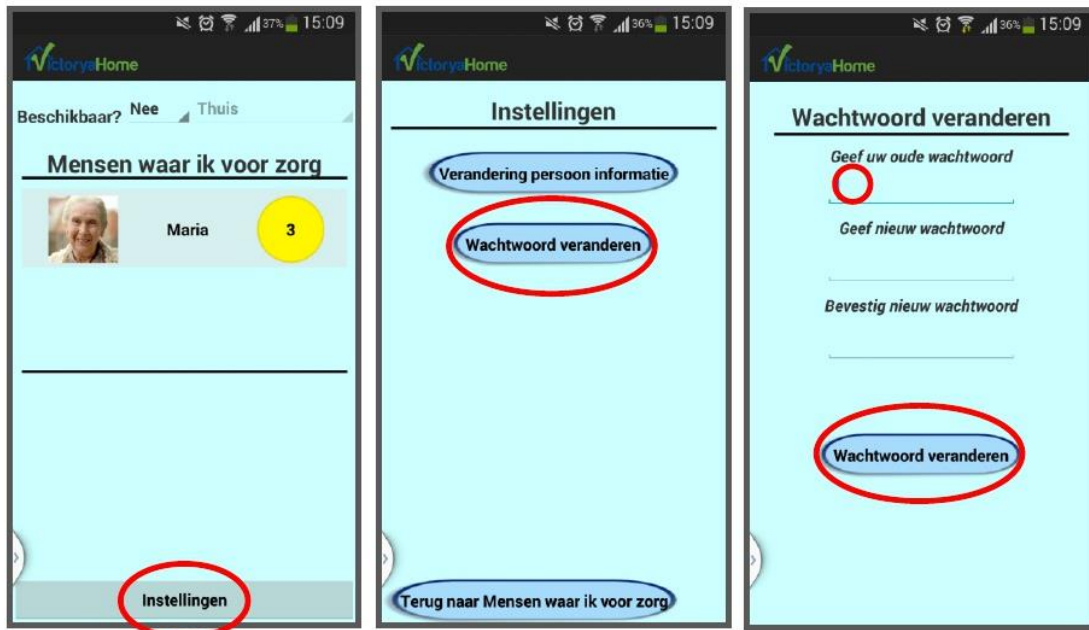
To login to the serenity app

- 1 The **serenity icon** is grey and showing a question mark when you are **not logged in**. The **network symbol** in the Figure is black with a red cross, meaning there is **no internet connection**. After you make connection (*this is phone dependent*) the symbol will turn white. Now you can press the serenity icon to login.
- 2 Press above the blue line to make the keyboard pop up and type your email address. Do the same for your password and press 'login'. You will now reach the homepage of the app. *Note 1: logging in and loading the homepage can take a moment. Note 2: when your keyboard is covering the login button, press the back button on your phone to make it go.*



To change your password

- 1** In the homepage press 'settings'
- 2** Press 'change password'
- 3** Type your old and new password. Then press 'change password'

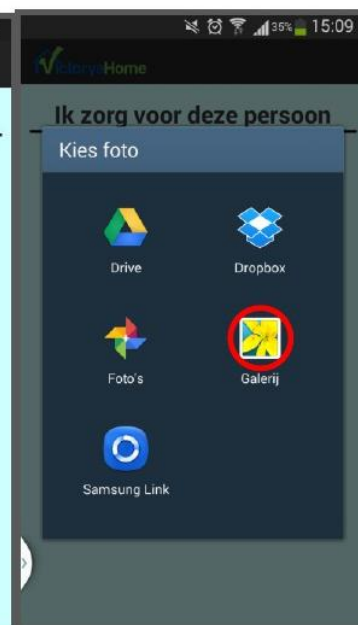


To edit resident information

- 1 In the homepage press 'settings'
- 2 Press 'change resident information'
- 3 Press 'change info' behind the person you wish to edit



- 4 Type a different name and/ or phone number. To change the picture press 'choose picture' and select the medium where you're picture is saved (here 'galary'). Then press the picture you want to use. When you see the picture in the screen press 'apply changes'.

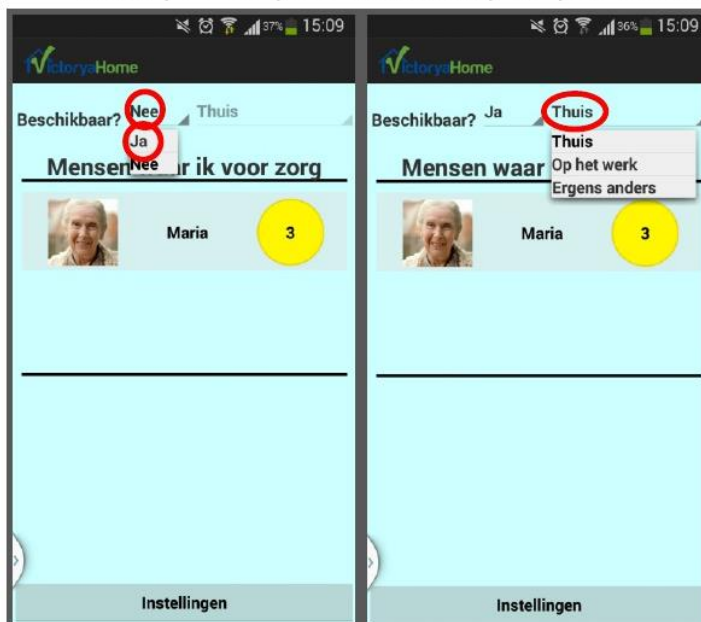


Showing your Availability

By setting your availability, you will inform the resident if you are available for contact. The location gives an indication to what extend you are available. If you state you are not available, it is not possible for the resident to send you social visit requests. However, other notifications will still be received.

To set your availability

- 1 Press the current answer to see the answer options in the drop-down menu. Then press your answer. *Note:* you can only select a location when you set your availability to 'yes' like in the Figure.



Viewing and Handling Resident Updates

The serenity app gives you information on how the resident is doing. Without the need for opening the app, the serenity icon (the widget) gives you a first indication. When you do open the app you can look at the details of the events measured by the belt clip, medication dispenser and Giraff. Note that they don't just measure care related events, but technical events as well. An example is when the batteries of the medication dispenser are low and need to be replaced. You can and should communicate your action to rest of the VictoryaHome care network. If you state you are working on it for example, the others in the network know they won't need to act. Finally, you can look at the history of events. When a new notification is sent to you, you will hear a sound and see the notification on your phone next to the updated serenity icon.

To get an overview of the resident's state

- 1** The colour of the serenity button shows the severity of the resident's state:
- Green: all is OK
 - Yellow: warning
 - Red: emergency
 - Grey: not logged in
- The number in the icon shows the total number of unsolved events.

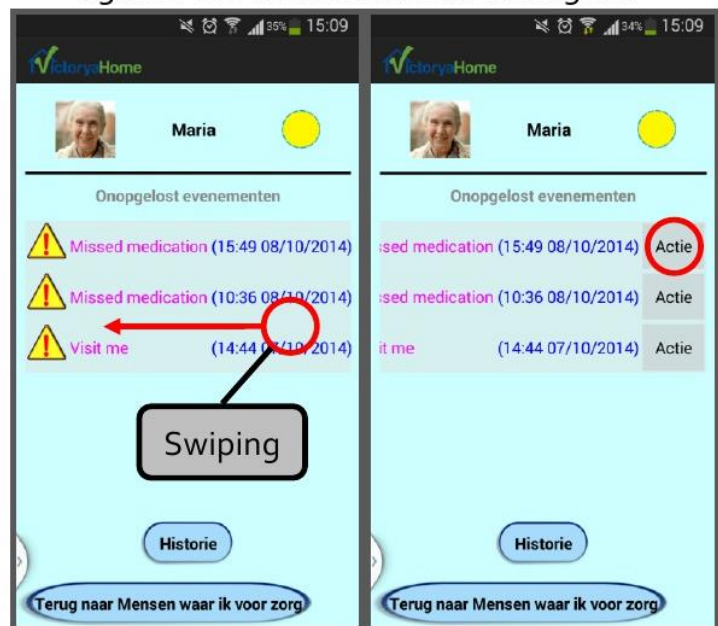


To see and act on specific unsolved events

1 Press the serenity icon next to the resident to see the detailed events.



2 Press 'action' to communicate your action. You might need to swipe to the right to see the button as in the Figure.



3 Press the correct action. If you don't want to do anything you can press 'close the window'. Remember: it is important to update the VictoryaHome care network, so please solve the problem when you have acted.



To view the history of events

- 1 Press the serenity icon next to the resident.
- 2 Press 'history'.
- 3 Press the calendar next to the date.



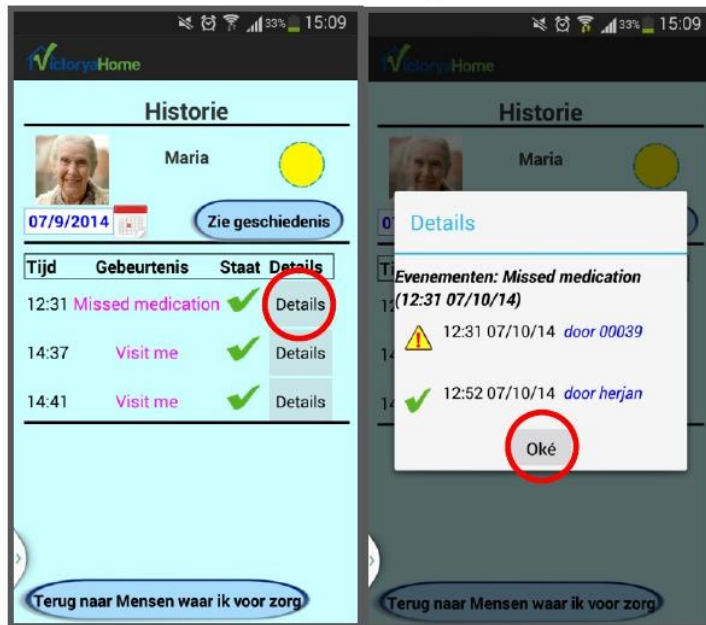
- 4 Select a date by swiping up or down. October 7th is selected. Then press 'set'.



- 5 Press 'see history' to see the events that happened on the selected day.



- 6 You might need to scroll down to see all events. Press '**details**' to see when the event happened, by what device it was measured, when it was solved and by whom. Press '**OK**' to close the window.



Having a Virtual Visit 4

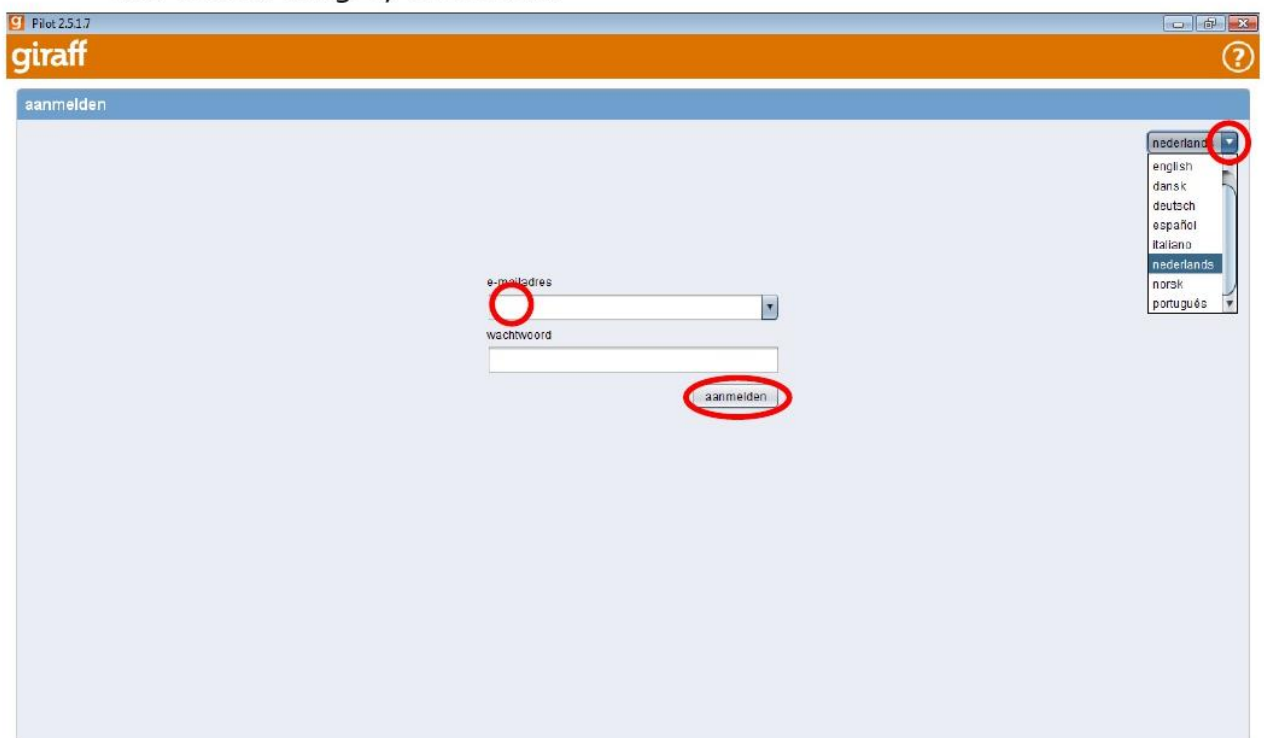
With the Giraff pilot software you can control the Giraff in your VictoryaHome resident's home and have a virtual visit. It is possible to talk to each other, see each other and drive the Giraff around. Remember that you have all the control over the Giraff.

Setting Up and Logging In

When you want to make a Giraff visit, you have to login into the Giraff pilot software and make sure your camera, microphone and speakers work well. This can be checked in the program.

To login to the Giraff pilot

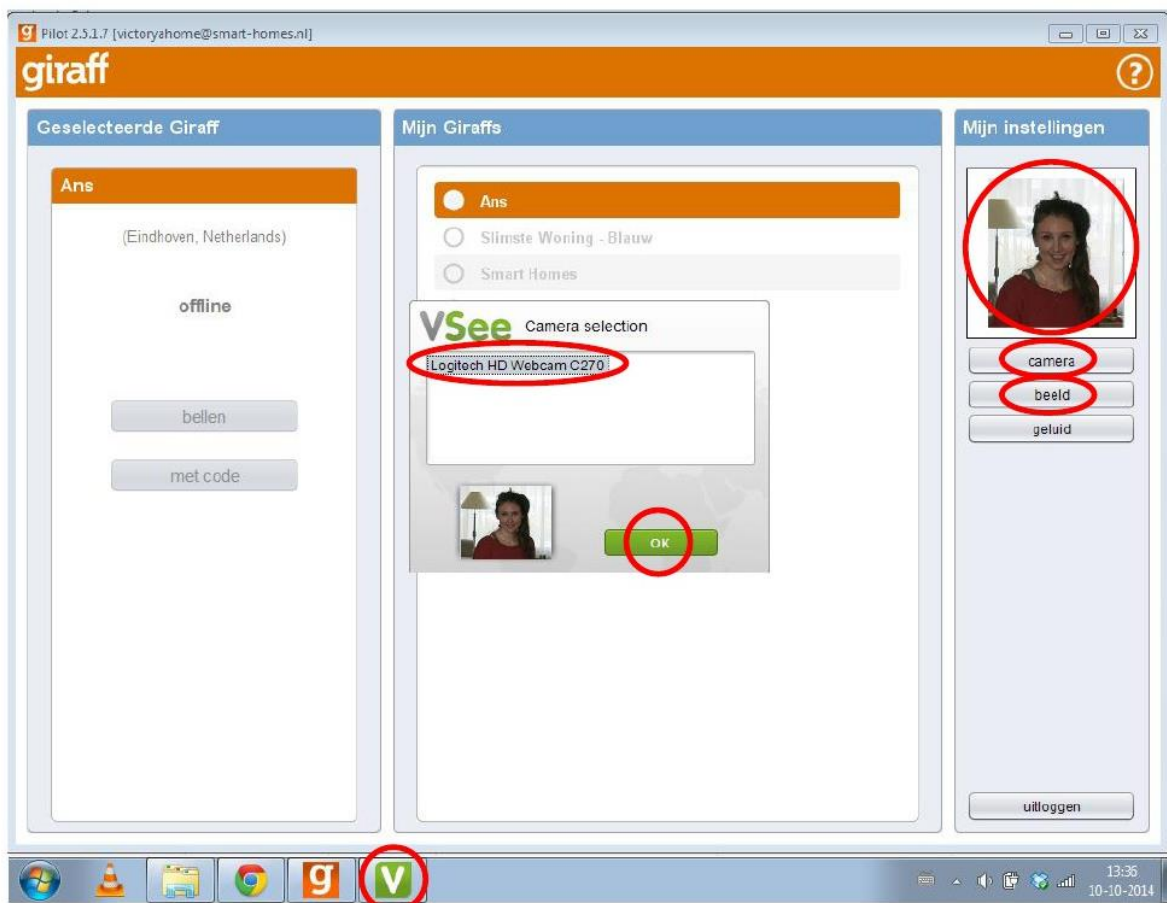
- 1 Open the Giraff pilot on your computer. Select your language from the drop-down menu. Then type your email address and password and click 'login'.
Note: It might take a moment before the 'login' button becomes available and turns from grey into black.



To set webcam settings

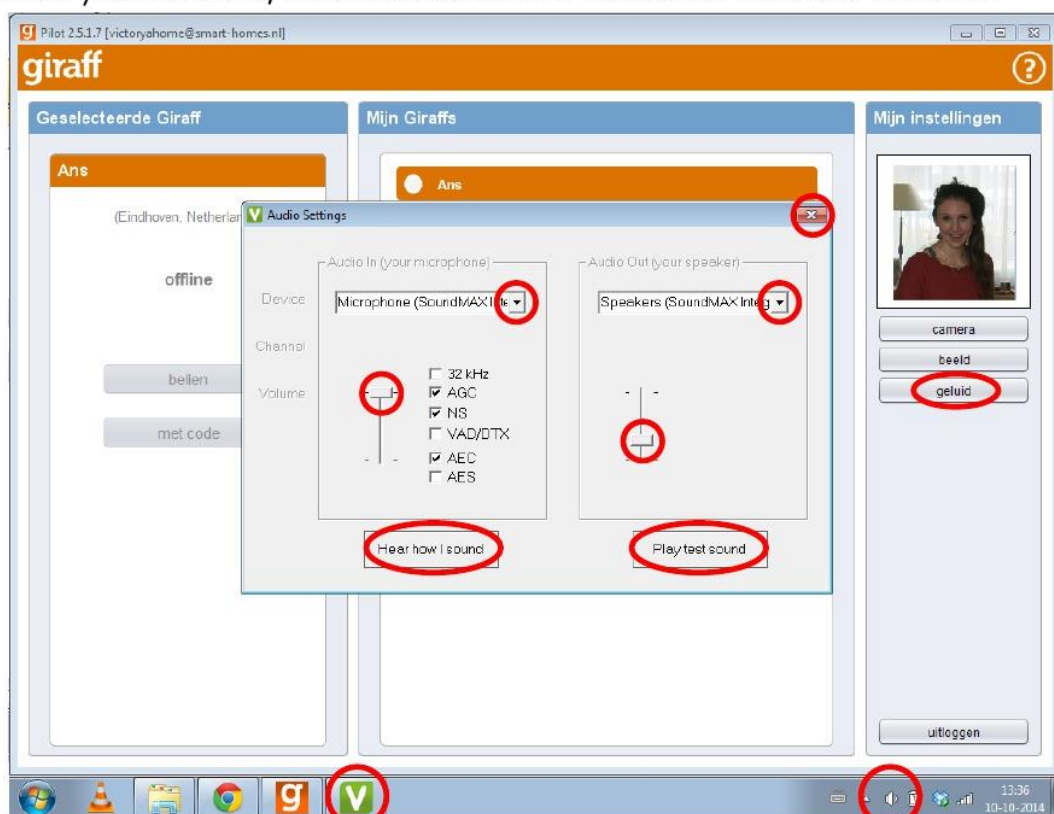
- 1** The box in the upper right corner shows how the resident will perceive you. If there is no image, there is no camera connected, the camera is in use by another program or there are other camera related problems.
- 2** To improve how the image looks, click 'image'. A window will pop up to adjust image settings (e.g. brightness). How the window looks depends on your camera and is therefore not shown in the Figure.
- 3** If you have several cameras connected, you can select a camera by clicking 'camera'. The VSee window will pop, showing the possible cameras (see Figure). After selecting one, click 'OK' to close the window.

Note: if the windows don't pop up, click the 'green V icon' in the task bar



To set speaker and microphone settings

- 1 Click 'audio' to open the audio settings window. If the window does not pop up, click the 'green V logo' in the task bar.
- 2 The microphone settings are in the left column.
 - 2.a. To check if the microphone works click 'hear how I sound'. *Note:* to avoid an echo it is best to plug in headphones when using this option.
 - 2.b. To select a different microphone, click the triangle next to the currently selected microphone and click the preferred one.
 - 2.c. To lower the microphone volume, click and hold the bar on the left and pull it down. Pull it up to increase the volume. *Note:* checking the microphone volume yourself is difficult since what you hear depends on your speaker volume.
- 3 The speaker settings are in the right column.
 - 3.a. To check if the speakers work, click 'play test sound'. *Note:* if you can't hear the sound, it could also be that the volume of your speakers is too low.
 - 3.b. To select different speakers (e.g. headphones) click the triangle next to the currently selected speakers and click the preferred ones.
 - 3.c. To lower the speaker volume, click and hold the bar on the right and pull it down. Pull it up to increase the volume. *Note:* you might also change the volume of your computer, by clicking on the speaker icon in the task bar and pulling the bar up or down.
- 4 When you are done, click the cross in the red box to close the window.



Calling a Giraff

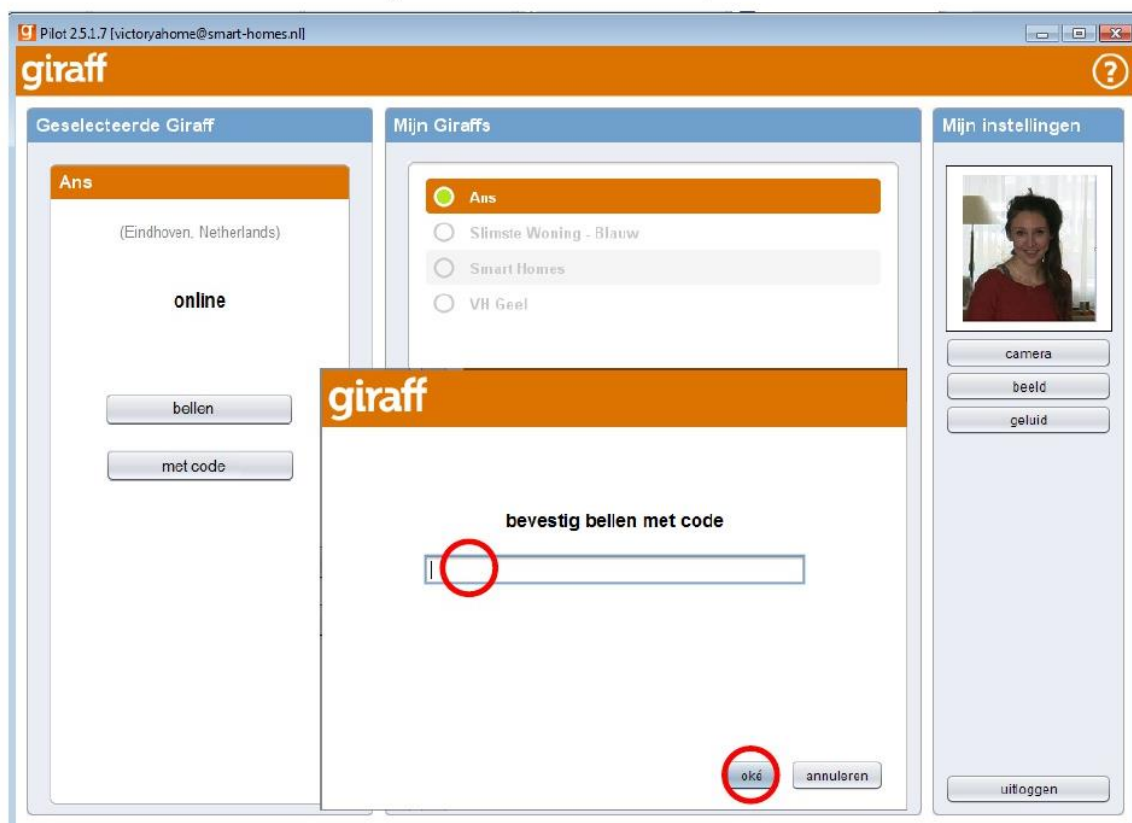
There are two ways to call the Giraff. The common method is letting the Giraff ring in the resident's house and waiting for the resident to 'pick up'. However, it is possible that the resident has given you a password. This password can be used in emergencies. When you use the password and the resident does not answer to the Giraff call, the Giraff will start on its own. This way you can drive the Giraff through the house to check if everything is alright. It is important to take the resident's privacy into account and not misuse the password!



Calling the Giraff with a password is meant for emergencies only!

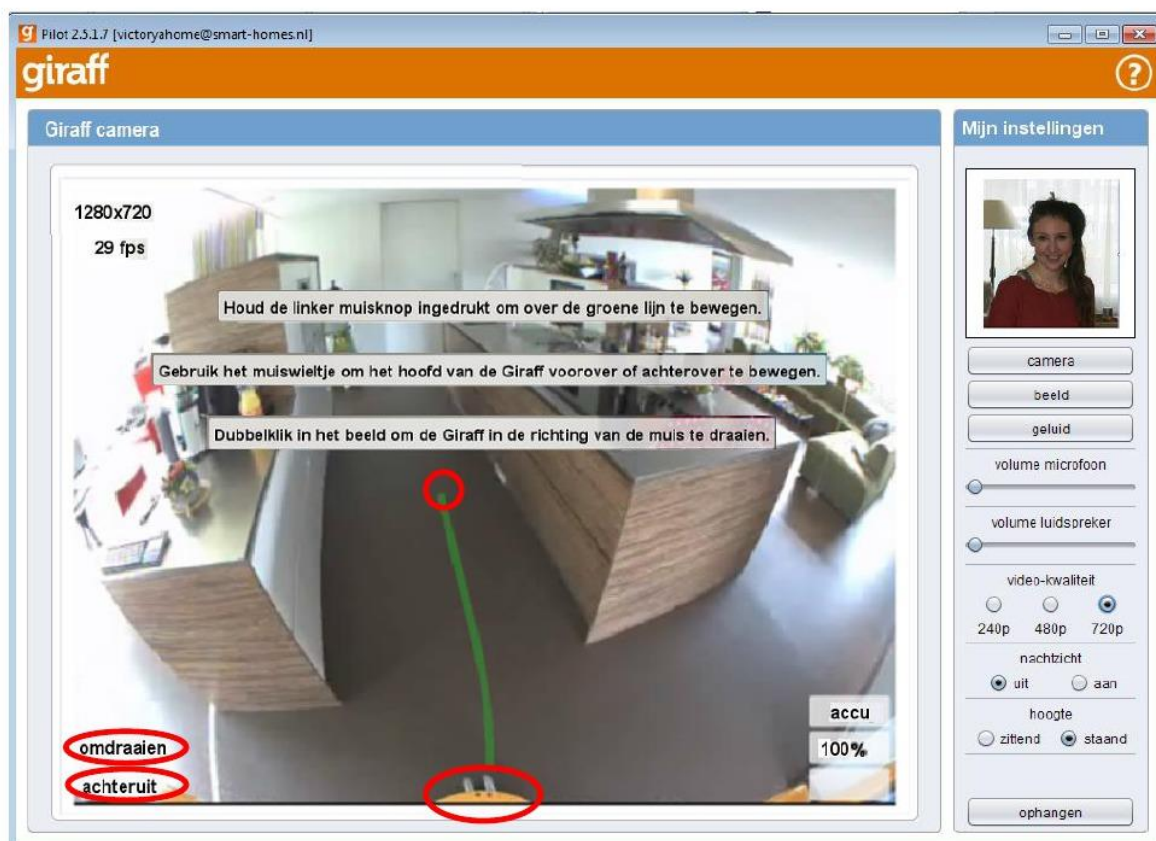
To call the Giraff (with password)

- 1 Select the Giraff you want the call by clicking it.
- 2 To call the Giraff, click 'call'. *Note:* to be able to call a Giraff, it must be available indicated by a green circle next to its name
- 3 In emergencies you can start the Giraff without needing the resident to answer the call. To do so, click 'with password'. A window will open where you type the password. Then click 'OK'. *Note:* the Giraff will first ring just as with a normal call. Only in case of no answer, the Giraff will start on its own.



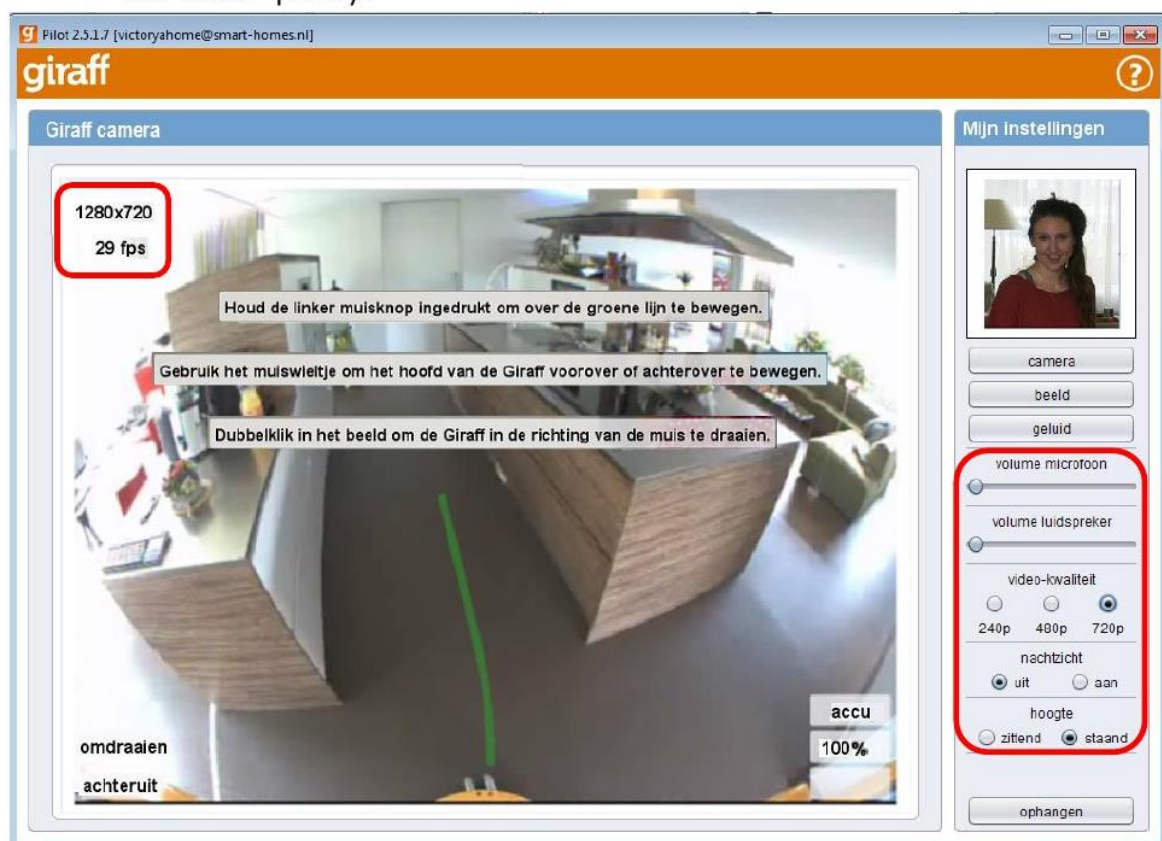
Driving the Giraff

- 1 To start you should **disconnect the Giraff from the charger** by pressing the text 'click here to undock' that appears on the screen. The Giraff will turn around and face the room.
- 2 To **drive the Giraff** position your mouse cursor in the direction you want the Giraff to go. When you hold the left mouse button pressed the Giraff will follow the green line towards the mouse cursor. The Giraff will stop when you release the mouse button again. You can move the mouse while holding the button pressed to adjust the direction.
- 3  To **adjust speed**, hold the mouse cursor closer or further away from the Giraff, making the green line respectively shorter and longer. A short line means a low speed. A long line means a high speed.
- 4 There are **two ways to turn**. To turn half a circle, click once on the button 'U-turn'. To turn into any other direction, position the mouse cursor on the place you want to face and double click the mouse. *Note*: don't place the mouse cursor too close to the Giraff when doing this.
- 5 It is not advised to **drive backwards**, since you then cannot see where you are driving. If you do need to back up, press the button 'back up' once and the Giraff will drive backwards a short length.
- 6  To **estimate distances** between you and the Giraff (and avoid collisions) use the 'feet' of the Giraff as a directive. If you can't see the feet scroll the mouse wheel to tilt the screen.



Optimizing the Virtual Visit

- 1 Change your microphone volume if **the resident cannot hear you well**. Drag the circle under 'volume microphone' left to sound softer and right to sound louder
- 2 Change the speaker volume when **you cannot hear the resident well**. Drag the circle under 'volume speakers' left to hear them softer and right to hear them louder. You may need to adjust the computer volume by clicking on the speaker symbol in the task bar.
- 3 **Go to the resident's eyelevel** (like you would do in a real visit) by adjusting the Giraff's height. Click the button left of 'sit' or the one left of 'stand'.
- 4 When your **vision is not good because of a lack of light**, activate the night vision mode by clicking the button left of the word 'on'. To deactivate night vision, click the button left of the word 'off'.
- 5 To focus on something you can **adjust the viewing angle and zoom**. Scroll the mouse wheel towards you to 'look' down and away from you to 'look' up. To zoom hold the 'Ctrl' button on the keyboard pressed and scroll the mouse wheel simultaneously. Click on the screen to go back to normal.
- 6  There can be **a delay in the video**. This is dangerous since now you have no visual feedback on where the Giraff is (going). If you realize this and/or you see the frame rate going under 15 frames per second (fps), lower the screen resolution by clicking the button under 'video quality' left of the currently selected button. When the fps is over 30 you can safely increase the video quality.



Ending the Virtual Visit

- 1 **Drive the Giraff against the charger.** If you succeeded and the two metal plates on the Giraff touch the two metal plates on the charger, you will hear a sound and see the message 'click here to undock' on the screen. **Don't press this message** or you will get disconnected from the charger again! If driving the Giraff against the charger is difficult use the 'docking assistant':
 - 1.a. Click on the target above the charger with the **right** mouse button and click on 'docking assistant'. A green square will appear on the image.
 - 1.b. Double click in the square when the square is located neatly around the target. The green line indicating the Giraff route is now thicker and locked to the target.
 - 1.c. Press the left mouse button as if you were driving normally and the Giraff will steer itself towards the charger.
 - 1.d. You might have to adjust the course a bit when the Giraff did not drive against the charger in the right angle (and is thus not charging).
- 2 When the Giraff is charging you can click 'hang up' to end the call.
- 3 If you hang up without the Giraff standing against the charger, you get the message as in the Figure. Click 'cancel' to still drive the Giraff against the charger.



Preparing Medication 5

The medication dispenser that reminds the person you care for to take medication and registers if the medication is forgotten, has to be filled and set periodically. This goes in cooperation with the care organisation.

To prepare the medication dispenser

1 Make sure you have the **medication schedule** and the right medication. In the box is space for 28 medication intake moments.

2 Place the pills for the first medication moment in the compartment slightly right of the opening in the box. Continue filling the box counter clockwise with the **pills for one medication moment per compartment**.



3 Confirm with the care organisation that they have set the times for the medication reminders correctly. If so, hold **button 2** pressed until you see '**SMS**' on the screen. Then let go of the button and check if you see the message '**RX OK**' before the device beeps and shows the time again.



Solving Problems

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Situations can occur that deviate from the standard usage scenarios. In this chapter some of these situations are described together with how to solve them yourself. Remember, if a different problem occurs or solving the problem yourself is not successful, you can always contact the VictoryaHome help service.



The VictoryaHome help service is reached by <to be filled out>

Internet is not Working in my House

When internet is not working in your house, you cannot make Giraff visits. Furthermore, if you don't have mobile internet activated on your phone, you won't receive messages on the serenity app either. Often the internet connection can be fixed by resetting the router. If the problem persists after resetting, call the help service.

To reset the router

1

Push the power button to turn the router off. Then wait about 30 sec and push the button again to turn it back on. *Note:* You're router may look different than the one in the Figure.



The Giraff Call ended before the Giraff was in the Charger

Depending on the reason why this happened, you can do several things.

If you or the resident **ended the call by accident**, you should call the Giraff again and yet drive it against the charger.

If you were **not able to drive the Giraff against the charger** and therefore ended the call, you could best contact a different person from your resident's network and ask them to call the Giraff to drive it against the charger.

If the **battery died**, the Giraff will have shut down. This means the brakes of the Giraff are off and you could help the resident (by phone) to push the Giraff against the charger and turn it back on.

I hear an Echo during a Giraff Visit

This problem can usually be helped by plugging in headphones.

The Giraff Acts a while after my Instructions

This could mean a slow network connection and therefore a delay in the video. To solve this problem, you should try lowering the video resolution (the video quality). You can see how to do this under *"Optimizing the Virtual Visit"*. If the problem persists call the help service. Note that driving with a big delay is dangerous since you cannot see how you are driving.

The Serenity App has Stopped Working

You should first try to just login again. If this does not work, you can try to force the app to stop. How to force-stop apps depends on the phone you have. Re-open the app and login again. If the problem persists, contact the help service.

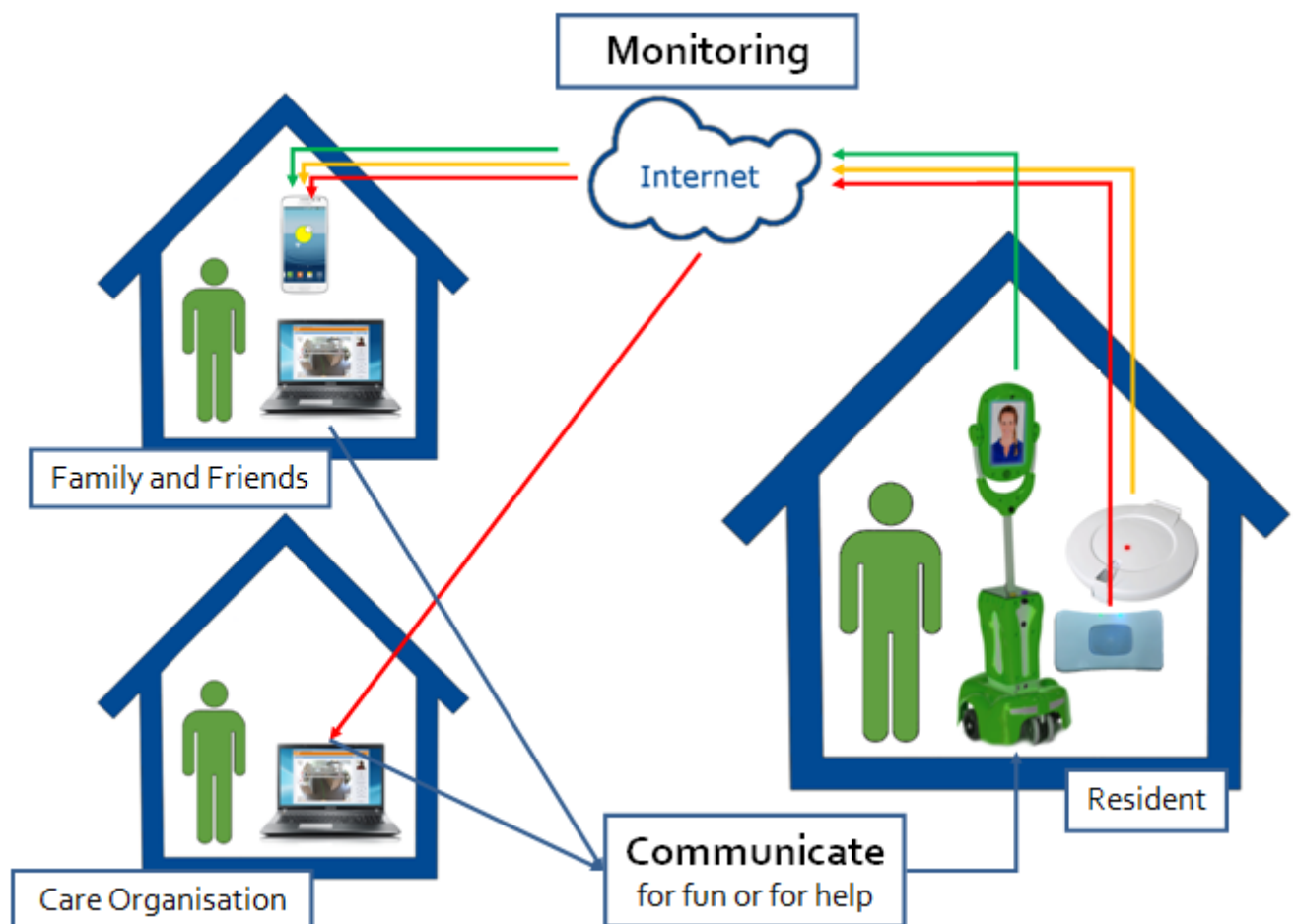
English version of the training hand outs for the elderly resident

Session 1	3 hours
• Introduction of VictoryaHome ○ Movie of use ○ Discussion • Getting to work ○ Installing ○ Practicing ○ Looking at each other • Making agreements • Homework and questions	30 min 90 min 30 min 30 min
Session 2	2 hours
• Discussing experiences and homework • New agreements • Getting to work ○ Demonstrating a visit ○ Difficult Situations • Question round and finishing up	30 min 30 min 30 min 30 min

Session 1

Introduction

You now have seen and discussed what VictoryaHome is and what it is for. The picture below gives an overview of the system. Use the picture to see if it confirms with your ideas of VictoryaHome. You can also add additional information in the picture if wanted.



Getting started

Below are some tasks to get familiar with the system. You can try working on them. If some things are not clear, you can use the manual to see all the steps. This will also help you to get familiar with the manual. Of course you can also ask one the VictoryaHome people for help or information. They are also there to give feedback, tips and more detailed explanations.

Taking medication from the medication dispenser

We will set an alarm on the dispenser. When you hear it, take the medication out of the box. You should turn the box completely upside down, because that movement is how the box registers you have taken the pills out. If you don't take the medication, a reminder will be sent to your caregivers.

If you want to write things down, you can do that on the dotted lines.

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Sending out an alarm with the belt clip

The belt clip measures activity and detects falls when you wear it on your waist. If a fall or low activity is detected, your caregivers get notified. So, let's start by placing the clip on your waist. The clip can also send out an alarm when you push the panic button on the clip. Let's try that out as well. Note that the panic button also works when you don't wear the clip.

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Requesting a visit with the Giraff

If you want contact, you can use the Giraff to send a 'visit-me' request. Only people from your VictoryaHome network that have stated they are available can be selected. Send a request to your family member or friend that is trying the system with you.

Having a Giraff visit

Your family member or friend will now call you on the Giraff. This way you can have a 'virtual visit' and see each other while speaking. Answer the call, have a chat and let the other person practice the driving. Make sure that in the beginning you don't stand too close when they are practicing driving. Try also to adjust the volume.

Have a look at what the others are doing

Have a look at what everything looks like on the other side. Your family member or friend can explain you briefly how they get notified on their phone and show you how it is to drive the Giraff. If you want to, you can also try driving it yourself. Also explain what you are doing.

Agreements

VictoryaHome is largely a social aid. How you use the notifications and the Giraff is completely up to you and your network. Therefore, it is important you and your family members and friends have the same ideas and expectations on how to use the system.

I want a visit

When do I use this option?

What kind of response can I expect and when?

What to do when there is no reaction?

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Other notes and agreements

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Calling the Giraff with a password

Who gets a password?

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When can the password be used?

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What to do when people misuse or overuse the password?

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Other notes and agreements (e.g. on data storage)

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Other agreements

Who fills the medication dispenser?

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Who do you want in your VictoryaHome care network and who receives what messages?

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Other things

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The VictoryaHome help service

If you have any questions or problems with the system or using the system, you can contact the help service. They can be reached **<when, how to be filled in>**

Home work

Your homework will be trying out the system. In this testing phase you will have the opportunity to try sending out alarms, visit requests and see how your family members and friends will respond. Try also to have some virtual visits with the Giraff and don't forget to charge the belt clip. Simulate situations to discover the whole scope of system functioning and problems.

The second task is to make notes on your experiences. How is it to use the system? Do the system and the people using the system respond as you expected? Are the agreements you made realistic and workable? Did any problems occur? We will discuss your notes in the next session.

Also in the test phase you can contact the VictoryaHome help service on **<to be filled in>**

New Agreements

This image shows a full page of white paper with horizontal dotted lines, typical of primary school writing paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

[illegible]

Difficult Situations

We will try out two tasks that will help you solve some problems on your own. It might be useful to grab the manual for these tasks.

Internet is not working

You must have internet for the messages to be sent to your VictoryaHome network. If the internet connection does not work, resetting the router often helps.

The Giraff is not working

When the Giraff is not working properly, you can also try to reset the Giraff. This way you also know how to turn the Giraff on, which can be helpful when the battery has died by accident during a visit. Note that you can push the Giraff more easily when it is not turned on.

Appendix P: Training hand outs for informal caregivers

*English version of the training hand outs for the informal caregivers***Planning****Session 1** **3 hours**

- Introduction of VictoryaHome 30 min
 - Movie of use
 - Discussion
- Getting to work 90 min
 - Installing
 - Practicing
 - Looking at each other
- Making agreements 30 min
- Homework and questions 30 min

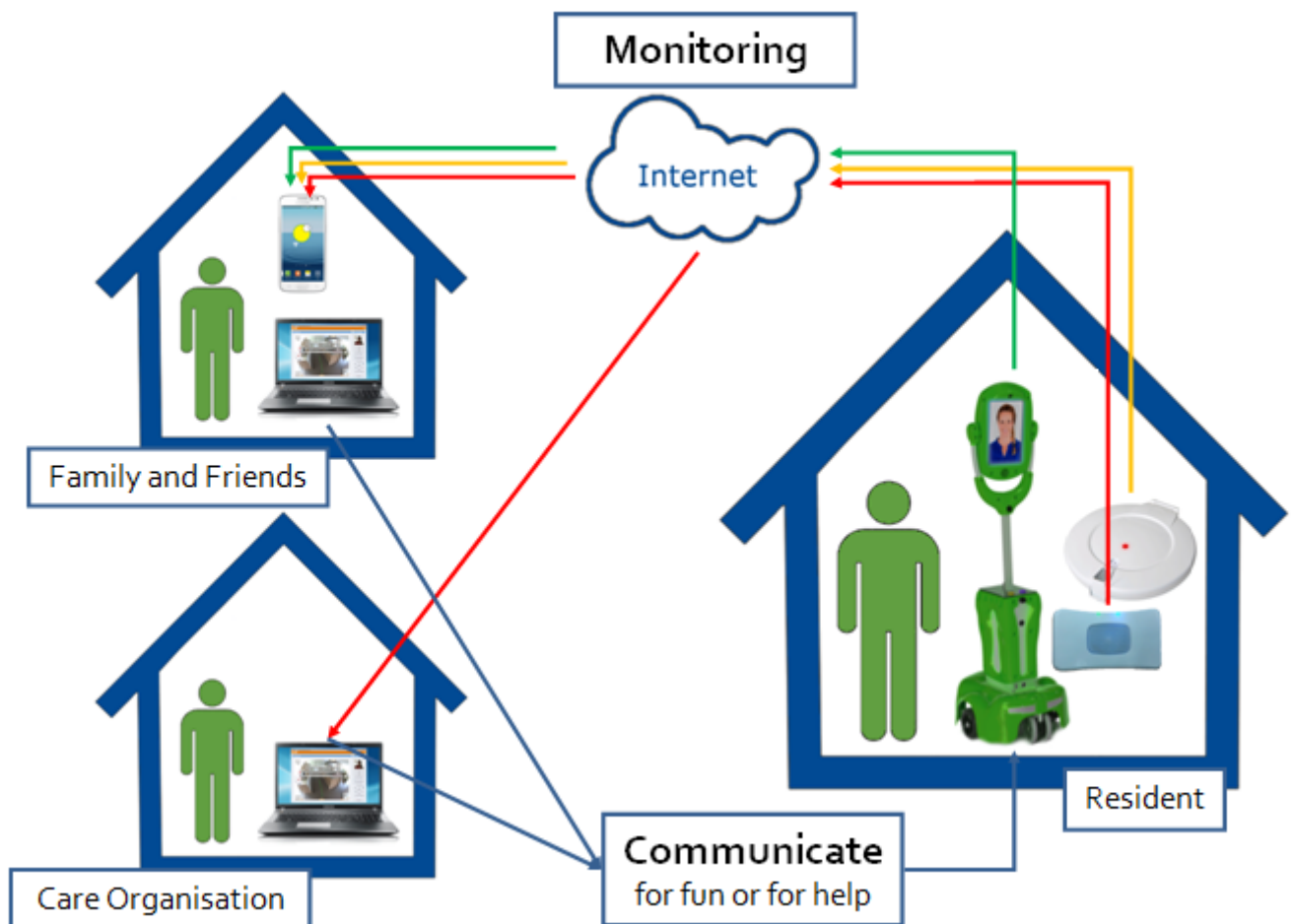
Session 2 **2 hours**

- Discussing experiences and homework 30 min
- New agreements 30 min
- Getting to work 30 min
 - Demonstrating a visit
 - Less Frequent Situations
- Question round and finishing up 30 min

Session 1

Introduction

You now have seen and discussed what VictoryaHome is and what it is for. The picture below gives an overview of the system. Use the picture to see if it confirms with your ideas of VictoryaHome. You can also add additional information in the picture if wanted.



Getting started

Below are some tasks to get familiar with the system. You can try working on them. If some things are not clear, you can use the manual to see all the steps. This will also help you to get familiar with the manual. Of course you can also ask one the VictoryaHome people for help or information. They are also there to give feedback, tips and more detailed explanations.

We will start however with installing the serenity app and the Giraff pilot software. Follow the instructions in the manual and try to install them yourselves before asking help. This way you can give advice to other people in the VictoryaHome network later. The login details can be found **<to be filled in>**

Log into the serenity app and change the resident's name

To receive notifications on the app, you have to be logged in. Make sure you have internet connection and login to the app. To make the app a bit more personal you can start with changing the resident's name.

If you want to write things down, you can do that on the dotted lines.

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Setting your availability

You can show the resident if you are available for contact. You can also set your location to give extra information on the extent to which you are available. Try setting your availability to 'yes' and the location to 'other location'.

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Receiving a notification

You just received an update on the resident (if not, wait a moment). Try to look how urgent the situation is based on the serenity icon and then open the app to see the details on the event. With the app you can communicate to the others in the network that you will handle the event or have solved it. Tell them that you will handle the situation.

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Having a Giraff visit

This task is a big one! Don't worry, the VictoryaHome people will support you and give feedback step by step. You will need the manual with this task.

You can decide to visit the resident virtually after you received a notification or just for fun. So that's what we're going to do. Let's start by **logging in** to the Giraff pilot and **calling the Giraff**. When the resident has answered you can get the Giraff loose from the charger (**undocking**). Tell the resident that you are going to practice driving.

Now we can drive. Have a look at the manual first on how to drive the Giraff. A summary of the instructions are also presented shortly on the screen. Try out some different things. Turn around, sit down, adjust the volume and of course have a talk with the resident.

Since we have just started, some safety instructions repeated:

- Hold the mouse pointer close to the Giraff, so you won't go too fast. The longer the green line on the screen, the faster you drive.
- Look at the 'feet' of the Giraff at the bottom of the screen to see how close you are to an object. If you can't see the feet, scroll down to tilt the 'head'.
- Is there a delay in the video? Watch out! Since you can't see what the Giraff is doing, driving is not safe this way. The delay can be caused by a slow network connection. You will notice a low frame rate (fps < 15). This can be improved by decreasing the image resolution.

End the Giraff visit

Before you end the Giraff visit, you have to drive the Giraff back to the charger. The resident cannot push the Giraff, because the brakes are turned on automatically. You can use the target on top of the charger as an aim. You can also try the docking assistant. Tell the resident you are going, drive the Giraff to its charger and end the call.

Have a look at what the others are doing

Have a look at what everything looks like on the other side. The resident can explain you briefly how you get all the notifications in your app and you can see how it looks like to have a Giraff visit from the other side. Also explain what you are doing.

Agreements

VictoryaHome is largely a social aid. How you use the notifications and the Giraff is completely up to you and your network. Therefore, it is important you and your family members and friends have the same ideas and expectations on how to use the system.

Receiving a 'visit-me' request

When does the resident use this option?

What kind of response can the resident expect and when?

What to do when there is no reaction?

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Other notes and agreements

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Calling the Giraff with a password

Who gets a password?

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When can the password be used?

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What to do when people misuse or overuse the password?

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Other notes and agreements (e.g. on data storage)

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Other agreements

Who fills the medication dispenser?

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Who do you want in your VictoryaHome care network and who receives what messages?

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Other things

The VictoryaHome help service

If you have any questions or problems with the system or using the system, you can contact the help service. They can be reached <how, when to be filled in>

Home work

Your homework will be trying out the system. In this testing phase the resident will have the opportunity to try sending out alarms, visit requests and see how you will respond. Act as if all the notifications are real! Try also to have some virtual visits with the Giraff to practice the driving. When driving try out the different options to optimize the conversation. Simulate situations to discover the whole scope of system functioning and problems.

The second task is to make notes on your experiences. How is it to use the system? Do the system and the people using the system respond as you expected? Are the agreements you made realistic and workable? Did any problems occur? We will discuss your notes in the next session.

Also in the test phase you can contact the VictoryaHome help service on **<to be filled in>**

New Agreements

[illegible]

This image shows a full page of white paper with horizontal dashed lines, typical of primary school writing paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Less Frequent Situations

Let's start by showing us how you control the Giraff after some practice. Now we can try some additional tasks that occur less frequent.

Looking at the history

You now had the time to use the system for a while. Let's see what has happened by looking at the history in the serenity app. Pick a day and look at the details of one specific event that has happened.

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Preparing the medication dispenser

The medication dispenser has to be filled once in a while (depending on how many times a day medication is taken). Setting up the medication dispenser will go in cooperation with a care organisation. This time the VictoryaHome people will set the alarms. Follow the steps in the manual. You don't have to use real medication.

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Appendix Q: Notes for trainers including the link to the informational video

Notes for trainers to enforce compliance with user requirements and guidelines

Notes for the trainers

- The English version of the **VictoryaHome info video** can be found here: https://www.youtube.com/watch?v=xtrWa_RwyCg
- Try to let the users work with the system with little help. Of course when something goes wrong or when people ask you specifically you step in. But try to motivate them to try it themselves first: **learning by doing**.
- Give **positive feedback** to reduce anxiety and motivate learning. Tell the users when things are going well. When things are difficult, tell them it is hard, but after some practice they will learn it just like other users similar to them.
- You lead the discussions. **Make sure everyone can say what they are thinking and involve all users** in the discussions. Encourage users to write things down (especially conclusions) and to ask questions, to keep them actively involved.
- When users show each other what they have learned, try to **discover misconceptions and correct them**.
- Make sure people can make **informed decisions on privacy issues** by explaining data storage and password use clearly. Make agreements with users on these issues that are both technically feasible and satisfying for the user.
- Encourage users to **seriously try out all kinds of situations** in the homework phase. What happens if I get out of bed and have a on the way to the bathroom? Can the Giraff reach me?

Appendix R: Movie script

The movie script for the English version of the informational video. The script is mainly based on the laddering results and the expert agreement map. The movie is found when following the link: https://www.youtube.com/watch?v=xtrWa_RwyCg

FILM SCRIPT VICTORYAHOME – VOICE OVER

ON SCREEN TEXT: A support service that monitors your health and safety, and facilitates social contact.

Scène 1: Intro users

Ans lives alone, and she is still able to do most things on her own. Even so, she is getting more ailments and doing her daily chores is getting harder.

Her sister, Tim, lives together with her husband Wil at the other side of the country. Tim and Wil sometimes worry about Ans, and thus find it important to stay updated. However, the distance does make it difficult.

Scène 2: Intro system

Recently, Ans got something that makes it possible for Tim and Wil to stay informed remotely, and give help when needed.

Tim and Wil have installed the Serenity app on their phone. It shows if everything is well with Ans.

Ans has some smart devices at home that can send a message over the internet to Tim and Wil's app. She has a medication box that sends a message when she has forgotten her pills. She also has a fall detector that automatically detects if she has fallen. The fall detector also sends a message if Ans hasn't moved for a long time. And it has an alarm button which can be used to call for help.

Lastly, Ans has a robot, the Giraff, with which she and her family easily can get in touch.

This way she can live independently while feeling safe.

ON SCREEN TEXT: An example: Mediation

Scène 3: Monitoring and the app

Wil receives a message. The app is yellow, so something is going on. When Wil opens the app, he sees that Ans has forgotten to take her medication. He will ask her about that, since taking her medication on time is important for her health.

Scène 4: Social contact via the Giraff

Meanwhile, Ans fancies a chat. With the Giraff she can ask her friends and family to visit her virtually. She's curious what Tim and Wil have been up to, and sends a message to Tim. That is very easy to do.

And there are Tim and Wil!

SUBTITLES: Hello Ans! We are coming your way.

They control the Giraff from their own home, and the video makes the contact a lot more enjoyable. Like this, Tim and Wil can visit regularly even though they live far away. And now they can see how Ans is really doing.

SUBTITLES: Everything okay? - Yes, everything is perfect. - Okay, and the weather is nice! Have you been outside? - No, I haven't been outside today. - Ah, maybe walk around the garden later on... - Yes, that might be a good idea. - But I see that you have forgotten your medications. - Oops, indeed I forgot, but I'm going to take them immediately!

ON SCREEN TEXT: Another example: Falling

Scène 5: Giraff use after a fall

Wil sees on his app that Ans has fallen. He calls her straight away to ask if she is alright. When she doesn't answer, he decides to have a look with the Giraff.

Wil received a password from Ans to use in emergencies. With the password he can use the Giraff to look inside the house without the need for Ans to accept the visit.

Ans her privacy is ensured by making clear agreements about who receives a password and when it is to be used.

SUBTITLES: Ah, there she is... Hello Ans! - Yes... - What has happened? - Well... I did not answer the phone because... I was sitting in my chair, and I wanted to get up, and... well, I tripped, I fell. But I am on my feet again! Fortunately. - But, you better sit down now, if you like, that is no problem.

ON SCREEN TEXT: Always available

Scène 6: Care organisation as back-up

Ans, Tim and Wil know that they and the rest of the family cannot always be reached. That's why they agreed to involve the care organisation when the family does not respond to an emergency within 15 minutes.

This way, they make sure that Ans will always receive help quickly.

ON SCREEN TEXT: In conclusion

Scène 7: Conclusions

We have seen what VictoryaHome is and what it can do.

Ans knows that her family keeps an eye on her, and that they can intervene quickly when she needs help. She also really enjoys the Giraff visits. They are surely a lot more real and lively than talking over the phone, and social contact is very important.

For Tim and Wil, staying updated by the app gives a good feeling. Furthermore, they now have the opportunity to visit more often, from their own home that is.

Besides making the chat more fun, Tim and Wil find it important that the video enables them to better assess how Ans is really doing.

Like this, Ans can continue living in her own home with a feeling of being safe.

Appendix S: Original Dutch citations

The original citations in Dutch that were translated in the document for readability reasons

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- ⁱ *“het rondrijden [met de Giraff] is nog altijd [lastig] voor mij, uh ik ben toch een vrouw, hahah. En ik kan best goed auto rijden en zo en met dingen omgaan, maar ik ben toch al gauw in paniek. Oeh, weet je wel.” (p.3)*
- ⁱⁱ *“gewoon praktisch zien, en dan [...] met opzet, bijvoorbeeld, of per ongeluk dat het fout gaat, maar dan meteen hè. Ja dat onthoud je het beste hè. En dan weet je ook dat kan gebeuren of dan moet ik dit of dat doen.” (p.10)*
- ⁱⁱⁱ *“[Het] is nodig dat het altijd werkt en daar is voor nodig dat je hulpverleners altijd beschikbaar zijn. Het hoeft niet zo te zijn dat een persoon altijd beschikbaar is, maar maar dat er bijvoorbeeld van de drie om de beurt of altijd één beschikbaar is” (p.7)*
- ^{iv} *“Mijn moeder had vroeger ook zo'n, zo'n ding [paniekknop] om en dan nam ze contact op met de GGD. Ja uh, ze was bijna dood en dan had ze nog niet gebeld. Ze liet bij mij twee keer de telefoon overgaan en ik wist oké, ik moet er naartoe.” (p.9)*
- ^v *“nou ja van alles. Van a tot z. [...] Wat heb je er aan in je dagelijkse leven.” (p.8)*
- ^{vi} *“uhm, even laten zien hoe die robot in elkaar steekt. Dus het scherm en dat hij met de wielmpjes door je kamer kan lopen. Uhm, er zaten ook knoppen aan denk ik hè. Ja die dan inderdaad even uitleggen wat dat is. Uitleggen inderdaad dat hij op die dock moet zitten om op te laden en uh ja gewoon wat jullie eigenlijk hebben gedaan.” (p.1)*
- ^{vii} *“want ja, de huisvoorzieningen in de huizen dat is ook al niets hè. En het aanatal meubelen dat de mensen hebben staan, mijn god, als je het bij sommige mensen ziet hè. Dan komt dat ding [de Giraff] nergens. Die stoot om de minuut, stoot hij zijn neus.” (p.8)*
- ^{viii} *“Nou hij is een keer in de badkamer gevallen toen hij zo ziek is geworden. en dan zou je hem [VictoryaHome] hebben kunnen gebruiken. Dan zou [...] meteen gekomen zijn, maar toen was ik er nog bij.” (p.6)*

^{ix} “Nee, ja dat weet je allemaal niet hè. Je geeft zoveel van jezelf prijs. Er gebeuren zoveel rare dingen in de wereld. Van iemand vermoorden en noem het maar eens op. Er zou eens zo iemand bij zitten die dan al je geheimen kent en uh die je onder druk zet of wat dan ook. Nee dat uh die privacy moet goed beschermd zijn” (p.8)