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Faculty of Behavioral, Management and Social Sciences

Improving Quality of Life for the Elderly

Assessing motivation to use an interactive home care technology in a qualitative study with older adults

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Abstract

Smart caring home technology promotes independent living and functionality of elderly with frailty. However, technology can only succeed at supporting elderly when they are motivated to use it. This study explores such a feedback and monitoring system called eWALL. The goal of this study is assess how older adults experience eWALL with regard to the motivational constructs Perceived Enjoyment, Perceived Usefulness and Perceived Ease of Use. The outcomes serve as recommendations for improving the system. An evaluation was conducted with eleven older adults of ages 55 and up. The evaluation methods used were semi-structured interviews, usability tests and two postinterview questionnaires. It was found that the older adults perceived eWALL as easy to use or easy to learn, but they did not want to implement it yet. Contact with family and healthcare was regarded as useful, but privacy concerns were raised as well. The participants made a lot of negative remarks about the main screen design. Therefore, motivation to use eWALL was not as high as it could be. It is recommended to adjust the main screen design to enhance Perceived Enjoyment. User experience can also be improved when training is provided and an off-button implemented. However, more research with the target group of frail elderly is needed to account for their specific needs.

Keywords: Smart caring home, Self-management, Elderly, Independent living, User experience, Interaction, Motivation, Perceived Enjoyment, Perceived Usefulness, Perceived Ease of Use

Summary

Background. The ageing of the population causes various diseases and health problems to become more demanding in the future. Research shows that elderly might be able to prolong their independent living and functionality through self-management. eWALL is an example of a feedback and monitoring system that could provide elderly with this kind of care. However, elderly need to be motivated to engage with eWALL in order for the intervention to work. The intention to use and actual use of a technology can be assessed with the constructs Perceived Ease of Use and Perceived Usefulness from the Technology Acceptance Model (TAM), and Perceived Enjoyment, which has been shown to influence intention to use a technology as well.

Goal. The goal of this study is to assess user experience of eWALL with regard to the constructs Perceived Enjoyment, Perceived Ease of Use and Perceived Usefulness. These results then provide recommendations for improving eWALL in order to enhance motivation to use the system.

Methods. The evaluation study consisted of semi-structured interviews and usability tests with eleven older adults. Additionally, two post-interview questionnaires were filled out, measuring user experience and technological experience.

Results. Most participants enjoyed using eWALL, especially the gaming feature. However, they expressed negative feelings towards various aspects of the main screen design. Mainly with regard to old-fashioned design, the weather/window feature and the busyness of the screen. Most participants perceived eWALL as easy to use and easy to learn, especially when training is provided. Most of them did not regard eWALL as useful for them yet, meaning they would not implement it. Privacy concerns and the lack of an off-button were mentioned often. Contact with family and healthcare was regarded as most useful about eWALL. All participants had previous experience with technology, although most of them not with a touch screen.

Conclusion. Motivation to use the technology is not as high as it could be. This could be improved by changing features of eWALL that hinder the positive experience of Enjoyment, Usefulness and Ease of use. It is recommended that issues with the main screen design are addressed, as well as the privacy concerns and the current obtrusiveness of the screen. The gaming feature should be optimized in order to enhance motivation. Then eWALL could offer a way of reducing health care costs and provide frail elderly with the support they want and need to stay independent.

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1. Introduction

In the Netherlands, the number of people that are 65 years old and up, is increasing. This ageing of the population is expected to continue for several more decades, reaching its peak in the year 2041 (Giesbers, Verweij & de Beer, 2014). Increased life expectancy is one of the main contributors to this situation. Consequently, various diseases and health problems that are common amongst the elderly will become more demanding in the future. It is estimated that about half of the increase in healthcare costs will be due to the higher number of elderly (van Rooijen, 2013). Care for the elderly already contributed to an estimated 18.3% of the total health care costs in the year 2011 (Panhuis, 2013). These expenses are expected to increase with the number of people suffering from chronic diseases, such as: chronic obstructive pulmonary disease (COPD), arthrosis and early stages of dementia. These conditions do not just affect the elderly, but costs for the care of these diseases do increase with age. For example, the costs for COPD nearly doubles for elderly suffering from this condition when compared to people with COPD between the ages of 40 and 50 (Suijkerbuijk, 2013). In addition, about 34% of care for arthrosis went to the elderly in 2011 and dementia appears to be the second most expensive disease. 53% of elderly with dementia receive home care as well (Peeters, 2012). Because resources are limited, a significant part of the care for the elderly depends on informal caregivers such as relatives. There are about 3.8 million people providing informal care, of which 1.1 million people do so for longer periods of time (de Boer, Woittiez, & van Zonneveld, 2013).

Reducing health care costs without compromising the quality of healthcare poses a challenge. One way to reduce health care costs would be by limiting the symptoms and progression of chronic diseases. To accomplish this, an elderly person could practice self-management. Self-management indicates that a person is an active participant in his or her own treatment (Lorig & Holman, 2003). When elderly monitor their health through self-management and engage in health promoting activities such as exercise, they might be able to prolong their independent living and functionality (Cramm et al., 2013; Gill et al., 2002; Lorig & Holman, 2003). Aspects like monitoring blood pressure, following a healthy diet and regular exercise are especially important for managing certain chronic diseases (Barnes, Lincorn, NGH). Because the costs for nursing and nursing homes are high, there is a great financial benefit to elderly continuing to live independently. Furthermore, elderly themselves prefer to stay autonomous as well (Doekhi, 2014). There is a need for a non-obtrusive, costly means to provide elderly with this kind of care.

There are several possible implementations of this kind of care. In the domain of eHealth especially, there are self-management interventions available that promote healthy ageing and functionality. The concept eHealth is defined by Eysenbach (2001) as "an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the Internet and related technologies." An eHealth intervention, therefore, can be described as a means of health service delivered through the internet. It is different from telemedicine; which commonly refers to the use telephone or video technology in the care for patients (Eland-de Kok, van Os-Medendorp, Vergouwe-Meijer, Bruijnzeel-Koomen, & Ros, 2011). A common problem with regular eHealth interventions aimed at elderly people is that adherence is usually below par. In a study that explored the effectiveness of an online health community (OHC) intervention for elderly with frailty, it was found that only a small number of elderly used the eHealth tool ((Makai et al., 2014). Low adherence appears to be a widespread problem with eHealth interventions, especially in the case of prolonged use (Vedel, Akhlaghpour, Vaghefi, Bergman, & Lapointe, 2013).

This is where smart caring homes aimed at interaction with the user may offer a solution. Smart caring home technology is best described as specialized home technology that assists in the self-management of health problems (Bara, Cabrita, op den Akker, & Hermens, 2015). It does so by providing the user with health information and feedback. By closely monitoring health conditions and by engaging with the programs the technology has to offer, elderly may be able to manage chronic diseases or other age-related impairments to prolong their independent functioning (Bara et al., 2015). Smart caring home technology can offer a more interaction-based means of self-management than regular eHealth interventions. This could positively influence the use of the system and, therefore, adherence.

The present study explores such an interactive smart caring home system: eWALL. It offers a brand new form of interaction between elderly and a large central screen. Details about the system will be discussed in a subparagraph of section 2. The goal of the study is to explore motivational aspects that influence intention to use the system. This will be done through usability and user experience testing with older adults in a small-scale evaluation study. The results will be presented as a redesign advice to improve the system and possibly enhance motivation to use the system. Section 1.2 presents the motivational constructs used in this study and the research questions. Then, section 2 presents the research methodology used. Section 3 shows the results and, finally, section 4 discusses the implications and limitations of the study.

1.2. Theoretical Background and Research Questions

There is more than one way of developing an engaging feedback and monitoring system. For example, one can contemplate a robotic approach in which a technological personification provides feedback to the user. Another approach entails a control panel in the form of a fixed installation, so the user will be free to decide when to interact with the technology. In the latter, emphasis is placed on user interaction; rather than having a robotic feedback system tell the user what to do, the user has control over the interaction and consequently their own well-being. This form of smart caring home technology is expected to be experienced as less obtrusive than its personified counterparts (Bara et al., 2015).

After initial acceptance of the technology in their homes, elderly need to stay motivated to engage with the application in order for the intervention to work. Therefore, the system needs to be designed in a way that promotes interaction and continued use. We need to identify which constructs are important for intention to use a system; then we can assess whether the system used in this study is indeed experienced as engaging.

Motivational constructs are those aspects of a system that make the user want to engage with it, or intend to use it. The Technological Acceptance Model (TAM) and the concept of Perceived Enjoyment as proposed by Marcel Heerink et al. (2008), serve as the theoretical framework for this study. The TAM is a model widely used in behavioural psychology and was originally developed in the context of utilitarian systems (Marcel Heerink et al., 2008; Lee, Kozar, & Larsen, 2003). It can be used to predict and explain the use of computer systems and serve as a means to evaluate design demands and user psychology. The two core constructs in the basic TAM are: Perceived Usefulness and Perceived Ease of Use (Davis, 1989). Based on the original definition by Davis (1989), Perceived Usefulness in this study refers to "the degree to which an elderly person believes that using the self-management technology would enhance his or her health and quality of life." Additionally, Perceived Ease of Use is defined as "the degree to which a person believes that using a particular system would be free of effort." An application easier to use is more likely to be accepted by its users, states Davis (1989). This is especially true for elderly, whom show less interaction with technology they perceive as difficult to use (Czaja et al., 2006; Morris & Venkatesh, 2000; Nahm et al., 2008).

Furthermore, for a partially pleasure oriented system, the construct Perceived Enjoyment forms a crucial factor in the intention to use the system as well (Bara et al., 2015; Marcel Heerink et al., 2008). Perceived Enjoyment is defined by Marcel Heerink et al. (2008) as *"the extent to which the activity of using the system is perceived to be enjoyable in its own*

right, apart from any performance consequences that may be anticipated." Perceived Enjoyment and the constructs of the TAM influence the intention to use a system and, consequently, the actual use of a system. Indeed, research has shown that intention to use a system is a good predictor of actual use of a system (Marcel Heerink et al., 2008; Heerink, Krose, Evers, & Wielinga, 2008). In the study with Perceived Enjoyment, they used a robotic agent named iCat which was connected to a touch screen. Elderly people could play with the robotic agent and filled out questionnaires measuring Perceived Enjoyment and Intention to use afterwards. The study found that the more elderly people perceive a robotic system to be enjoyable, the more they intend to use it. This was proposed to count for all kinds of partly hedonic, partly utilitarian types of systems. Because the eWALL aims to be a partly hedonic system, it means that Perceived Enjoyment is a factor of influence as well. The same was found for the TAM model, where Perceived Usefulness and Perceived Ease of Use influenced behavioural intention and actual use of a system (Tao, 2009). Thus, if eWALL is perceived as enjoyable, useful and easy to use, then elderly will likely use it more.

Based on the constructs Perceived Enjoyment, Perceived Ease of Use and Perceived Usefulness, this study aims to answer the following research question:

How do older adults experience the constructs Perceived Enjoyment, Perceived Ease of Use and Perceived Usefulness in relation to eWALL?

This study aims to answer the research question and it will give recommendations for improving the system. This will be done in terms of a redesign advice in order to enhance the motivation to use the technology.

2. Methods

We conducted an evaluation study to explore the concepts of Perceived Enjoyment, Perceived Usefulness and Perceived Ease of Use in relation to eWALL. The evaluation methods used were a Small Scale Evaluation Protocol, which contained usability tests and a semi-structured interview to assess user experience, and two post-interview questionnaires. The following sections discuss the device used for the study, the participants, the evaluation protocol, procedure and data analysis.

2.1. The Electronic Wall

The home care technology used in the study is the eWALL, short for 'Electronic Wall for Active Long Living'. The eWALL is a smart, caring home environment which supports independent living by offering specialized technology for self-management of chronic diseases and frailty. It consists of a large, central screen that provides a natural interaction through a touch screen interface (Figure 1). A potential user can initiate interaction by simply approaching the screen and interacting with its applications. The eWALL consists of a large number of applications, targeting several aspects of the user's life. Some of these features are digital books containing health information; for example the book on Sleep Monitoring, which shows the quality and quantity of the user's sleep pattern. Other features of the system are Daily Functioning Monitoring, which provides to the user information about their daily activities; Daily Activity Monitoring, where the user can see how active he/she has been; Cognitive Training and Physical Training, which provide the user with mental or physical exercises. When implemented, the data are meant to be collected through sensors in the home monitoring network and sensors worn by the user. For purposes of the study however, the data are entirely randomised and based on a fictional persona: Michael. Details about the project can be found on the official website: http://ewallproject.eu/.



Figure 1. Image of the eWALL main screen in active mode.

2.2. Participants

The target group for the study were older adults of ages 55 and up. Inclusion criteria were the ability to stand for longer periods of time and the ability to reach the facility independently. Participants were recruited through 'Stichting 55 plus' through a press-report and an invitation to a meeting about the research project (see Appendix D). Interested participants could contact the Roessingh Research and Development centre, where the meeting was held. Afterwards, they received a summary of the meeting and were contacted by phone or e-mail to schedule the experiments. A total of 9 Dutch participants were recruited through 'Stichting 55 plus', of which 5 male and 4 female participants. Two other, German participants were recruited through convenience sampling from family members, one male and one female. Mean age of the participants was 71 years.

2.3. Small Scale Evaluation Protocol

The study had a qualitative design and consisted of 9 different interview scenarios. The interview was task based and semi-structured. The researcher was allowed to ask additional questions to find out more about the participant's impression of the system, but mostly followed the 45 questions in the protocol. The protocol had been used in previous tests and was adapted to fit the purpose for this study. Any alterations were based on the literature in order to get a

good impression of the constructs Perceived Enjoyment, Perceived Usefulness and Perceived Ease of Use. A figure of the test architecture can be found in Appendix H.

Scenario 1 evaluated the eWALL's main screen and its features. Examples of questions in this scenario were: 'Can you imagine having a large screen like this in your house?' and 'What is your first impression?'. Scenario 2 evaluated the books with personal data about the user. Scenario 3 explored the feature of Daily Functioning Monitoring, scenario 4 was about Daily Activity Monitoring and scenario 5 about Sleep Monitoring. These scenarios each had similar questions. Examples of questions in these scenarios were: 'Which of the information is useful to you?' and 'Is it interesting for you to track your daily activities?'. Scenarios 6, 7 and 8 were about cognitive and physical training. Finally the last scenario consisted of questions about the general experience with the system. Examples of these questions were: 'How easy or difficult will it be to learn to work with eWALL?' and 'What do you think about the way eWALL looks?'.

During each scenario, participants were allowed to freely explore the screen and its features. Usability was also assessed during the interview process. This was done to establish the usability of eWALL and to observe any problems experienced by users of the interface. In addition, the usability tests gave information about the way participants use the application, and whether this deviated from the intention of the developers. Furthermore, the participants were encouraged to think aloud when they interacted with the screen. Thinking aloud refers to the technique discussed by Jaspers (2009), meaning a user-based testing method by which the user states directly what he or she thinks, in order to obtain a "model of the cognitive processes that take place while a person tackles a problem". The method is particularly useful for this purpose, because cognitions are assessed concurrently with their occurrence.

The full small scale evaluation protocol can be found in Appendix A. It was partially translated from English to Dutch for the purpose of interviewing the Dutch participants and from English to German for the German participants.

2.4. Post-interview Questionnaires

The post-interview questionnaires were a User Experience Questionnaire (UEQ) and a demographic questionnaire. They can be found in Appendices B and C. The demographic questionnaire contained questions about technological experience as well. The UEQ is a questionnaire to measure user experience and it measures both classical usability aspects (efficiency, perspicuity and dependability) and user experience aspects (originality,

stimulation and attractiveness). It was thoroughly tested in different studies concerning different products. The UEQ scales are considered sufficiently consistent, with a Cronbach's Alpha of 0.70 or more (Table 1). Dutch and German translations were retrieved from the original website (http://www.ueq-online.org/). The UEQ was used to gain more insight in user experience of the interactive technology. Answers given on a questionnaire might suffer less from a social desirability bias than answers given in a face-to-face interview. Furthermore, triangulation in social research increases the credibility of qualitative analyses. According to O'Donoghue and Punch (2003), triangulation is a "method of cross-checking data from multiple sources to search for regularities in the research data." As such, the data from the interviews and the questionnaires can be compared to gain a more complete and accurate picture of the user experience with eWALL.

Scale	Internal Consistency (α)	Description
Attractiveness	0.92	Overall impression of the product. Do users like or dislike is?
Perspicuity	0.82	Is it easy to get familiar with the product?
Efficiency	0.72	Can users solve their tasks with the product without unnecessary effort?
Dependability	0.84	Does the user feel in control of the interaction?
Stimulation	0.81	Is it exciting and motivating to use the product?
Novelty	0.70	Is the product innovative and creative?

Table 1

Measured Scales	in the l	UEQ and	Their .	Internal	Consistency
		~ ~			

2.5. Procedure

The experiments were conducted in the Roessingh Research and Development centre, scheduled at least 2 hours apart. There were two experimenters present during most of the interviews; one to conduct the interview and one to observe and take notes. When it was not possible to have two experimenters present, one would function as both observer and interviewer simultaneously. The participants were escorted to the lab where eWALL was

standing. After a short introduction about the goal of project and eWALL, the participants were asked to sign the informed consent form. The interviews were then recorded with mobile phones, audio only. The participants were informed of the fact that we were not responsible for the creation of eWALL, so that they would feel free to express any criticism they might have. They were encouraged to think aloud during the interviews and given a demonstration of the thinking aloud method if necessary. Length of the interviews was approximately one hour. The participants could sit down when they wanted to, but were encouraged to stand for the duration of the interview. It was possible to deviate from the exact order of questions for each scenario, or to skip any questions that were already answered. Participants were asked to elaborate on short yes or no answers. After the interviews, participants were asked to fill out the questionnaires (5 minutes). Each participant received an incentive in the form of a box of chocolates at the end of the experiment. The global structure of the evaluation protocol and a timeline are shown in Table 2.

Table 2

Activity	Estimated Time (in minutes)
Greetings and introduction	5
Informed consent	5
Task-based evaluation (interview)	45
Post-questionnaires	10
Incentive and goodbyes	5
Total time	70

2.6. Data Analysis

The interviews and questionnaires were analysed through qualitative analysis and some descriptive data analysis in SPSS. First of all, the interviews were recorded and transcribed literally in Google Spreadsheets. Next, the interviews were translated from Dutch or German to English in natural wording. The fragments relevant to the research constructs were selected and inductively coded. For Perceived Enjoyment, those fragments were comments about the design (aesthetics) of the main screen of eWALL in order to get an impression of the attractiveness of eWALL. Secondly, the general enjoyment of the system was explored by

coding the answers given on question 44 of the protocol: "Did you enjoy using eWALL?". Reason for this is that the main screen is the first thing users see and that the purpose of the main screen is to stimulate interaction, directly influencing motivation to use the system. The amount of positive and negative remarks were counted to obtain a general appraisal of the main screen design (positive, mixed or negative). The codes used for Perceived Enjoyment can be found in Appendix E.

Fragments about Perceived Usefulness were selected from the first impression of the system and the general experience with the system. It was explored by coding the answers given on question 41 of the protocol: "Would you want to use the system at home? Why (not)?". This question gave an impression of whether participants would want the system implemented and why (or why not) they regard it as a useful technology to have. The codes used for Perceived Usefulness can be found in Appendix F.

Finally, fragments about the construct Perceived Ease of Use were also selected from the first- and general impression of the system. In the analysis of this construct, the experience from German participants 10 and 11 weren't included in the results. They were unable to interact with the touch screen due to malfunctions. Their opinion about the (ease of) interaction with eWALL would therefore not be credible. The construct was divided into a first impression of handling eWALL and a general impression of the confidence in learning how to use eWALL (question 41 of the protocol). The codes used for Perceived Ease of Use can be found in Appendix G.

All the data obtained from the post-interview questionnaires were entered in SPSS. The questions from the UEX questionnaire were labelled according to their scales (Attractiveness, Perspicuity, etcetera). The scores of the 7-point Likert Scale were interpreted as 'value=1' being the most negative appraisal and 'value=7' being the most positive. For example with the scale Attractiveness, the values were: 1= Very unattractive, 2=Unattractive, 3=Somewhat unattractive, 4=Neutral, 5=Somewhat attractive, 6=Attractive, 7=Very attractive. Some of the questions were oppositely framed and had to be transformed to get the correct values (questions 3, 4, 5, 9, 10, 12, 17, 18, 19, 21, 23, 24 and 25). Mean scores were then calculated. The scales Attractiveness and Stimulation were analysed as indicators of Perceived Enjoyment. Perspicuity, efficiency, dependability are fitting of Perceived Ease of Use. The scores on the Novelty scale were outside the scope of this study and therefore not used.

3. Results

The following section presents the demographic variables of the participants, the outcomes of the interviews and the results from the user experience questionnaires. These results are based on the three constructs measured to determine use of the system: Perceived Enjoyment, Perceived Usefulness and Perceived Ease of Use.

3.1. Demographic Variables

A total of 11 participants participated in the interviews and filled out the questionnaires, of which 9 in Dutch and 2 in German. The participants ages varied between 63 and 87 years, with an average age of 71 years (SD: 6,714). There is an even distribution of gender with 6 male and 5 female participants. Education is categorized as higher and lower; higher meaning college or university and lower all the other forms of education. A majority of the participants followed a higher education. The demographics are summarised in Table 3.

Table 3

	Male	Female	Total
No. of users	6	5	11
Mean age (years)	74	69	-
Nationality			
Dutch	5	4	9
German	1	1	2
Education			
Higher	4	3	7
Lower	2	2	4

Demographics of the Participants

The participants filled out a questionnaire measuring their experience with technology. All participants said to have experience with mobile phones. Most of them said to have experience with a laptop or PC, mobile internet and smartphones as well. 7 out of 11 participants have used tablet, while the other 4 had no experience with using a tablet at all. These results are summarised in Table 4.

Tablet Smartphone Mobile PC/Laptop Mobile Internet Phone 2 5 5 1 0 At least once per hour 3 7 5 At least once a day 3 4 At least once a week 0 3 1 1 2 Less often 1 1 1 0 0 Never 2 2 0 2 4

Technological Experience of the Participants

Table 4

3.2. User Experience Evaluation

We analysed the answers from the interviews by sorting and coding the transcripts in accordance with the three motivational constructs. Each construct has its own coding scheme (see Appendices E, F and G). User experience of these constructs is based on questions regarding three separate categories: a first impression of the system, an impression of the system in general and the main screen. The following sections show the outcomes of the interviews separate for each motivational construct. Information regarding the usability of the system was also collected.

3.2.1. Perceived Enjoyment

The main screen gained both appraisal and criticism from the participants. 3 out of 11 participants were positive, but most had mixed (N=4) or negative (N=4) views about the main screen design. Specific remarks about the main screen are summarised in Table 6. More than half of the participants commented negatively on the window feature of the main screen of eWALL. It was experienced as depressing, too prominent or useless. "*I can look out the window*," was mentioned by one of the participants. Another participant said: "*I want to close the curtains because I don't need to see rain all the time*".

A second negative aspect frequently mentioned was the busyness of the screen. "*There are distractions that don't matter. If it is just decoration, away with it*". About half of the participants commented on this. 3 out of 11 participants also didn't like it how (some of) the furniture looked old-fashioned and that an off-button was lacking. "*When I don't use it I*

would want it to be dark. So please, not a turned on screen all day long. You'll go insane," is an example of how strongly an older adult felt about the need for an off-button. "One of the most important things is something I don't see: an off button. So that I can decide that the noise gets turned off, right now". This feeling didn't change when zooming in on just the portrait; the 'inactive mode'.

Some participants however experienced the design as homely instead of old-fashioned. 4 out of 11 participants felt the main screen looked orderly. "*This is fine. It looks clear this way*," was one positive comments about the orderliness of the screen. All and all, there were more negative than positive remarks made about the main screen design.

Table 5

Appraisal	Ν
Positive (+)	3
Mixed (+/-)	4
Negative (-)	4
Total	11

Table 6

Positive and Negative Remarks About the Main Screen

Positive	Ν	Negative	Ν
Orderly design	4	Dislikes window	6
Attractive design	3	Busy screen	5
Homely design	2	Old-fashioned design	3
		Lacks off-button	3
		Large screen size	2
		Childish design	1
		Unfitting design	1
		Bad wording	1

When participants were asked whether they enjoyed using eWALL, most of them said they did. 7 out of 11 participants found eWALL to be enjoyable. Participants did not expand much on why they enjoyed it, but there were suggestions to make the system more enjoyable. One participant mentioned that he would enjoy the technology more on a tablet instead of a large screen. Others suggested that the system should be customisable to personal preferences in order to enhance enjoyment. During the interviews, participants expressed most enjoyment in playing the games and that it would be fun to play them together with the grandchildren. Just one participant did not enjoy using the system, because it was too much technology. Overall enjoyment of eWALL is summarised in Table 7.

Table 7

Appraisal	N
Enjoyable	7
Somewhat enjoyable	3
Not enjoyable	1
Total	11

Overall Enjoyment in Using eWALL

3.2.2. Perceived Usefulness

Some of the participants did not want to have the technology implemented yet, because they were not yet in a position of needing it. Therefore, they did not regard it as useful for them. A lot of participants (5 out of 11) mentioned that they would not want the technology in its current form. It was experienced as unfinished or in need of adjustments before they would consider using it. For example, one of the participants experienced the sad faced smileys in the Daily Activity Monitoring as punishment: "*Yes, it's long from done. I mean, the punishments should be removed. There are a lot of things that make me not want to do it yet*". Altogether, just 2 of 11 participants would want to implement and use the eWALL in their homes. In its current state, eWALL is regarded as obtrusive and privacy sensitive by 3 out of 11 participants. It was mentioned more than once that eWALL would be too obtrusive if it is not combined with the television screen: "And it would be hanging on my wall somewhere. Correct? And next to it would be my regular TV. That won't work". Others would rather see the technology in a less obtrusive form, such as a tablet. Contact with health care and/or family was regarded as the most important reason for using the technology, because it was mentioned most frequently (3

times). See Table 9 for a summary of all the reasons for wanting or not wanting to use the system.

Table 8

Usefulness of the Technology

Implementation	Ν
Yes	2
Not yet	3
Not like this	5
No	1
Total	11

Table 9

Reasons for (Not) Wanting to Use the System

Usefulness	Ν	Objections	Ν
Contact with healthcare/family	3	No need for it	4
Independence	1	Privacy concerns	3
Reassurance	1	Obtrusiveness	3
Amusement	1	Financial concerns	2
		Unfinished	1
		Too much technology	1

3.2.3. Perceived Ease of Use

The interviews give an impression of how easy or difficult older adults find it to use of the system and how they judge their ability to master using the system overall. A first impression of the system indicated how comfortable the older adults were to use the technology. 4 out of 9 participants viewed the interaction with eWALL as easy. For the most part they attributed that to their experience with similar technology. "*That goes well. Because I already work with screens, so in that way I am used to technology*," as one participant mentioned it. Two participants had no opinion about the interaction yet. One participant raised questions regarding physical limitations of the target group and handling a touch screen. Two participants did not perceive handling eWALL as easy, but that with some practice it would be possible to do. For

example: "You need to practice. You need to try and learn what certain things mean". Table 10 contains a summary of these first impressions.

Table 10

First Impression of Perceived Ease of Use

Remarks	Ν
Easy handling	1
Easy handling: experience	3
Needs practice	2
Difficult handling: physical limitations	1
No opinion	2

Near the end of the interview, participants were asked how easy or difficult they would find it to master using the system. Most of the participants (5 out of 9) said that they would find it easy to master; three of which mentioned they had previous experience with technology. One of them would find it easy to master when training is provided. 3 out of 9 participants view the technology as "*possible to learn*," even for elderly. They used examples from their own environment to illustrate that elderly are able to learn new technology: "*The woman I was with, she was 90. I told her to start using a computer. She started and had lessons for a week. She then spent day and night on that computer until she was 85 years old. It enriched her life*". Two participants were less confident about mastering the system. One mentioned difficulties for the elderly target group. The other said that it depends on the individual; not everyone could learn it. In general, the system was perceived as easy enough to use by the participants (Table 11).

Table 11

Subcategory	Label	N
Easy to master	Easy to master	2
	Easy to master through training	1
	Easy to master with experience	3
Possible to master	Possible to master through practice	3
Difficult to master	Difficult to master for the target group	1
Individual differences	Ability to learn depends on the person	1

General Impression of Perceived Ease of Use

3.3. User Experience Questionnaire

The User Experience Questionnaire (UEQ) was a second way of analysing user experience. Participants had to fill out a questionnaire with a 7-point Likert scale. The mean scores on this questionnaire can be found in Table 12. Perceived Enjoyment was measured through the scales Attractiveness and Stimulation and Perceived Ease of Use was measured through the scales Perspicuity, Efficiency and Dependability. All scales had a mean score of 5 or higher, indicating a slightly more positive experience (4 is neutral). Dependability received the lowest score with a mean of 4.95 and Stimulation was valued highest of all the scales with a mean score of 5.20. Some participants were rather positive on all scales, while others gave mostly negative ratings. This resulted in relatively neutral mean scores.

Table 12

Mean Scores per UEX Scale

Scale	Mean	
Attractiveness	5.08	
Perspicuity	5.14	
Efficiency	5.16	
Dependability	4.95	
Stimulation	5.20	

4. Discussion and Conclusion

The goal of this study was to explore motivational constructs that influence intention to use a home care technology system and to identify how older adults experience these aspects in relation to eWALL. The explored motivational constructs were: Perceived Enjoyment, Perceived Usefulness and Perceives Ease of Use. They were based on literature indicating that positive experiences with these constructs improve the intention to use a technology and, therefore, actual use of a technology.

Through usability testing and qualitative research methods, we aimed to answer the following research questions:

- 1. How do older adults experience Perceived Enjoyment in relation to eWALL?
- 2. How do older adults experience Perceived Usefulness in relation to eWALL?
- 3. How do older adults experience Perceived Ease of Use in relation to eWALL?

The following section will discuss the results of this study and recommendations for further development and improvement of eWALL. It will also discuss any limitations to the findings.

The results indicate that Perceived Enjoyment of the system in general was positive. Although participants did not elaborate much on the general enjoyment, they expressed most enjoyment while playing the games. The aim of the gaming feature is to provide cognitive training and enjoyment for the elderly. Games have long been used to improve cognitive function and other functionality. In a study with non-institutionalised elderly, arcade-type videogames were able to improve perceptual motor skills and cognitive functioning (Drew & Waters, 1986). Similarly, a meta study found that computerized cognitive training is more effective in improving cognitive function than paper-and-pencil approaches (Kueider, Parisi, Gross, & Rebok, 2012). The older adults did not need to be technologically savvy in order to benefit from these effects. It was not reported whether the elderly enjoyed playing the games, but they showed scores of improved wellbeing. For this reason, the games are an important feature of eWALL. They stimulate interaction and function to prolong mental health. So when this feature is improved, it will likely positively influence enjoyment and cognitive functionality.

In order to improve enjoyment, some participants suggested that the games should be challenging. Others suggested the possibility of playing the games together with family, especially the grandchildren. These findings are comparable to the literature, where it was found that challenge, socialization and fun are important determinants of why older adults would be interested in playing games (Diaz-Orueta, Facal, Nap, & Ranga, 2012). Playing the games together would not compromise its effects on cognition, as participating in social activities has been found to improve cognitive function as well (Glei et al., 2005). Moreover, the social component appears to be an important factor in motivation. As discussed by Ijsselsteijn, Nap, Kort, and Poels (2007), the number one motivation to play games is the social component. Many elderly enjoy games as a means of socializing. Therefore, it is advisable to account for this in the further development of the gaming feature. The feature should include challenging games that can be played together, for it to be most enjoyable.

The design aesthetics of eWALL are a second factor of Perceived Enjoyment. The participants made a lot of negative remarks about the design of the main screen. This means that there is room for improvement in that area. In order to enhance experience, issues with the main screen should be addressed. Based on the results, these issues are mainly with the weather forecast, the old-fashioned design and the lack of an off-button. They negatively influenced the enjoyment of eWALL.

In the development of the main screen, the design was intentionally made to look oldfashioned. For example, there is an old television screen in the design as opposed to a modernday LCD screen. The design was meant to relate to the older adults' history. However, it appears that the older adults do not experience these attributes as nostalgic. The design was even said not to fit in with the rest of the living room. It is possible that older adults actually prefer modern design over things that remind them from their past. One way to account for this, would be by removing some features altogether, such as the old-fashioned lava lamp. The weather forecast could be removed as well, because the older adults generally did not like it.

Some participants suggested the design of the main screen should be customised to the individual instead. Customization refers to the extent to which the user can adapt the technology to his or her needs. This has been found to positively influence aesthetics and perceived usability (Blom & Monk, 2003). It encourages users to take ownership of the system. Currently, only the background of the screen is customizable in eWALL. If users can choose what they want eWALL to look like, without changing its functionality, then this could enhance enjoyment. A recommendation would be to allow users to turn eWALL off and to customise the main screen to their liking.

It was also apparent that most participants did not want to use the system at home. They felt no need for the technology or did not like eWALL in its current form. Experience with Perceived Usefulness was therefore not optimal. In order to improve Perceived Usefulness and intention to use the system, a couple of things need to be addressed.

Some participants raised privacy concerns regarding the implementation of the technology. More people might be inclined to use the technology if there are less concerns for privacy. The concerns were related to the monitoring of the user and to visitors viewing the content of the screen. The latter can be dealt with by allowing the screen to be turned off, as mentioned before. Furthermore, monitoring concerns are not uncommon in smart home technologies. In a study assessing senior residents' perceived need and preference for smart home technologies, these privacy concerns were raised as well (Demiris, Hensel, Skubic, & Rantz, 2008). However, these adults were willing to install the applications they perceived as useful in their own home. This suggests that monitoring is less of a problem if there is a need for certain applications. Furthermore, privacy shows to be of less concern when less invasive monitoring is used (Fisk, Rogers, Charness, Czaja, & Sharit, 2009). In that respect, a shortcoming of the present study is that the users did not perceive the eWALL as useful for them yet, because they did not have significant health problems. So, the experience of perceived usefulness might be different for the target group of frail elderly. After all, when the perceived benefits do outweigh the privacy concerns, elderly are more inclined to implement the technology (Wild, Boise, Lundell, & Foucek, 2008). Therefore, more tests with frail elderly are needed to accurately explore the perceived usefulness of the system.

It is however recommended to enhance feelings of privacy by making the screen viewable only to the user. Information should still be sharable with the health care, because this kind of communication is regarded as a useful feature of eWALL by the participants. But only if and when the users chooses to share the data. Secondly, it is advisable to combine the eWALL technology with a television or to make it optional for a tablet. Otherwise, the technology might be experienced as too obtrusive to have at home as stated by some participants. Considering eWALL aims to be less intrusive than other monitoring technologies such as robotics, this concern is important to address. This way, usefulness can be improved.

Finally, most participants experienced no difficulty in using the system after initial trialand-error. All of them had previous experience with technology. So, although the technology was easy enough to use for the research group, the experience could possibly be lower for elderly without this technological experience. Especially since elderly in general experience more computer anxiety than younger adults and this has a negative impact on perceptions of ease of use (Hackbarth, Grover, & Yi, 2003; Laguna & Babcock, 1997). Participants mentioned that the system would become easier to master through training and practice. It was suggested that elderly users should be provided with training, so they would have no difficulty using the technology. This seems rather important for elderly, whom feel more confident in using technology when training is provided (Broady, Chan, & Caputi, 2010; Demiris et al., 2008). Training has also shown to have positive effects on self-efficacy, and as such indirectly on ease of use (Torkzadeh & Van Dyke, 2002; Venkatesh & Davis, 1996). For that reason it is recommended that training be provided when implementing the system.

However, there are some limitations to the outcomes of this study. First of all, the sample size was smaller than we had hoped. A larger sample size would have given a better impression of the way older adults experience the technology. It is difficult to generalize any findings based on the experience of a small group of people. There seemed to be some consensus among them on certain aspects of eWALL, but with a small sample size this could also be a coincidence. Secondly, the experience of research group might not be representative for the target group of the technology. eWALL is aimed at vulnerable elderly with age related frailty, but the older adults used in the study were relatively active and healthy older adults. This explains why the participants in the study judged the perceived usefulness of eWALL lower than expected. Most of them did not see the use of implementing the technology yet. Furthermore, the research group had experience with technology. Most elderly do not have previous experience with touch screens. They might therefore experience the use of eWALL as more difficult than the participants used in this study. So, although eWALL was perceived as easy enough to use, this might be different for the target group without technological experience. The results should therefore be interpreted with caution.

Another possible limitation to semi-structured interviews was a social desirability bias in the answers given. It appears that this was not the case, because the user experience scores on the UEQ were not much lower than those from the interviews. We also accounted for the social desirability by telling the participants beforehand that the system was not ours, so that they would feel free to express any feelings they might have. Therefore, we can assume that participants were not afraid to give their honest opinion and criticism.

In conclusion, we can say that the eWALL is a good initiative to improve independence and quality of life for the elderly, but motivation to use the system is not as high as it could be. This could be improved by adjusting certain aspects of eWALL that hinder the positive experience of enjoyment, usefulness and ease of use. However, more research is needed with members of the target group in order to accurately account for their wishes and needs when it comes to technology. In the future of health care, it becomes increasingly important to provide elderly with a costly means to manage their diseases. eWALL is definitely a step in the right direction when it is not viewed as obtrusive technology, but as a means to stay healthy and independent.

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Appendix A

Partially Translated Small Scale Evalution Procotol

The checklist

Tasks	Check
1 WEEK BEFORE	
Explore the interface, try out all the scenarios proposed. It is necessary to have a	
first-hand experience with the system.	
Book the evaluation facility.	
Recruit end-users for specific dates and times.	
Ask one of your colleagues to be available during the study as the observer .	
Prepare and send instructions for the participants how to find the facility.	
Print Informed Consent forms (consider some extra copies in case participants	
request to take it home).	
Print the questionnaires .	
Print this protocol.	
Arrange incentives for participants.	
3 HOURS BEFORE	
Check the prototype and the camera if they work.	
Make sure informed consent and questionnaires are in place.	
Rehearse the protocol.	

Facilitator tips

- > Make small talk with the participant to warm her up.
- > Explicitly encourage each participant to **think aloud** about their actions on the tasks given.
- > Listen and do not make any judgments. Just **nod your head** to show that you understand her.
- > If you think of more questions, go ahead and ask them. The more feedback, the better.
- > Dig below top-of-the-mind answers. **Find out why and how.**

Timeline

Time (in min)	Activity
5	Introduction
5	Informed Consent
45	Task based evaluation
5	User Experience Questionnaire
5	Post-questionnaire (Demographic Data, Technology Experience)
5	Incentives/Sign reimbursement, thanks, goodbye!
65-70	Time total

Introduction

- Thank them for participating
- Explain briefly what will happen within the next hour. (een interview & 2 korte vragenlijsten)
- Introduce shortly the project and the purpose of eWall.
- Underline that we are not aiming to judge their opinions but want to evaluate our ideas: "Er zijn geen verkeerde antwoorden. U mag op elk moment kritiek uiten, dit product is niet van ons. We zijn geïnteresseerd in uw mening en gedachten. Alles wat u zegt is behulpzaam en waardevol voor het project. Hoe meer u kunt bijdragen aan de evaluatie, hoe beter."
- Encourage them for thinking aloud. Example: pour & drink coffee
- Explain that everything is recorded and why an observer is present

Informed Consent

The participant receives an Informed Consent (IC) that must be read and signed by her/him in order to participate. If needed, please go through it with the participant to gain her/his trust.

Personas

Introduce Personas to demonstrate them a potential end user:

Persona:	Michael, 67 jaar, man	
Woonsituatie: Kenmerken:	Woont thuis met zijn vrouw Maria in de stad. Hoge bloeddruk, Vergeetachtgheid, Sociale Angst, Gebrek aan motivatie, Isolatie, Ervaring met moderne technologie.	

Task-based Evaluation:

Task 1: Hoofdscherm

"Stelt u zich voor dat u het eWall systeem thuis heeft en dat u in de woonkamer bent. U wilt gebruik maken van de eWall, dus loop alstublieft naar het scherm."

[When they arrive in front of the screen, close enough to touch it, Press ENTER on your wireless keyboard -> the screen zooms

out and shows the full screen.]



Questions:

Q1: Wat is uw eerste indruk?

Q2: Kunt u beschrijven hoe u de interactie met het scherm ervaart?

Q3: Kunt u zich voorstellen een scherm als deze in uw huis te hebben? Waarom wel/niet?

Q4: Wat verwacht u achter elk onderdeel van het scherm te vinden?

Observation:

O1: How does the user interact with eWall? \rightarrow Screen size, distance to the screen, standing interaction, active/passive mode, Does the user find out that objects launch representative information by touching it?



Task 2: Persoonlijke gegevens

"eWALL houdt boeken bij over uw leven. Het wil laten zien hoe gezond u leeft."

Questions:

Q5: Wat vindt u van deze functie?

Task 3: Daily Functioning Monitoring

"Open alstublieft het boek Mijn Dag."

Questions:

Q6: Wat is uw eerste indruk?

Q7: Kunt u vertellen wat u gisteren heeft gedaan volgens dit overzicht?

Q8: Vindt u het interessant om uw dagelijkse bezigheden bij te houden? Waarom wel/niet? Q9: Welke informatie vindt u nuttig?

Q10: Hoe makkelijk vindt u de bediening?

Q11: Kunt u zich voorstellen zulke informatie met uw familie te delen? En met uw verzorger of huisarts?

Observation:

O2: How does the user interact with eWall? \rightarrow touch interaction, swipe functionality to see another day

Task 4: Daily Activity Monitoring

"Laten we kijken naar uw boek over fysieke activiteit. Open het alstublieft en krijg te zien hoe actief u de laatste dagen bent geweest." (Open the Activiteit book)

Questions:

Q12: Wat is uw eerste indruk?

Q13: Leg uit wat u kunt opmaken uit het overzicht van vandaag.

Q14: Hoeveel stappen heeft u afgelopen dag gezet?

Q15: Vindt u het interessant om uw fysieke activiteit bij te houden? Waarom wel/niet?

Q16: Welke informatie vindt u nuttig?

Q17: Wat zou u verder nog willen weten over uw fysieke activiteit?

Q18: Hoe makkelijk vindt u de bediening?

Q19: Kunt u zich voorstellen zulke informatie met uw familie te delen? En met uw verzorger of huisarts?

Observation:

O3: Does the user find the way from the DFM to the DPAM?

Task 5: Sleep Monitoring

"Stel u wilt weten hoeveel uur u de afgelopen nacht geslapen heeft. Wat zou u dan doen?"

Q20: Wat is uw eerste indruk?
Q21: Leg uit welke info u hier kunt vinden.
Q22: Hoeveel onderbrekingen van de slaap zijn er te zien? (alleen maar vragen als het nog niet bij de laatste vraag genoemd is)
Q23: Vindt u het interessant om uw slaapgewoonten bij te houden?
Waarom wel/niet?
Q24: Welke informatie vindt u het meest nuttig?
Q25: Wat zou u verder nog willen weten over uw slaap?
Q26:Hoe makkelijk vindt u de bediening?
Q27: Kunt u zich voorstellen zulke informatie met uw familie te

(Geef tussendoor reminders van hardop denken)

Task 6: Cognitive Training

"We gaan nu kijken naar een paar spelletjes die het geheugen trainen. Ga terug naar het hoofdscherm en open het schaakboard alstublieft." (zonder een spelletje te openen)

Q28: Wat is uw eerste indruk? Q29: Wat verwacht u hier te kunnen doen? Q30: Wat verwacht u achter elk onderdeel op het scherm te vinden?



"Probeert u maar een paar spellen uit alstublieft."

delen? En met uw verzorger of dokter?











Q31: Vindt u dit soort spellen leuk? Q32: Kunt u zich voorstellen deze spelletjes thuis op een soortgelijk scherm te spelen? Waarom wel/niet? Q33: Zijn er nog andere spellen die u hier zou willen zien?

Task 8: Physical Training

"Open alstublieft het video gymnastiekprogramma en start een video."



(Het video wordt kort voor het eind gepauseerd)
Q34: Wat is uw eerste indruk?
(laat de trainingsevaluatie zien)
Q35: Denkt u dat technologie een goed persoonlijk trainingsplan voor u zou kunnen
opstellen, gebaseerd op zulke vragen*?
(* wijst naar de trainingsevaluatie)
Q36: Wat vindt u ervan om na elk video trainingsprogramma zulke beoordelingen te geven?
Q37: Wat vindt u van dit soort trainingsinstructies?
Q38: Zou u zelf zulke oefeningen uitvoeren als het aangeboden zou worden? Zo ja: hoe vaak?

"Nu is het interview bijna klaar; er is maar nog een onderdeel met algemene vragen."

Task 9: Algemene indruk / ervaring

"Tot slot heb ik nog een paar vragen over uw beleving van het system in zijn geheel."

Q39: Wat vindt u van dit systeem?

Q40: Nu dat u het heeft gebruikt, zou u dit systeem bij u thuis gebruiken? Waarom wel/niet? Q41: Hoe makkelijk of moeilijk zou u het vinden om de eWall te leren gebruiken?

Q42: Hoe makkelijk of moeilijk zou het zijn om eWall te gebruiken in uw dagelijkse leven? Q43: Wat vindt u van het uiterlijk van eWall?

Q44: Vindt u eWall leuk om te gebruiken? Waarom wel/niet?

Q45: Tot slot, als u de makers van eWall advies zou kunnen geven voor de verbetering van het systeem, wat zou u dan zeggen?

Appendix B

User Experience Questionnaire in Dutch

Evaluatie van het product

Vul de onderstaande vragenlijst in om het product te beoordelen.

De vragenlijst bestaat uit paren van tegengestelde eigenschappen die van toepassing kunnen zijn op het product. De cirkels tussen de twee eigenschappen symboliseren de verschillende gradaties tussen de twee tegenstellingen.

Kruis de cirkel aan welke het meest overeenkomt met de indruk die het product op u heeft nagelaten.

Voorbeeld:

Aantrekkelijk $\bigcirc \otimes \bigcirc \bigcirc \bigcirc \bigcirc \bigcirc \bigcirc \bigcirc$ onaantrekkelijk

Dit antwoord betekent dat je het product dus aantrekkelijk vindt.

Probeer zo spontaan mogelijk de lijst in te vullen. Wacht dus niet te lang met uw keuze, zodat de antwoorden zo dicht mogelijk bij u oorspronkelijke indruk van het product liggen.

Soms zijn er misschien eigenschappen die niet helemaal overeenkomen met de eigenschappen van het specifieke product. Probeer dan zo goed mogelijk te antwoorden. Zorg er wel voor dat er op elke regel een cirkel aangevinkt is. *Let op: er is geen goed of fout antwoord; het is uw persoonlijke mening die telt!* Gelieve nu het product te beoordelen door het aanvinken van één cirkel per regel.

	1	2	3	4	5	6	7		
Onplezierig	0	0	0	0	0	0	0	Plezierig	1
Onbegrijpelijk	0	0	0	0	0	0	0	Begrijpelijk	2
Creatief	0	0	0	0	0	0	0	Fantasieloos	3
Makkelijk te leren	0	0	0	0	0	0	0	Moeilijk te leren	4
Waardevol	0	0	0	0	0	0	0	Waardeloos	5
Vervelend	0	0	0	0	0	0	0	Prikkelend	6
Oninteressant	0	0	0	0	0	0	0	Interessant	7
Onvoorspelbaar	0	0	0	0	0	0	0	Voorspelbaar	8
Snel	0	0	0	0	0	0	0	Langzaam	9
Origineel	0	0	0	0	0	0	0	Conventioneel	10
Belemmerend	0	0	0	0	0	0	0	Ondersteunend	11
Goed	0	0	0	0	0	0	0	Slecht	12
Complex	0	0	0	0	0	0	0	Eenvoudig	13
Afstotend	0	0	0	0	0	0	0	Begeerlijk	14
Doorsnee	0	0	0	0	0	0	0	Vernieuwend	15
Onaangenaam	0	0	0	0	0	0	0	Aangenaam	16
Vertrouwd	0	0	0	0	0	0	0	Niet vertrouwd	17
Motiverend	0	0	0	0	0	0	0	Demotiverend	18
Volgens verwachting	0	0	0	0	0	0	0	Niet volgens verwachting	19

Inefficient	0	0	0	0	0	0	0	Efficient	20
Overzichtelijk	0	0	0	0	0	0	0	Verwarrend	21
Onpragmatisch	0	0	0	0	0	0	0	Pragmatisch	22
Ordelijk	0	0	0	0	0	0	0	Rommelig	23
Aantrekkelijk	0	0	0	0	0	0	0	Onaantrekkelijk	24
Sympathiek	0	0	0	0	0	0	0	Onsympathiek	25
Conservatief	0	0	0	0	0	0	0	Innovatief	26

Appendix C

Demographic Questionnaire in Dutch

Vult u alstublieft deze vragenlijst in over demografische/technologische informatie.

Hoe oud bent u?	jaar
Wat is uw geslacht?	O Vrouw O Man
Wat is of was uw beroep?	
Wat is uw educatieve achtergrond (bijv. basisschool, middelbare school, MBO, HBO of universiteit)? Als uw scholing niet in een van de bovenstaande opties staat, probeer deze dan anders te omschrijven.	
Bent u in het bezit van een smartphone?	O Ja O Nee
Gebruikt u een smartphone?	O Ja O Nee
Hoe vaak gebruikt u een smartphone?	 Minimaal een keer per uur Minimaal een keer per dag Minimaal een keer per week Minder vaak Nooit
Hoe lang gebruikt u al een smartphone?	maand
Gebruikt u mobiel internet?	O Ja O Nee
Hoe vaak maakt u gebruik van mobiel internet?	 Minimaal een keer per uur Minimaal een keer per dag Minimaal een keer per week Minder vaak Nooit

Bent u in het bezit van een mobiele telefoon?	O Ja O Nee
Gebruikt u een mobiele telefoon?	O Ja O Nee
Hoe vaak gebruikt u een mobiele telefoon?	 Minimaal een keer per uur Minimaal een keer per dag Minimaal een keer per week Minder vaak Nooit
Hoe lang maakt u al gebruik van een mobiele telefoon?	maand

Bent u in het bezit van een PC/Laptop?	O Ja O Nee
Maakt u gebruik van een PC/Laptop?	O Ja O Nee
Hoe vaak gebruikt u een PC/Laptop?	 Minimaal een keer per uur Minimaal een keer per dag Minimaal een keer per week Minder vaak Nooit
Hoe lang gebruikt u al een PC/Laptop?	maand

Bent u in het bezit van een Tablet PC (bijv. een iPad)?	O Ja O Nee
Gebruikt u een Tablet PC?	O Ja O Nee
Hoe vaak gebruikt u een Tablet PC?	 Minimaal een keer per uur Minimaal een keer per dag Minimaal een keer per week Minder vaak Nooit
Hoe lang gebruikt u al een Tablet PC?	maand

Appendix D

Research Invitation



http://ewallproject.eu

EWALL ONTWERP TESTS

Wij doen mee aan een grootschalig Europees project genaamd eWALL. Het project richt zich op het ontwikkelen van een system dat in huis gebruikt kan worden en dat de gezondheid van ouderen bijhoudt. We ontwerpen op dit moment een applicatie hiervoor en we zouden erg graag uw mening hierover horen in een kort interview.

U krijgt hierbij ten eerste wat tijd om een indruk te krijgen van de applicatie en deze wat te leren kennen. De applicatie wordt samen met de interviewer doorlopen. Daarna worden u wat vragen gesteld. U wordt uiteraard niet beoordeeld op hoe goed u met de eWALL om kunt gaan, alleen uw ideeën en impressies zijn van belang. Voelt u zich dus vrij om vragen te stellen en opmerkingen te maken, want met alles wat u zegt helpt u om de applicatie te verbeteren. Na het afronden van de vragen wordt u gevraagd om een korte vragenlijst in te vullen. Om de verwerking van de informatie zo efficient en volledig mogelijk te maken, vragen wij uw toestemming voor het opnemen van het interview met een geluidsrecorder. Uw mening wordt anoniem verwerkt en wordt gebruikt voor de verbetering van de applicatie en gepubliceerd in wetenschappelijke tijdschriften.

De interviews vinden plaats bij Roessingh Research and Development in Lab 3. Dit is aan de Roessinghsbleekweg 33b, 7522 AH Enschede. Een interview duurt 40 minuten tot een uur.

Interesse in meedoen? Neem contact op door een mail te sturen naar [student@email] of door te bellen naar [phone number].



[STUDENT NAME] ROESSINGH RESEARCH AND DEVELOPMENT Roessinghsbleekweg 33b, 7522 AH Enschede, the Netherlands www.rrd.nl

[phone number] | [student@email]

Alvast onze dank!

Appendix E

Coding Scheme of Perceived Enjoyment

Measured construct	Label	Description
Enjoyment (main screen)	Design appraisal	Praise for the design (aesthetics) of the main screen
	Neutral comment	Neither praise nor criticism of the design (aesthetics) of the main screen
	Design criticism	Criticism of the design (aesthetics) of the main screen
Enjoyment (specifics)	Orderly design	Person likes the orderliness of the screen
	Attractive design	Person thinks the screen looks nice / beautiful
	Homely design	Person likes the homely atmosphere of the screen
	Dislikes window	The weather and/or window design is regarded as undesirable
	Busy screen	Person feels the screen holds too many (useless) features
	Old-fashioned design	Design of the main screen and its features / furniture is regarded as old- fashioned
	Lacks off-button	Person dislikes the fact that the screen can't be turned off
	Large screen size	The screen size is considered too big and therefore undesirable
	Childish design	Design of the main screen and its features is regarded as childish
	Unfitting design	Design of the main screen doesn't match the interior of the person
	Bad wording	Person dislikes the choice of words for features of the main screen
	Suggestion:	Person suggests that the design /
	individualised design	features should be customised to the individual
	Suggestion: orderly design	Person suggests that the design should be more simple / clear
Enjoyment (experience)	Enjoyable	Person enjoyed using the system
	Somewhat enjoyable	Person somewhat enjoyed using the system
	Not enjoyable	Person did not enjoy using the system

Appendix F

Measured construct	Label	Description
Usefulness (implementation)	Yes	Person would want to use the system
	Not yet	Person wouldn't want to use the system yet / doesn't need it yet
	Not like this	Person wouldn't want to use the system in its current form
	No	Person wouldn't want to use the system
Usefulness (specifics)	Contact with	The system is regarded as useful
	healthcare/family	because of communication with health care / family
	Independence	The system is regarded as useful in prolonging / facilitating independence
	Reassurance	The system is regarded as useful in providing reassurance
	Amusement	The system is regarded as a useful in providing amusement
	No need for it	Person doesn't want the system implemented (yet) because he / she has no need for it (yet)
	Privacy concerns	Person doesn't want the data to be shared / recorded in this way
	Obtrusiveness	The technology is perceived as too obtrusive in this shape or form (next to the television) and therefore undesired
	Financial concerns	Person raises concerns for the cost of implementation
	Unfinished	Person feels the system needs (a lot of) adjustment before implementation
	Too much technology	The system is regarded as too much technology and therefore undesired

Coding Scheme of Perceived Usefulness

Appendix G

Measured construct	Label	Description	
Ease of Use (first impression)	Easy handling	Person says the technology is	
		easy to operate	
	Easy handling: experience	The system appears easy to	
		operate because of previous	
		experience with similar	
	Needs practice	Person states that operating the	
	Needs practice	technology requires practice	
	Difficult handling: physical	The technology appears difficult	
	1	to operate because of (possible)	
	limitations	physical limitations (of the	
		target group)	
	No opinion	There is no initial touch screen	
		interaction with the system or no	
		opinion about the interaction yet	
Ease of Use (general impression)	Easy to master	Person states it is easy to learn	
	Easy to mostan training	how to use the technology	
	Easy to master: training	asy to learn when training is	
		provided	
	Easy to master: experience	The technology is perceived as	
	2 1	easy to learn because of	
		previous experience with similar	
		technology	
	Possible to master	Person states it is possible to	
		learn how to use the technology	
	Difficult to mostory torget	through practice	
	Difficult to master: target	difficult to learn for the target	
	group	group	
	Individual differences	Ability to learn depends on the	
	· · · · · · · · · · · · · · · · · · ·	person	

Coding Scheme of Perceived Ease of Use

Appendix H

User Test Plan Dashboard

Procedure What are the main steps in the test procedure Greetings and Inform introduction Conse 5 minutes 5 minutes	Not performing the tests may increase the risk of developing a product that people don't want to use,	The test will address questions regarding the usability and UX which answers will determine motivation to use the product and development gaps in the interface.	Business case Why are we doing this test? What are the benefits? What are the risks of not testing?	eWALL main screen, the DFM application, the DPAM application, the DPAM application, the sleep application, cognitive training and physical training applications. General experience of the product.	Product under test What's being tested? What are the business and experience goals for the product?	Author Leanne la Faille
re? ed Task-based nt evaluation ttes 45 minutes		Flow do users experience Perceived Usefulness? How do users experience Perceived Lease of Use?	Can people understand where to find and how to use the DPAM application? Can people understand where to find and how to use the DFM application? Experience	Usability Can people understand the eWALL concept? Can people understand where to find and how to use the sleep application?	Test objectives What are the goals of the usability test? What specific questions will be answered? What hypotheses will be tested?	
Post-interview questionnaires 10 minutes 5 minutes		ELO 42" touch screen. Computer with internet. Mobile phone audio recorder,	Equipment What equipment is required? How will you record the data?	20 older adults of ages 55 and up. Participants must be able to stand for the whole period of the test.	Participants How many participants will be recruited? What are their key characteristics?	Contact details I.lafaile@student.utwente.nl
and Total time 70 minutes	Post-interview: a) User Experience questionnaire b) Demographic questionnaire	 a) How does the user interact with eWALL? b) Does the user find the way from DFM to DPAM? 	 Tasks: Main Screen Personal data Daily Functioning Monitoring Sleep Monitoring Sleep Monitoring Cognitive Training Playing Games Physical Training General experience 	Get the informed consent signature. Task-based evaluation: a) explain Michael's persona to the participant b) have participant approach the screen c) let participant browse around the screen d) proceed with the task-based interview questions	Test tasks What are the test tasks? Explain the experiment and thinking out loud procedure.	
		RRD, Lab 3 Date: starting November 16th, according to participants availability	Location and dates Where and when will the test take place? When and how will the results be shared?	Leanne la Faille (Performing tests and observations) Julia Bouwer (Performing tests and observations) Cristian-Dan Bara (Technical Setup and Technical Support)	Responsibilities Who is involved in the tests and what are their responsibilities?	