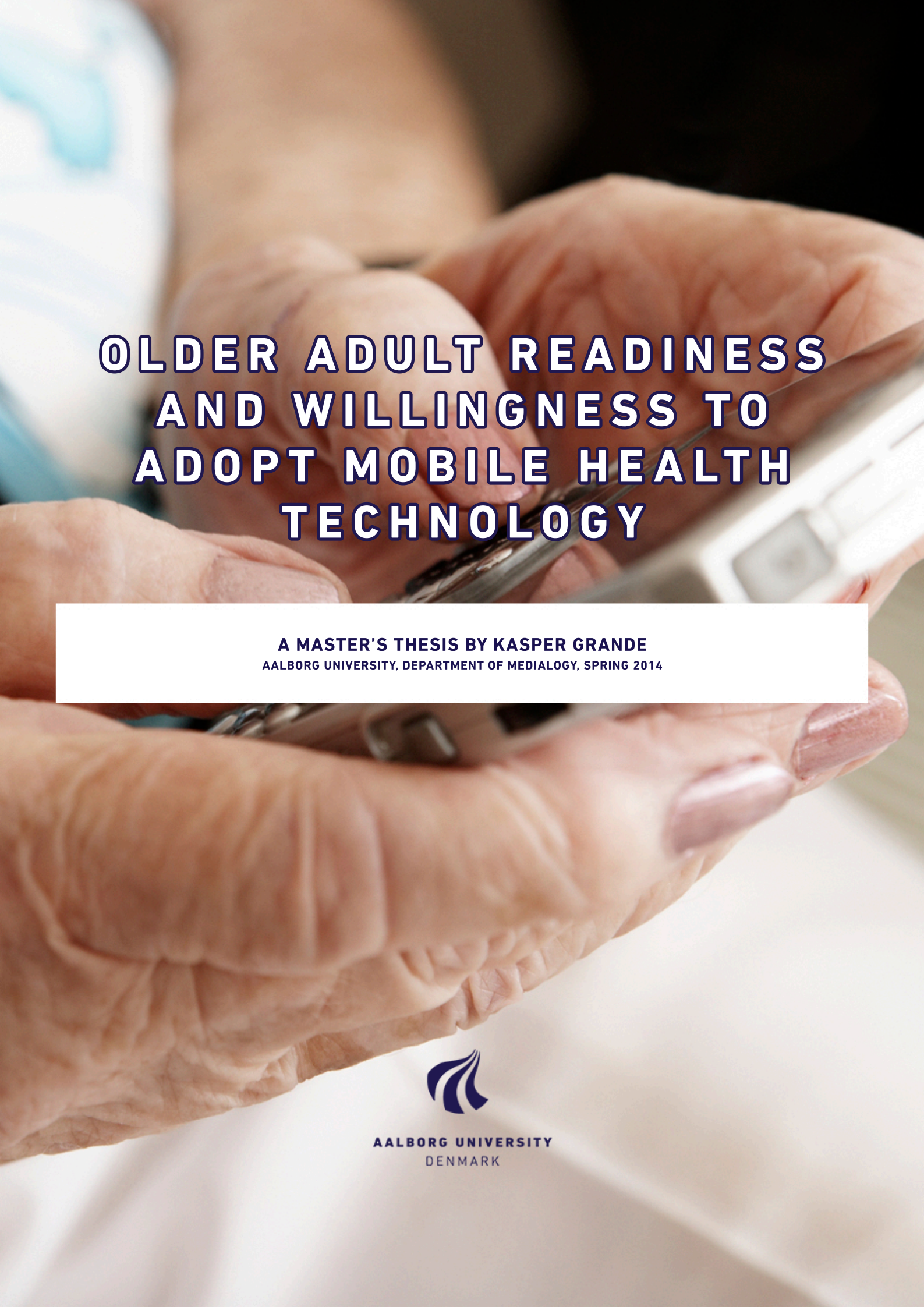

OLDER ADULT READINESS AND WILLINGNESS TO ADOPT MOBILE HEALTH TECHNOLOGY

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1 Introduction

As the lifespan of the population increases so does the number of older adults in need of support (APA, 1998). Thus, the spending required by national governments to cover these expenses will take up an increasingly larger part of national budgets unless steps are taken to remedy this development.

Several studies have investigated the health of older adults and the kinds of behavior causing a decline or improvement in their health status. Major factors contributing to this decline include inactivity, smoking, low-quality diet, hearing loss, memory problems, chronic disease, unemployment, bereavement, and being single. Positive factors include independent mobility, social activity, exercise, and a healthy lifestyle (de Groot et al., 2004; Colcombe & Kramer, 2003; Foottit & Anderson, 2012; Foottit, 2009; Cohen et al., 1983; Schutzer & Graves, 2004; Booth et al., 2000). Motivating older adults to get out of the living room and be active will not only reduce mortality risk (Cress et al., 2006) but can also contribute to improve their cognitive abilities (Colcombe & Kramer, 2003).

To this end, changing or maintaining behavior of older adults towards more physical and social activity is the goal. A direct solution to this problem could be for governments to hire an army of social workers to visit both older adults and elderly stuck in a sedentary lifestyle and take them for a walk, encourage them to be more active, and introduce them into social life activities. However, now, and even more so in the future, this solution is financially and practically unrealistic. The complexity of the public sector is beyond the scope of this study. However, one of the possibilities governments have to help reduce health care expenses is to take advantage of new research into persuasive technology; technology that can help facilitate change or maintain behavior of older adults to be physically and socially active and independent as long as possible.

1.1 Research Focus

The scope of this report is to examine the possibility of introducing persuasive technology to older adults in Denmark with the goal of motivating them to change or maintain positive behavior regarding physical and social activity.

To conclude on this research the following hypothesis will be used:

Persuasive technology can be used to help motivate Danish older adults to maintain or change behavior to be physically and socially active.

In order to answer the hypothesis, multiple interviews with 10 older adults aged 62 to 77 will be used to determine the readiness and willingness to adopt persuasive technology and their need for information regarding their health and wellbeing. Previous research from 2010 with American and Israeli senior citizens have suggested that older adults are not ready to adopt health related ICT (Heart & Kalderon, 2011) if this is also the case for Danish older adults in 2014 will be determined in this report.

If the hypothesis is confirmed a mobile health app will be designed according to available guidelines on the topic and will be tested in a field experiment with older adults to determine its usefulness in practice and provide concrete information and feedback on persuasive technology design and use.

If the hypothesis is rejected the next step will be to design an alternative solution to help maintain or change behavior of the older adults to stay physically and socially active without the use of persuasive technology.

2 State of the Art

This chapter presents and analyzes available literature concerning older adults and their relation to ICT (Information and Communications Technology) in general and persuasive technology more specifically. Approaches to experiment methodology, data gathering, and development and design are examined. Additionally, the potential of measuring Heart Rate Variability data in persuasive technology and using it to increase the accuracy of health information provided to the user is examined. Lastly, reasons for physical exercise and activity are examined.

2.1 Older Adults and Persuasive Technology

The incorporation of wearable devices into the daily activities of older adults, to monitor their health and activity, presents many usability and technical challenges such as small fonts and screen sizes, entering data into system, traditional WIMP interfaces, and an overload of information (Lu et al., 2005; Jorge, 2001; Carmichael, 1999; Plaza et al., 2011). It is also important to recognize the extreme diversity of this age group (Dickinson et al., 2007; Carmichael, 1999) be it social, physical, or ICT proficiency. The goal of persuasive technology should be to assist and promote the four major positive health factors; independent mobility, social activity, exercise, and a healthy lifestyle.

2.1.1 Methodological Approaches to Working with Older Adults

When working with older adults in experimental conditions certain considerations should be made regarding behavior and treatment, e.g., explain extensively how the equipment works; that they need not fear breaking it, and to be explicit about the need for silence and concentration during tests (Baldi, 1997; Bhachu et al., 2008; Dickinson et al., 2007).

Methods used when conducting experiments and tests with older adult participants have been held in controlled lab environments (Choi et al., 2012; Henkemans et al., 2008) and instrumented spaces (Looije et al., 2010), while persuasive technology has most often been used in field tests (Jafarinaimi et al., 2005; Hirano et al., 2013; Consolvo et al., April 2008; Consolvo et al., September 2008; Lane et al., 2011; Bentley et al., 2013) using a platform that is already common to users, such as the smartphone, to improve usage (Jimison et al., 2008). When testing usability of both

hardware and software, in situ field tests can provide critical information from user experiences when prototypes are introduced into the daily lives of the target population (Klasnja et al., 2011). In the case of Consolvo et al. (September 2008) their prototype *UbiFit Garden* was tested in the field over a three month period in an attempt to *"get beyond potential novelty effects"*, which are usually present when people are asked to test new technology. However, no conclusion was reached regarding the success of this part of their experiment.

2.1.2 Data Gathering Approaches

Test and experiment data is gathered using different sensors, mostly wearable. Consolvo et al. (September 2008) use a fitness device which has a 3d accelerometer and a barometer. This sensor data is then used to infer what activities the person is doing, i.e., walking, running, cycling, using an elliptical trainer, or using a stair machine. They then use the number of inferred activities to determine the level of physical activity for each participant.

Hirano et al. (2013) use an accelerometer service, which is installed on the participants' phones together with the rest of the necessary software to measure their number of steps and register long periods of inactivity. This information is used to determine and visualize their progress towards their daily step goal (default is ten thousand) and to interrupt them if they are inactive for more than thirty minutes.

Lane et al. (2011) combined data from sleeping, exercising and socializing behavior gathered using only sensors embedded in off-the-shelf smartphones (GPS, microphone, and accelerometer) to provide users with a total score of their overall wellbeing. Giving users an overall score for wellbeing, instead of the raw data most popular health apps provide (Endomondo, Runtastic, etc.), is a step forward in terms of providing users with personal health information that does not require a high level of interpretation and analysis to say something about a user's general health.

Bentley et al. (2013) combined data from user logging, smartphone apps and embedded sensors to gather information about their users concerning weight, sleep, step count, calendar data, location, weather, pain, food intake, and mood. In addition to this their system *Health Mashups* was able to analyze and find patterns in users' behavior. This is a very important step because users lack a tool to look at all their personal information holistically (Li et al., 2011) and because older adults need to see very clearly how new technology can benefit them compared to current practices (Heart & Kalderon, 2011; Baldi, 1997).

2.1.3 Approaches to Increasing Physical Activity through Persuasive Technology

Motivation or encouragement to physical activity has been attempted by providing users with glanceable displays on their mobile phones to remind them of their weekly physical activity goals either as a background (Consolvo et al., April 2008; Lane et al., 2011) or a widget (Hirano et al., 2013). Users with glanceable displays of their physical activity were able to maintain it during winter holidays, as opposed to those who did not have glanceable displays (Consolvo et al., September 2008).

Inclusion of natural language as part of a mobile application has been examined by Bentley et al. (2013) because studies point towards the fact that statistical literacy is low in 44 % of Americans and 41 % of Germans (Galesic & Garcia-Retamero, 2011). Their system *Health Mashups* gathered data from nine different sources and told users about patterns in their behavior in a natural way, such as: *"On days when you X, you Y"* or *"On Wednesdays you X more than usual."* The system gathered data using a combination of smartphone apps, embedded smartphone functions, and user logging. They reported that by helping users to reflect on observations of their life by giving them a 'nudge', they were able to make small targeted changes that can, in number, improve their wellbeing over time.

Interruptions have also been attempted as a method to shorten periods of inactivity to increase physical activity. Hirano et al. (2013) reported that a buzzing interruption made office workers feel guilty but did not cause them to change their behavior; they felt powerless to make changes; responding to the buzz required time they did not have. They also reported that most users did not usually respond to the phone vibration interruptions and turned off or ignored the phone at home. They suggest coupling interruptions and glanceable display with concrete advice on how to incorporate active moments into their day, otherwise they might be ignored. They also found a conflict of motivation between the two goals in their experiment with completing significant amounts of exercise and shortening periods of inactivity (with interruptions) because a short walk in a break at work would not contribute considerably to the overall step goal and as such would be considered a waste of effort. Jafarinaimi et al. (2005) reported that the user in their experiment appreciated the ability to ignore their 'Breakaway' sculpture during busy hours but that it played a role in the times she took a break while not busy. This suggests that interruptions should be possible to ignore at certain times, otherwise they are likely to be ignored all the time.

Bentley et al. (2013) reported that they had used reminders successfully in their system by showing an icon in the users' smartphones' notification bar and having the status light on the phone blink to remind them that it was time to log data. Users were able to manage the reminders themselves, which has been shown to have some significance (Li et al., 2011).

Li et al. (2011) argued that user involvement is critical in the data collection process. A high level of automation in the data collection can diminish a user's engagement and should therefore be balanced with ways to keep the user engaged with their data.

2.1.4 Design Guidelines to Persuasive Technology

Building on the work of Jafarinaimi et al. (2005), Consolvo et al. (2009) have developed eight design strategies to help build persuasive technology systems. The usefulness of the design strategies is validated using qualitative data from participant interviews. Munson & Consolvo (2012) have investigated the effectiveness of four different strategies to encourage physical activity: 1) Goal-

setting: Positive results using both primary and secondary activity goals, allowing users to fall back on secondary easier goals on busy weeks and vice versa. 2) Rewards: Only 3 of 24 participants described rewards as motivating, however the trophies and ribbons in the prototype were more literal compared to other studies, and this may have contributed to them seeming like a gimmick. 3) Self-monitoring: Reminders can be effective to help increase physical activity but they have to be context aware. 4) Sharing: Sharing information on Facebook was not particularly compelling for any of the participants. However, the researchers still believe sharing as a motivational factor is worth investigating. The incorporation of these design strategies during development can help design software and devices useful to the users.

Li et al. (2011) reported that their 15 test participants asked different kinds of question concerning their personal health information and that the questions asked depended on which of two phases (Discovery and Maintenance) they were in at the given time. In the Discovery phase they were searching for information to help them reach their personal health goal (concept level goal). In the Maintenance phase they were already aware of what they needed to do and were able to set concrete day-to-day goals (program level goals) to reach their concept level goal. Concept level goal examples are; to improve physical attractiveness, to improve sleep, and to understand how to minimize risks concerning diabetes. Program level goal examples are; running three times a week, going to bed no later than 11 pm every night, and buying less sugary foods when grocery shopping. Dependent on these goals the individuals are either in the Maintenance phase or Discovery phase (see figure 1).

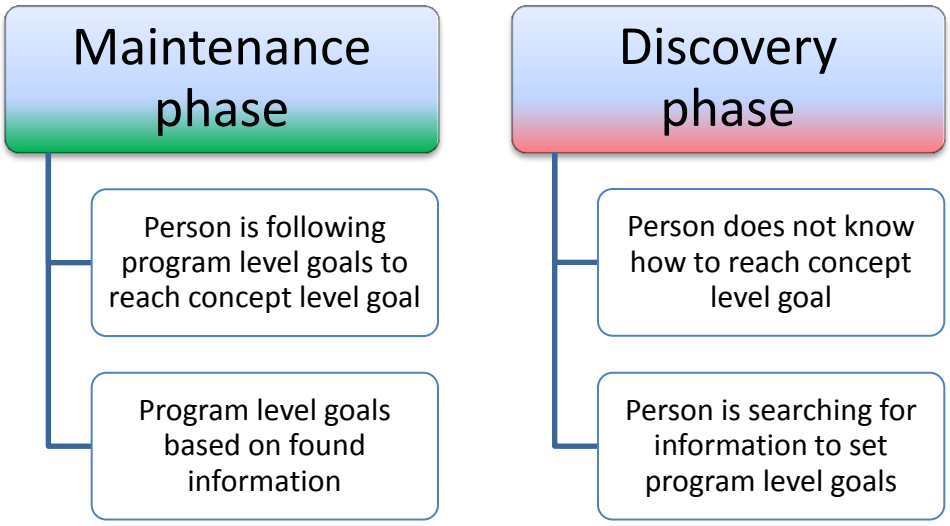

Figure 1: Simplified theory of Li et al., 2011

This research is valuable to designers of persuasive technology and mobile health devices to help determine what type of information the user is in need of at any given time. The importance of goal-setting in healthy behavior change has also been documented by Medynskiy et al. (2013).

2.2 Heart Rate Variability as an Indicator of General Health in Mobile Technology

Heart Rate Variability (HRV) is a widely used method for understanding health in general (Bilchick & Berger, 2006; Levy et al., 1998; Mukherjee et al., 2011; Wood et al., 2002; Choi et al., 2010). The problem with HRV monitors is that they require at least a chest strap to be worn, which is a very different matter compared to just carrying a phone or sensor system in the belt or pocket. Compared to an accelerometer, a HRV monitor records more data directly linked to a persons' health (both physical and mental) but it is unlikely that people will want to wear a HRV chest strap during daily work and activities; it would simply be too invasive for longer periods of time. However, it is reasonable to expect wearable HRV sensors will become available in the near future, e.g., as *smart clothes* (Yoo, 2013; Smith, 2014). This makes field research into HRV in a daily activity context valuable, to better understand cause and effect correlations of daily activities on health. In order to increase the accuracy of health data analysis, HRV could be included in larger systems, such as *Health Mashups* (Bentley et al., 2013) where it can be analyzed and compared with other data streams, because, as Li et al. (2011) reported; *"… users do not have a tool to look at all their personal information holistically, they want to explore their data in a single interface."* This indicates a strong need for tools that can combine the many sources of information that already exist, help analyze it for patterns and trends, and determine what tangible goals and behaviors are required for the users to accomplish their main health goals. Overall, HRV data is a valuable addition to any mobile health system which attempts to analyze daily life activities to reveal patterns that affect the persons' health.

2.3 Social Influence and Connectedness

Social influence (or social support), access to local facilities, and neighborhood safety all have a positive impact on physical activity of older adults (Booth et al., 2000). Furthermore, research suggests a significant relationship between social influence and exercise adherence and self-efficacy, although the link appears to be indirect and is most notable for older adult women (Schutzer & Graves, 2004).

Jenneke A. Foottit (2009) completed a quantitative and qualitative study of 257 Australian older adults (age 65+) and was able to conclude that: *"For older adults good health is related to social connectedness and is not a goal in itself."* (Foottit, 2009)

3 Older Adult Activity Habits and ICT Readiness

The goal of this session of interviews is to reveal the context of, and reasons behind, their use and purchase of ICT devices and their physical activity. This information is crucial when exploring new methods for providing relevant health information to the target group and to understand under which circumstances they will be most in need of such information. To reveal the context of older adults in regards to their skills and experience with ICT and physical activity habits, the interview method was chosen as the primary method of data gathering, making use of basic interview techniques to reveal underlying reasons for behavior (Cooper et al, 2007). This means fewer participants and less data, compared to a survey, but more detailed data and the possibility to explore different avenues than planned if the opportunity presents itself.

3.1 Methodology

To gather data about Danish older adults' physical habitual behavior and their experiences with ICT, interviews were completed with 10 older adults. The interviews consist of three parts; a part focused on general wellbeing, a part focused on physical activity, and a part focused on their experiences with ICT. The interview manuscript can be seen in appendix 11.6.

3.1.1 Part 1 – Wellbeing

The questions in the part concerning wellbeing addressed broad health related issues including sleeping habits, eating habits, current and earlier (when working) stress levels, satisfaction with current lifestyle, vices (drinking and smoking), and more.

3.1.2 Part 2 – Physical Activity

Questions in the topic of physical activity addressed the participants' weekly activities and exercises, asking what activities they currently engage in, have engaged in before and what parts of the activities they enjoy the most.

3.1.3 Part 3 – ICT Readiness

Regarding ICT, participants were asked if they owned a cellphone, a computer, or any other electronic gadgets or health technology, and how they use them and how often. They were also asked how and why they acquired the devices in question.

The questions were used to start a dialogue focused on a specific topic. The interviewer would then try to determine the underlying reasons of behavior as the interview progressed.

3.1.4 Participants

The participants used for this interview session are all Danish older adults living in close vicinity of the city of Aalborg in Denmark. Their age ranged from 62 to 77 with a mean of 68.6. The mean age of the four male participants is 68.5. The mean age of the six female participants is 68.7. Participant demographic data can be found in appendix 11.5.

3.1.5 Recruitment

Two participants were recruited by a contact at SOSU Nord Future Lab, while the remaining eight were recruited directly at an exercise club run by '*Æ*ldre Sagen', a Danish association for the benefit of the old and elderly. The members of the exercise club meet weekly and exercise together with assistance from an instructor. The only requirement is that they are mobile, and do not require assistance to be part of the exercise. This event was chosen because the members of this group were believed to have motivation to improve their health, and would thus be more likely to also participate in an interview regarding health and ICT. In the recruitment situation they were told that the topic of the interviews they were going to participate in was simply "about health" leaving them with no specific expectations about the interview.

3.1.6 Apparatus

The interviews were recorded using a video camera.

3.1.7 Procedure

The interviews were carried out in the participants' own residence to help them relax and feel comfortable. The length of the interviews was approximately 35-45 minutes. Spouses of the interviewed were allowed, but not encouraged, to comment or elaborate on questions or discussions during the interview.

3.2 Results

To analyze the results from the 10 interviews, all responses were transcribed from audio and given one or multiple codes reflecting the response and its meaning. From a total of 264 codes, they were then combined into 39 different code groups (Appendix 11.4), with maximum one code entry per code group per participant (see figure 2). These code groups are used to indicate tendencies for this particular sample of the population of older adults in the Aalborg region in Denmark. All quotes are translated from Danish. The entire database of participant responses can be found on the DVD at path \Appendix\Chapter 3 Database.mdb.

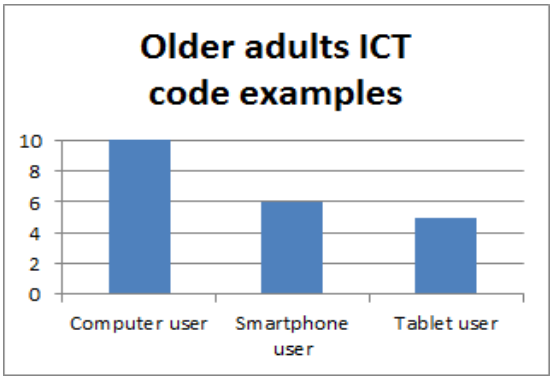

Figure 2: Number of older adults identified by codes such as 'Computer user' etc.

3.2.1 ICT Readiness

The most surprising tendency discovered is the fact that 10 out of 10 participants answered that they use a computer at least once a week and often on a daily basis; e.g., to manage emails, manage photos, do research into genealogy, or play simple games such as card games. A likely reason behind this widespread use is the recent digitalization of the public sector in Denmark, carried out by the Danish Agency of Digitization (DAD, 2014), meaning that any communication with local and public authorities has to be done online by email or by seeking information on their websites. This is also the case for banking services. Because of this change, older adults with no computer experience have been forced to take lessons in computer use by official or private organizations, friends or relatives. Of the 10 participants 3 had previous computer experience from their work life. This means that 7 have recently acquired their computer skills. Of these 7 participants 2 mentioned that they had attended classes for computer use and 3 had lessons from relatives. The question is then, if the best way for them to adapt to these new technologies is to be forced, as they were with computers. During the interviews 4 participants mentioned that they would need some form of pressure or motivation before they would increase their effort in learning new ICT.

Smartphones are quite common among the participants. 6 of the 10 participants owned a smartphone. 3 of the 6 smartphone owners did not buy the smartphones because they wanted one, instead they answered that they had bought them off a relative, such as a grandchild or child when they had bought a new smartphone and needed to get rid of the old one. Another participant answered that she bought her smartphone to "follow suit" or compete with another woman in her social circle who had bought a new smartphone just recently. Of the 6 smartphone users only 1 had an interest in ICT and electronic gadgets. All in all these responses indicate that the reasons for acquiring a new smartphone vary widely between participants and the primary reason is, surprisingly, not because of a need or desire to own or use one but to do a favor to a friend or relative by buying their old smartphone after they have purchased a newer model. This is also indicated by the use of the smartphones, 3 of the 6 smartphone users only use it for regular cell phone activities e.g., calling and texting.

Half of the participants used a tablet at least once a week. They generally prefer to use the tablet over both the smartphone and the computer. Partly because they can use the tablet in a social setting, i.e., sit together with the spouse or friends and still take part in conversations while they, in 9 of 10 homes, keep their computers in separate rooms; as one participant said:

"I probably surf more on the iPad now, because I can do that while we sit on the couch and watch a movie."
(Subject 2, about using ICT)

Also partly because the tablet has a larger screen size compared to the smartphone making it easier for the older adults to read text; as two participants said:

"The text is not so large on such an iPhone… We've been talking about [purchasing] a tablet, then perhaps I could also get my husband interested in it."
(Subject 2, about using ICT)

"It [a tablet] is easier to sit with, read on, and write on."
(Subject 5, about using ICT)

Older adults' ICT purchases are influenced by social reasons. Half of the smartphones were bought from friends or relatives, not because of a need or desire, but to do a favor for the friend or relative. For tablets the social aspect is not the reason behind the purchase, but rather an excuse to purchase it, because two of the interviewed couples had bought/received one as a gift from one to the other with a pretense; as one participant said:

"I wanted it [a tablet] for him so he could have a hobby but he never really adopted it."
(Subject 2, about buying ICT)

In both cases the gift did not work as intended and the buyer of the gift was, perhaps as expected, also the primary user of the tablet; as another participant said:

"She [the wife] was not really into it [using ICT] so she is the reason I got this one [the tablet] so she could better get into it."
(Subject 5, about buying ICT)

The 10 interviews have shown a picture of the Danish older adults as being ICT proficient; all of them with computers and 7 out of 10 with touch screen interfaces. This indicates that a large part of Danish older adults are familiar with ICT interaction, a good offset for introducing more advanced ICTs such as mobile health ICT.

3.2.2 Health and Exercise

Given the recruitment and exercise schedule, it is no surprise that all the participants engage in weekly exercise as 8 of the 10 participants were recruited from an exercise club. The members meet weekly. 3 participants also engage in daily exercises on their own; following a certain routine of morning or evening exercises for 15 to 30

minutes. 4 of the participants mentioned that they have a history of exercise; having exercised routinely from when they were younger.

The reasons behind the participants' exercise is what must be revealed to understand which of the four major health factors they think about consciously or subconsciously when they exercise: Do they exercise to feel healthy, to be with friends, to keep their body strong, or because they like to exercise?

From their responses the different codes applied attempt to differentiate between a physical reason for exercising (to keep their body strong), a psychological reason (a sense of wellbeing), and a social reason (to meet with friends). When asked what was the primary reason for their exercise 6 participants explained the physical benefits of exercise. 2 participants value the sense of wellbeing as the primary reason for their exercise. 1 participant was clear about it being for social reasons, and 1 answered, surprisingly, that it was because of a sense of duty, i.e., the participant had committed to this activity and was determined to see it through. When asked why they think physical exercise is so important, their answers revolved around their mobility and fear of losing it; as one participant said:

"*I would like to become an elderly man who doesn't sit [all the time].*"
(Subject 6, about why he does physical exercise)

The most likely reason for trying to stave off infirmity is the fear of becoming immobile, thus dependent of others and unable to live an active social life; as another participant said:

"I'm afraid of growing old. Those with zimmer frames, they really scare me."
(Subject 4, about why he does physical exercise)

Jenneke A. Foottit (2009) suggests that the reason behind older adults' exercise is to stay mobile in order to stay socially connected (see section 2.3). It is interesting, however, that none of the 10 participants of this study mentioned social connectedness as the reason for exercising by their own volition during the interview, they saw the connections from exercise to a healthy body to maintaining their mobility, but are not aware of the last connection from mobility to social connectedness. Despite the lack of awareness of exercise being linked to social connectedness in participants, it is believed, as suggested by Jenneke A. Foottit (2009), that this is indeed the primary reason for their exercise.

3.3 Conclusion

From the interviews it was revealed that older adults in close vicinity to the city of Aalborg in Denmark are very likely to be ICT proficient especially with computers but also with touch screen interfaces. However, the small text on smartphones was sometimes a problem. Instead the larger display of tablets and computers was preferred. Tablets were also preferred over computers due to their accessibility from anywhere in the house and during semi-social activities such as watching TV together. All in all the participants are in a high level of ICT readiness. Furthermore,

the reason for most physical exercise is to prevent physical disabilities and immobility and thus retain social connectedness.

4 Data Collection of Older Adult HRV

The research into daily life HRV data was run parallel with the research into older adult readiness and willingness to adopt persuasive technology with the assumption that a mobile app, which can provide health information and concrete advice, can be adopted by older adults (the hypothesis is confirmed).

The goal of these tests is to examine the usefulness of Heart Rate Variability (HRV) to differentiate between different kinds of daily life activities. This knowledge is useful for developers of mobile health applications to help map and analyze a person's pattern of behavior and physical activity. Together with other input sources such as weight, sleep, step count, calendar data, location, weather, pain, food intake, and mood (Bentley et al, 2013) it can help improve our ability to predict cause and effect correlations of daily activities on health. With this increased accuracy in health information more concrete advice can be given to users about how to improve their fitness and wellbeing or how to solve their health problems, thereby increasing their motivation to act (Hirano et al., 2013).

4.1 Methodology

Physiological data was collected from 10 participants. Over the course of the 10 tests, the participants engaged in four different kinds of activity. Before the first activity and between each activity, the participants sat down and were engaged in small talk by the test facilitator.

The first activity used a variation of the Stroop test (Appendix 11.1) in order to make the participants focus their thoughts on a single task. In this activity the participants are instructed to speak the color of the text as quickly as possible while refraining from speaking the word of the text.

The second activity was a breathing exercise, which had the participants relax and breathe at 7.06 breaths per minute an interval used at beginner's level in the 'Pranayama Universal Breathing - Free Edition' mobile application (see figure 3).

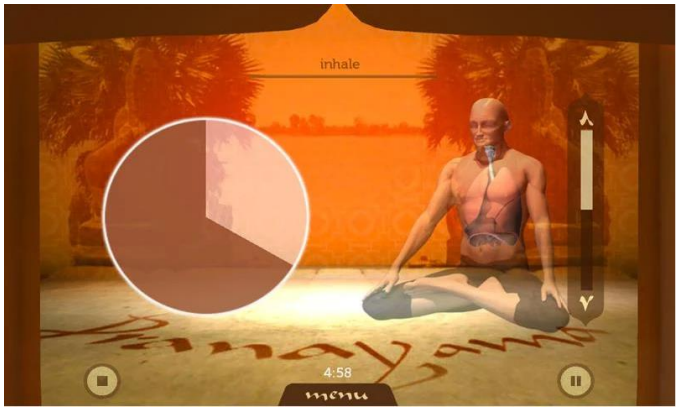

Figure 3: Android app 'Pranayama Universal Breathing – Free Edition'

The third activity had the participants walk around their residence at a pace normal to them.

The last activity had the participants complete a step test in which they would step up and down a small step. Initially the step frequency was set to 96Hz but the first participant was not able to follow such a fast pace and was allowed to slow down. The other participants were also allowed to find a pace suitable to them also taking into account the height of the step. They would only be asked to increase or decrease their pace if it seemed too slow or fast for them.

All activity tests were chosen to represent different kinds of daily activities such as working focused on a task, relaxing, walking, and engaging in physical exercise. They were also chosen by their ability to be carried out inside a private residence with a minimum of accessories.

4.1.1 Participants

Eight of the ten participants in the test also participated in the previous session of interviews (see chapter 3). Two participants were replaced from the participant roster due to illness, the replacement participants were recruited by a contact at SOSU Nord Future Lab. The participants used for this test are all Danish older adults from the Aalborg region in Denmark. Their age ranged from 62 to 74 with a mean of 67.1. The mean age of the four male participants is 67.25. The mean age of the six female participants is 67.

4.1.2 Apparatus

The physiological data was collected using a Zephyr BioHarness 3.0. The BioHarness was worn as a strap around the chest with another strap above right shoulder for stability (see figure 4). Below the left arm the data collection unit was attached which stored the data locally. The data collected by the device include: ECG data, heart rate, breathing rate, and accelerometer data, of which the RR intervals of the ECG data are the focus of this experiment.

Figure 4: Zephyr BioHarness 3.0

A Motorola MB526 smartphone was used to play the 'Pranayama Universal Breathing - Free Edition' mobile application for the participants.

The sessions were recorded using a video camera.

4.1.3 Procedure

The tests were carried out in the participants' own residences. The participants were first asked to put on the BioHarness and were instructed in how to wear it and to wet the two grey nodes on the front of the BioHarness to increase data accuracy. After the participants had equipped the BioHarness to their skin, the camera was started and the device was turned on. The participants were then asked to sit down and relax for a few minutes before the tests would start to measure baseline data meanwhile the four activities were explained to them. Full test and activity durations can be seen in appendix 11.2. Summarized activity durations can be seen in figure 5 below.

Activity	Small talk	Stroop test	Small talk	Breathing exercise	Small talk	Walking	Small talk	Step test
Time (min)	3 to 5	3	3 to 5	3 to 4	3 to 5	3	3 to 5	2 to 3

Figure 5: Overview of test procedure and time approximation of time spent for each activity

After approximately three minutes the Stroop test was begun and ran for three minutes. The test facilitator would sit next to the participants and watch while the test ran and would correct the participants if they had not understood the test correctly. At the end of the Stroop test, the facilitator would engage the participants in small talk for at least three minutes.

The participants were then shown how to use the 'Pranayama Universal Breathing - Free Edition' mobile application after which the breathing activity was begun. For this test the facilitator did not watch the participants. At the end of the test the facilitator would again engage the participants in small talk for at least three minutes.

Next the participants were asked to walk around their residence at a pace they were accustomed to. They were allowed to talk meanwhile. After three minutes the test was stopped and they were asked to sit down and were again engaged by the facilitator in small talk for at least three minutes.

The last activity was the step test, which was completed using a small stool, a staircase, or a step between rooms. The facilitator would ask the participants to increase or decrease their step frequency depending on the height of the step, their BMI, and their fitness. After three minutes of stepping the test was stopped and the participants were asked to sit down and were again engaged in small talk for at least three minutes before the BioHarness was turned off.

4.2 Results

The data recorded by the BioHarness was filtered for duplicate and abnormal values using Microsoft Excel 2010. Using Kubios HRV software the filtered data from Excel was corrected for artifacts and analyzed within-subject for each of the five different activities: Small talk (baseline activity), mental effort (Stroop test), respiration (breathing exercise), moderate physical activity (walking), and vigorous physical activity (step test). The entire dataset can be found on the DVD at path \Appendix\Chapter 4 Data.xlsx. A summarized dataset can be found in appendix 11.3. The data processed and provided by Kubios to provide the summarized dataset can be found on the DVD at path \Appendix\Kubios\Subject X.pdf for each of the participants. An overview of the findings can be seen in figure 6.

Indicators	Physical activity	Respiration	Mental effort
Mean RR	Good	N/A	N/A
Poincare SD1	N/A	Good	Average
Poincare SD2	N/A	N/A	Average
pNN50	N/A	Good	Average
LF/HF Power	N/A	Good	N/A

Figure 6: Overview of the findings from HRV results. The indicators of activities are shown with their level of accuracy (Good, Average, and N/A)

The results analyzed with Kubios (see appendix 11.3) indicate that for physical activity the 'mean RR' mean value in the time domain is the most useful indicator because of its linear decrease when the physical activities become more vigorous during the test, i.e., 786 ms when sitting and talking, 669 ms when walking, and 545 ms when stepping. The mean value for mental effort and respiration lie close to the baseline, 770 ms and 810 ms respectively, thus the mean RR mean value is a useful indicator only for physical activity.

The mental effort mean value from the Stroop tests are notably different from the baseline when examining 'Poincare SD2' in the nonlinear domain with a value of 36.8

ms compared to the baseline of 93.6 ms. Physical activity values lie closer to the baseline with mean values of 77.3 ms for walking and 73.3 ms for stepping. This makes Poincare SD2 a useful indicator for mental effort. However, possible inaccuracy can arise due to respiratory changes because the mean value for respiration, 57.6 ms, lie closer to the mean mental effort value than the mean baseline value.

Another useful indicator of mental effort that can be used with Poincare SD2 is the 'pNN50' mean value in the time domain. Like the Poincare SD2 mean value, the pNN50 mean value show mental effort as the lowest value compared to the baseline, i.e., 2.9 % compared to 7.9 % while physical activity mean values are higher, i.e., 4.2 % for walking and 5.1 % for stepping. The difference from Poincare SD2 is that the mean value for respiration is no longer a source of inaccuracy because it is now higher than the baseline. The same pattern is found in the 'Poincare SD1' mean value in the nonlinear domain: Mental effort has the lowest value, physical activity is found in between mental effort and the baseline, and respiration is higher than the baseline, making Poincare SD1 a third useful indicator of mental effort.

The most useful indicators of respiration are pNN50, LF/HF power, and Poincare SD1. The mean values for respiration in these three domains are the only values to lie notably higher than the baseline. An overview of the findings can be seen in figure 6.

5 Older Adult ICT Willingness and Health Information Need

The goal of this session of interviews is to determine any barriers that may exist that could potentially prevent older adults from adopting technology, such as the smartphone, to provide information and advice about health.

5.1 Methodology

The theory of Li et al. (2011) (see chapter 2.1.4) was chosen as the framework for this session of interviews because of its useful approach on how to determine what health information people need.

The interview attempts to determine if the participants have a concept level goal in connection to their health and if they have set program level goals to reach it. Furthermore, participants are asked how the experience of trying to reach their concept level goal could have been improved and if a simple device such as a mobile phone would be wanted to help them provide relevant information about their health. The interview structure will be repeated for each concept level goal identified. See the interview manuscript in appendix 11.7.

Quotes from participants have been translated from Danish. The use of idioms to express attitude about a subject was common and in cases where no corresponding English idioms could be found they have been translated to best convey the meaning behind the words.

5.1.1 Participants

The participants used for this session of interviews are all Danish older adults living in close vicinity of the city of Aalborg in Denmark. Their age ranged from 62 to 74 with a mean of 66.9. The mean age of the three male participants is 66.7. The mean age of the five female participants is 67. All eight participants also took part in previous sessions (see chapter 3 and 4).

5.1.2 Apparatus

The first two interviews with subject 4, 5, 9 and 10 were recorded using a camera. The last interviews were audio recorded with 'Smart Voice Recorder' app for Android smartphones because there were no visual cues worth noting during the first interviews.

5.1.3 Procedure

The interviews were carried out in the participants' own residence to help them relax and feel comfortable. The length of the interviews was approximately 25-45 minutes. Subjects 4 and 5 are married and were interviewed at the same time. The same was the case with subjects 9 and 10. The interview manuscript can be found in appendix 11.7.

5.2 Results

Records of the interviews were replayed and all responses in direct or indirect relation to the manuscript were noted (see notes on DVD at path \Appendix\Chapter 5 Notes.pdf).

The interviews show a low degree of consideration concerning both concept and program level goals. When asked directly, only one of the eight participants (subject 10) could think of a concept level goal for the person's health. After some inquiry into their health, two more participants (subject 4 and 9) explained that they would like to lose some weight but while subject 9 said the reason was to be able to fit smaller size clothes, subject 4 could not think of a reason why. The remaining participants could not think of any concept level goals. Although concept level goals concerning physical fitness and wellbeing were very few, participants instead had a different kind of concept goals; those tied to health problems. Among health problems that troubled participants were diabetes (subject 7), osteoporosis (subject 8), hip problems (subjects 3, 6, and 9), meniscus damage (subject 10), and pain in specific body parts (subject 5). Reflections about health were primarily centered on these health problems rather than fitness and wellbeing. Most of these participants knew what they could do or not do in order to live with their health problems on a daily basis (see figure 7 on page 25) but they were not aware of setting program level goals in order to resolve such health problems. The weekly routines with exercise, such as the health exercise club all participants in this interview session were recruited from, could be argued to be a program level goal to combat sickness but the participants did not link this or other similar activities with a wish to resolve or minimize specific health problems.

5.2.1 Quality of Life

One explanation why the participants lack interest in acting on their knowledge of health problems, other than what is required, is because they do not want to set program level goals that do not contribute directly to their quality of life. This indicates that exercise does not equal quality of life; subject 3 and 10 both explained that it was more important to them to enjoy the remaining years of their life than to

spend time exercising or refraining from eating certain food when they really did not want to do that. As they said:

"We should be happy and enjoy the life we have been given."
(Subject 10, on the topic of a happy life versus a long life)

"One day we must die all others we should live."
(Subject 3, on the topic of a happy life versus a long life)

5.2.2 Looking for Sickness Makes You Sick

An explanation for why the participants seem to not act and seek information and set program level goals when they have health related problems is that they first want to be sure that it really is a problem that warrants attention. As three participants said:

"I almost feel embarrassed at showing up [at the Physician's] if there really isn't anything wrong anyway." (Subject 6, about the need to see a physician)

"It depends a lot on if it is a need you have right now to have it checked out."
(Subject 5, about the need of getting a medical check-up)

"What can come on its own, can leave on its own."
(Subject 7, about health problems)

If the problem does not disappear, the first they do is see a physician then wait for a diagnosis. Until then, looking for information about the problem is commonly restricted to social circle small talk with friends and family. Subject 9 said that she had discussed her hip problems with a lifeguard at the indoor swimming pool she visit regularly. Subject 5 said he would sometimes talk with other people at his health exercise club about his shoulder pains. They seem unwilling to search for information outside social relations, because they do not know what information to look for without a diagnosis, because they believe looking for information about illness only makes a person more ill, and because they trust in the authority of the physician to resolve the problem. As they said:

"What do I write? Hip problems? When the Physician can't answer anything?"
(Subject 9, about searching for information while waiting for a diagnosis)

"Until you have a diagnosis so you know what is wrong, it has a bad influence on us to go seek medical journals and read about what it <u>can</u> be."
(Subject 10, about searching for information while waiting for a diagnosis)

"You should also be careful not to look too hard because that can also become a problem; if you always think about what it could be."
(Subject 5, about looking for information about sickness)

"People who buy a health encyclopedia, they suddenly get all kinds of sick."
(Subject 6, about looking for information)

"If you are not already sick you will be."
(Subject 9, about consulting online doctors and symptom checkers)

This reason for not wanting health information is also tied to quality of life, as discussed in the previous section, because, as subject 4 said when asked if she would like to be able to measure information about a disease she was at special risk of, she would rather not have this information, even if it could provide some benefits, she explained it would cause more distress if you are reminded of it regularly. To the same question subject 3 said that she also did not like to or want to think about sickness. In other words 'blissful ignorance' seems to be preferred by these two participants. Other participants feel differently. Subject 5 said he would like to have information about health risks but mainly because he has a technical interest in using new technology. If health information could be provided through a smartphone, subject 6 and 8 said that they would use it. However, subject 6 also said that he did not want a *"babysitter"*. Similarly, subject 7 is reluctant to carry a smartphone; it makes her uncomfortable because she feels monitored.

5.2.3 Confusion and Distrust of Health Information

Another reason why information search outside personal relations is not used seems to be because of distrust of the media and sources of health information and confusion about the different messages they send. Subject 9 and 10 agreed that it was confusing that experts on health would strongly disagree on TV about what food was healthy to eat and what was not. Subject 6 said that she would pay attention to information about Diabetes on TV or in the newspaper, but also expressed that she would not trust the information easily. As she said:

"One day you may eat this, another day you may eat that, and the next day you may eat nothing at all."
(Subject 7, about trusting information)

5.2.4 Social Influence and Motivation

Since there are many barriers to why older adults would seek or want information about their health, what other approaches would be effective to motivate them to maintain or change their behavior to stay physically active? In chapter 3 it was concluded that social connectedness was the main drive behind many of the participants' exercise. The social aspect is also revealed again in this session of interviews. Subject 6, 7, 9, and 10 mentioned that it is easier to go for a walk if you have someone to do it with. Subject 6 said that it sometimes takes a person to kick you out of the chair, in his case it was his wife. Other participants mentioned the benefits of social influence in other areas such as learning to use new technology. Subject 7 explained that she had no friends to talk with about using the computer. She thought this was a shame because she did not use it as much or learn as much about it as she would have otherwise. Subject 3 and 6 both have a positive influence from their children, who help them learn new technologies.

5.3 Conclusion

There are many barriers that need to be broken down before the older adult participants of this experiment would adopt technology, such as the smartphone which 6 of 10 participants own already, to provide information about health. These barriers are related to attitudes to health and technology. First of all, concept level goals were related to health problems rather than fitness and wellbeing. None of the participants explained that they had set program level goals specifically to combat a particular health problem. Despite their lack of program level goals, they still had knowledge or experience about how to live with their problems; i.e., what actions or food to avoid, placing them in the Maintenance phase. Two participants were clear about having a need for more information about a health problem. This puts them in the Discovery phase, which means they are asking questions to try to find out what program level goals to set in order to solve their health problems (see figure 7).

Subject #	Subject 3	Subject 4	Subject 5	Subject 6	Subject 7	Subject 8	Subject 9	Subject 10
Maintenance	X	X		X	X	X		X
Discovery			X				X	

Figure 7: Older adults own perception of their need for information. The two subjects in the Discovery phase are aware they are in need of information. Subjects in the Maintenance phase have solve their problems or learned to live with them.

Current, and previous, search for information is limited to social relations such as friends and other members of the participants' health clubs and to asking the physician for a diagnosis. The reason for this limitation is that the participants' need for information is low, even despite their immediate health problems, and they are reluctant to use other sources of information, such as ICT.

The major barriers to why it would currently be difficult for the older adult participants to adopt persuasive technology are:

- Regular reminders about health information can cause distress, this also includes searching for and talking about health problems.
- Exercise does not equal quality of life, on the contrary exercise in itself is thought of more as a chore than as fun.
- Trust in technology and health information provided by the media is low.
- Trust in authorities (i.e., physician) to take care of problems is high.

However, three participants said that they would use a smartphone that could give them health information if it was relevant to their specific health problems. An overview of the attitudes can be found in figure 8 below.

Participant #	Subject 3	Subject 4	Subject 5	Subject 6	Subject 7	Subject 8	Subject 9	Subject 10
Tech reluctant	X	-	-	X	X	-	X	-
Tech positive	-	-	X	-		X	-	-
Health info reluctant	X	X	-	-	-	-	X	X
Health info positive	-	-	-	-	-	-	-	-
Trust in authorities	-	-	-	X	X	-	X	X
Quality of life =! Exercise	X	-	-	-	-	-	-	X
Social influence important	-	-	-	X	X	-	X	X

Figure 8: Overview of the attitudes that were expressed during interviews
(results found on the DVD at path \Appendix\Chapter 5 Notes.pdf)

Based on these results the hypothesis:

Persuasive technology can be used to help motivate Danish older adults to maintain or change behavior to be physically and socially active.

… is rejected. The results acquired from the participants are general attitudes towards technology and health information. Whether these attitudes also translate to, i.e., using a smartphone to monitor health and provide concrete advice, is unclear. However, it is likely that these attitudes will influence their decision to adopt new technology to some degree, until the benefits of the new technology has been proven useful to them, which is, based on my results, not likely to happen without strong external pressure.

Further research into HRV monitoring as a method to help persuasive technology provide motivation to older adults will be not be pursued based on my decision that this report should focus on solutions which can be adopted by older adults within the next three years. As stated in the introduction, the rejection of the hypothesis turns the focus of the report towards discovering possible approaches to help maintain or change behavior of the older adults without the use of persuasive technology tools.

6 How to Motivate the Older Adult Persona

In previous chapters I have gathered results about older adults' ICT readiness and willingness, their physical activity habits and motivation, their need for health information, and their physiological data. I found that the older adult participants:

- Are proficient with computers and to a lesser degree with tablets and smartphones.
- Use the smartphone like a regular phone.
- Buy the smartphone from relatives.
- Prefer to use the tablet when possible because of easy accessibility and large screen size.
- Are engaged in exercise primarily to stave off infirmity.
    - Are unaware that the reason for this is to retain social connectedness.
- Are interested in health problems such as disabilities and sickness rather than health related to fitness and wellbeing.
- Are reluctant to use more technology.
    - Do not like the idea of being monitored, machines doing a physician's job, using a credit card online, being "babysitted" by electronic devices, and sharing private information on social media.
- Are reluctant to search for information regarding health problems outside their social relations and authorities.
    - Distrust media sources with information about health because it is inconsistent.
    - Feel that spending time searching for possible health problems has a negative impact on life quality.
- Would consider using a smartphone that could give them information about relevant health problems or risks.
- Are motivated by social influence.
- Can be effectively monitored according to daily activities with use of HRV.

These are the main features I've found for the older adults from the collected data. With these findings I will create the personas I think best represents the participants I have interviewed. These personas will make it easier to conceptualize a design solution to help them increase motivation to be socially and physically active.

6.1 Persona 1 – Kirsten

Kirsten is 67 years old, retired, and lives together with her husband Jens. She enjoys spending time with friends doing different activities such as yoga and exercise as part of a health club. She knows that being active can help her to avoid sickness and disability and this is the main reason she does these activities, although she also value spending time with friends. Kirsten does not like to talk or think about sickness, she thinks that spending time worrying about health problems will only cause her unnecessary distress. This is true even though she has a disability that has caused her problems. But with treatment from her physician she has learnt to live with it and no longer considers it a problem.

Kirsten sometimes uses a computer to find information on the internet and to send and receive emails from friends and relatives. She does not use a smartphone or a tablet, and does not see what it could possibly help her with that she cannot already do with a regular telephone and computer. Even though a few of her friends use Facebook it does not appeal to her, she does not want to post information about what she does or likes to do; such information should be kept private she thinks.

6.2 Persona 2 – Jens

Jens is 68 years old and retired. He lives together with his wife Kirsten. Like Kirsten he enjoys spending time together with his friends playing pool or exercising in his health club. He does these activities mainly to spend time with his friends but also knows that it can help him avoid sickness and disability. Jens is bothered by pain in his shoulder. He cannot figure out what is causing the pain and neither can his physician so he is waiting for results from a test he had at a specialist a while ago. He would really like to know what is wrong with his shoulder, so while waiting for a diagnosis he sometimes talks about it with his friends and members of his health club. He has also considered searching for information on the internet but he does not know what to write in the search engine or what search results he would even be able to trust.

Jens likes to do photo editing and genealogy in his spare time on the computer. He also has a smartphone, which be bought from one of his grandchildren after she had gotten a new one and wanted to sell her older model. He mostly use the smartphone to make calls and send text messages but he also check emails and browse the internet for information occasionally, furthermore, has a few apps he use regularly. When he sits in the living room he prefers to use the tablet though, which he actually bought for his wife Kirsten to try to get her more involved in learning ICT. It did not help however but he is quite happy to have it to himself. He likes that the tablet has a larger screen size than the smartphone and is more accessible than the computer.

6.3 Conclusion

Because I've found that social influence is the best motivator for the older adult personas, the design solution should focus on using this approach. With Jens' interest in health problems, I believe that a mobile application which can capture his

attention by providing information on health problems in a context that promotes social influence can be designed to increase his motivation for social and physical activity. I choose an app because it is an easy way to reach a large group of users and because Jens already has experience with smartphone interaction. In order to have any change to also be able to reach Kirsten, the design of the app has to take special care to avoid her reluctance to using more technology and to avoid mentioning sickness and infirmity.

7 Concept Co-Design

The goal of this session of co-design interviews is to gather feedback from older adults about their experience with using a smartphone and using apps. Specifically, it is to discover what ways of understanding information they are familiar with and consider natural on a smartphone and how they interact with a new smartphone without instructions.

7.1 Methodology

The co-design session consist of three parts:

7.1.1 Part 1

The participants are asked questions concerning their experience with using a smartphone, other touch-based interfaces, and what they use the smartphone for.

This part is used to determine their exact use of their smartphone, most importantly; if they regularly use apps.

7.1.2 Part 2

The participants are asked to navigate the contact list of a Samsun Galaxy S II to find the address and telephone number of two fictitious persons created in the contact list.

This part is used to determine how they interact with a new smartphone, i.e., what gestures they use to open the phone and navigate the contact list. The contact list was chosen because of its use of a dynamic search field, a common and effective way of searching through information in which the possible results of the entry are presented with each new character entered in the search field. An example of a dynamic search field is Google.com (see figure 9).

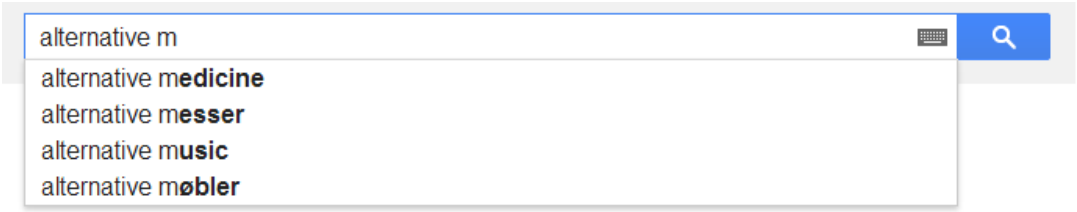

Figure 9: Example of a dynamic search field from Google.dk

7.1.3 Part 3

The participants are asked to give input and feedback to different methods of presenting information on a smartphone. The interviewer draws up ways of presenting information using a paper template of a smartphone, i.e., dropdown menus, dynamic search fields, tables and lists, grids, and icons (the drawings can be found on the DVD at path \Appendix\Chapter 7 Drawings.pdf). The participants are asked about their experiences and familiarity with the methods, and are asked to think about other sources of information they usually use, such as commercials, magazines, invitations, etc. Furthermore, they are asked about what situations most often trigger them to think about their own wellbeing and health problems to discover in what situations an app could be most useful. They are also asked about what information they would prefer to have available if there were looking to join a group of people to share a hobby or other interest.

This part is used to determine their familiarity with different methods of presenting information. This can indicate what methods currently would be most useful to implement into an app, without requiring the users to adapt to new gestures and designs.

7.1.4 Participants

The six participants used for this session of co-design interviews are all Danish older adults living in close vicinity of the city of Aalborg in Denmark. Their age ranged from 62 to 74 with a mean of 66.7. The mean age of the three male participants is 66.7. The mean age of the three female participants is also 66.7. All six participants had been part of previous sessions (see chapter 3, 4, and 5).

7.1.5 Apparatus

The whole session was recorded using a camera in order to capture the participants' use and navigation on the smartphone during the second part of the session and the drawing on the paper smartphone template during the third part of the session.

7.1.6 Procedure

Before the co-design session was begun the participants were told that the test involved how they use a smartphone. If they expressed concerns about not having any experience with using smartphones they were reassured that their participation was just as important as those who do have experience with using smartphones. The sessions lasted approximately 35 to 75 minutes. See appendix 11.8 for manuscript.

For the first two parts of the session, the participants were questioned and tested individually. In the last part, the co-design, they were allowed to sit together in the case when both participants were a couple (4 of the 6 participants).

In part two, the participants were handed a Samsung Galaxy S II smartphone and immediately told to open the contact list and find the telephone number of a fictitious contact named Søren Telman. The second task was to find the address of a fictitious contact named Lone Henningsen.

7.2 Results

Records of the interviews were replayed and all responses in direct or indirect relation to the manuscript were noted (see notes on DVD at path \Appendix\Chapter 7 Notes.pdf).

The first part of the session shows that the older adult participants' experience with smartphones can be split into three levels:

- **Apprentice** – The user use only basic functions of the smartphone mainly calling and texting.
- **Journeyman** – The user use more functions than the apprentice; primarily internet browsing but sometimes also the camera or the calendar.
- **Master** – The user use more functions than the journeyman; specifically regular download, installation and use of apps.

How the participants fall into these categories can be seen in figure 10.

Participant #	Subject 4	Subject 5	Subject 6	Subject 8	Subject 9	Subject 10
Own smartphone	yes	yes	yes	yes	yes	yes
Smartphone user level	journeyman	master	apprentice	journeyman	apprentice	apprentice

Figure 10: Participants' experience level with their smartphone and the number of seconds needed to complete two tasks to navigate the contact list in a Samsung Galaxy S2.

The second part of the session shows that tap and swipe are the gestures the older adult participants use by default. The same has been concluded by Roxanne A. Leitão (Leitão, 2012). Subject 4 and 5 used the dynamic search field to look for the contacts. The other four participants chose to navigate the alphabetic contact list by scrolling.

In the third part of the session all six participants answered without hesitation that they value user friendliness more important than beauty when it comes to design strategies. Large buttons, search fields, step by step instructions, and fast response time on phone are design suggestions requested by the participants. All participants are familiar with drop-down menus from computers, but two agree that this method of presenting information might be a poor design choice for smartphones because of the large space it requires. Participants are also familiar with search fields, and two mention situations in which they would have liked search fields to assist them in searching for specific information. For a simple ordered list like the contact list used in the task in part two of the session, most of the participants (4 of 6) instinctively

used scroll to navigate, which indicates that the search field method is most useful for searching through lists without a clear order.

Information that the participants would find useful when looking for a group to share interests with include:

1. Information about who is arranging the course (both association and the trainer/teacher) including contact information with phone number and email.
2. When and where the group meets.
3. How many members the group has.
4. What activities they do.
5. What type of people the group is for (e.g., men, women, young, or old).

Participants are aware that a group which meets with the sole purpose of sharing experiences about specific health problems is unattractive because sickness and disease is not a topic that is enjoyable to discuss. Two participants said that people who love to talk about their health problems are generally not people they would like to talk to. As subject 6 said:

"It is my experience that people who like to talk about their ailments, you just don't want to listen to."
(Subject 6, about sharing health problem experiences with other people)

However, when asked if they would have liked more information in connection with a period of serious sickness or surgery, subject 6 and 7 both answered yes. Subject 9 and 10 suggested that instead of attending a group about disease you could instead register with a network about a specific health problem. In this digital network you could then post questions and answers quick and easy. In reality this suggestion comes very close to the common internet forum or message board.

Lastly, participants expressed that situations in which they are most bothered by health problems are often when they are physically active and pain force them to stop or rest (subject 5, 6, 7, and 9).

7.3 Conclusion

This session of co-design interviews has revealed interesting points that need to be considered when designing a solution to help older adults increase motivation to be socially and physically active.

Of the six older adult participants, only one used apps on a regular basis. This indicates that introducing apps into this group of the population will be difficult and has to be taken into special consideration before development.

Tap and swipe gestures were dominant during tests and should be the primary form of manipulation in apps developed with older adults in mind.

Test participants were familiar with search fields and scrolling lists, and even expressed their expectation to find search fields in situations where information

could not be presented in an ordered list, e.g., alphabetical or chronological. The dynamic search field method was familiar to most participants and was understood intuitively by those not familiar with it. It is an improvement over the traditional search field method, also for older adults. Generally, user friendliness is very important to the older adults, e.g., large buttons, quick visual feedback, and step by step instructions.

Participant feedback concerning the possibility to share experiences about health interests and health problems in a group was met with different suggestions. As in previous interviews (see chapter 5) health problems were not a topic they found enjoyable to discuss. But still, the older adults express an interest and need for information about it. The idea of a group that met with the purpose of discussing health problems to share experiences and help each other was unappealing to the older adult participants. Subject 9 and 10 instead suggested that the physical group be replaced by a digital one, a network of contacts, with which health problems could be discussed without the high personal involvement of a physical meeting. This would also make feedback to questions faster and more suited to immediate situations where users feel are especially troubled by certain health problems and feel a higher need to search for information accordingly. However, the motivation from social connectedness (see chapter 3.2.2 and 5.2.4) to engage in activity without physical social contact might be lower.

The discrepancy between the reluctance to discuss health problems and the interest in information about health problems, of older adults, shows that special care needs to be taken when addressing the topic of health problems in order to avoid distancing users while at the same time providing the information about health problems they are interested in.

8 Design Concept Scenarios

Social connectedness is the primary motivator for the older adult personas (see chapter 3.2.2 and 5.2.4), which means that an app must promote communication with other people. The reason for Jens (see section 6.2) to learn how to use an app is his interest in health problems. If the interest in health problems identified by this study is genuine, he will want to put effort into learning how to use the app. For Kirsten (see section 6.1) it is more difficult. If she is supposed to use the app she will need to see its benefits first hand, from either a spouse or a close trusted friend. Despite her reluctance towards using new technology, talking about health problems, and looking for information about health problems, if she sees that the benefits of the app are significant compared to what she is currently able to achieve, she will want to use it, as long as the app is designed according to guidelines provided by previous research into older adults and ICT use (Lu et al., 2005; Jorge, 2001; Carmichael, 1999).

A possible solution, to keep older adults physically and socially active, is to design an app which makes it easier for the user to meet or chat with other people who share the same kind of health problems as the user does. Currently, Jens shares such information with personal relations and where there might not be many with similar problems. An app will give the user the opportunity to expand personal relations to include other people who he shares common health problems with. It is very important that the app does not ignore the reluctance Kirsten has to technology and looking for information about sickness. The terminology of the app must try to avoid making it 'an app about sickness' and instead talk about itself as 'an app about health interests'. Likewise the app must make it clear that it does not monitor or control anything the user shares without permission and use only natural language (see chapter 2.1.3). This of course makes it difficult to incorporate HRV data monitoring into the app. But, if the user recognize the usefulness of the app, the incorporation of HRV in the future will be possible to help the user more accurately determine his or her health status and possible problems.

8.1 App Concept Requirements

In short an app must:

1. Enable the user to meet or chat with other people interested in sharing experiences and knowledge about certain health interests (which could be many things, but must include health problems).
2. Communicate with the user in a natural language.
3. Use terminology that emphasizes wellbeing not sickness.
4. Use common gestures, specifically tap and swipe.
5. Use large buttons, quick visual feedback, and step by step instructions.

8.2 Reaching the Older Adults

One challenge is how an app should be designed, another challenge, identified in chapter 7.3, is how an app can be introduced to the target audience despite their lack of experience with apps. One solution, which would likely have good results, is to let the physicians of older adults tell them about the app and its usefulness to share experiences and knowledge about specific health problems (Schutzer & Graves, 2004). If physicians are allowed or willing to promote such methods for their patients, is not known, even if the app is non-profit. It is also unclear through which channels physicians should be approached with such suggestions.

Another easier option is to work together with Ældre Sagen, a national association for the benefit of the old and elderly with 650 thousand members (www.aeldresagen.dk), and use their magazine and website for promotion purposes. A partnership with Ældre Sagen would help an app benefit from the association's large subscription base and trustworthiness, an issue which was also found to be important to the older adults (see section 5.2.3). In return the app can help Ældre Sagen get more people to join their association. Since older adults value social connectedness highly (see section 3.2.2) word of mouth would also be an effective way of promoting the app. Word of mouth promotion could be achieved by offering a free course with information and instructions about the app to the key instructors and teachers within the organization. These key people interact with older adults on a daily or weekly basis. They can help spread awareness of the app by word of mouth to the participants in their courses and activities.

8.3 App Use – Possible Scenarios

This section describes concrete situations where the two personas (see chapter 6) have specific problems and how an app can help them solve these problems.

8.3.1 Scenario 1 – Based on Jens

Jens is sitting in the living room with his wife, they are watching a crime series on television but Jens is bored and picks up the tablet to find something else to occupy him. After checking his email he browses through the icons on the start screen and glances through them trying to decide what to do. His gaze stops at the app as he remembers earlier today when he went for a walk with his wife but they had to slow down because his shoulder started hurting. He thought that was a bit embarrassing and feels motivated to find out why his shoulder sometimes starts hurting. So he opens the app, types "shoulder" in the search field at the start screen, and finds a group who share a common interest in problems with the shoulder. Since he is

sitting next to his wife he does not want to make a call, instead he looks at information on when and where the group usually meets and makes a note in his calendar to make an appearance at the next meeting with the hope that someone there can answer some of his questions about the pains in his shoulder.

8.3.2 Scenario 2 – Based on Kirsten

Kirsten is walking to her husband Jens who is picking her up from her weekly yoga class in their car. She had a great time today and spent a while after class to talk with her friends about this and that. They kept mentioning some new app they have been using to find people to share their experiences about doing proper health exercise with. One of them also said she had found answers to questions she had about osteoporosis. Even though Kirsten doesn't like to talk about disability and the like, it made her a little bit curious because she has been wondering about a disability that her mother has, and she is afraid she might have it from her mother genetically. She borrows her husband's smartphone after she gets in the car. On the way home she learns that it is possible to ask questions directly to other people on a message board, just using the smartphone. This makes her quite excited and her husband agrees that it is about time she gets a smartphone for herself. Then she will be able to check in regularly and learn what other people have done to reduce the risk of disability.

9 App Design Guidelines

This chapter is a summarization of all the information I have gathered during the many sessions and tests and marks the end of the report. It will be presented as a list of guidelines based on the conclusions from previous chapters. The guidelines are intended to help future app design to avoid or overcome the barriers I've identified within the context of mobile health technology to older adults. In addition to existing literature on the subject of designing persuasive technology (see section 2.1) future designers have a good basis for creating interfaces to motivate both young and old.

9.1 A Health Information Collective

I have concluded that social influence is a good approach to increase older adult motivation (see section 5.2.4). An app designed to share health experiences between older adults to establish positive social influences requires a database of user health interests to function. This is necessary in order for users to find people who share their specific interests. To start this database it could be possible, in partnership with an association for old and elderly, to list their available courses, training sessions, and clubs. Additionally, information about who is organizing it, type of activity, number of participants, age of participants, location, and meeting times should be made available. To expand this database, new users should select a few personal health interests with the possibility to include health problems when registering to use the app. Thus, the app will make it easy for users to enlist to available groups, courses, clubs, to meet new people, but should also make it possible to ask and answer questions directly in forums, chats, or message boards.

9.2 User Involvement

It is important that the app allows both a high degree of personal involvement for users like Jens (see section 6.2) who is motivated by social connectedness and a more casual and lower degree of involvement for users like Kirsten (see section 6.1) who is reluctant to talk and discuss sickness or disability. Jens would be likely to contact a designated contact person for a group to find out what the group is all about before visiting the location where they meet. Kirsten is more likely to find a message board about her interests and post questions and answers there, whenever she feels the need to share her experiences in certain situations.

9.3 Navigation and Gestures

From co-design sessions with participants (see chapter 7) I learned that navigating information provided in an app should be made possible with dynamic search fields and ordered lists, because older adults are familiar with these methods of searching for information. Gestures used to navigate should be kept simple and stick to tapping and swiping gestures. Furthermore, use of large buttons, clear and quick visual feedback should be included in the design. Step-by-step instructions should also be made available to the user because, based on the participants of this study; the older adults have only little experience with downloading, installing, and using apps.

9.4 Language

In section 7.3 I described a discrepancy between the older adults' interest in information about their health problems and the reluctance towards talking about them. The balance between providing information about health, including health problems, while avoiding talking about issues related to health problems will be difficult to find but intelligent use of wording and paraphrasing should be enough to keep the balance as long as the language is kept natural. In a list of potential health interests it would also be a good idea to let the health problems blend in with other health interests such as playing cards or bicycling and avoid isolating the health problems in separate groups and menus.

9.5 The Health Authority Shortcut

From my observations, trust in health authorities is generally high (see section 5.2.2). This can have very important implications when introducing an app or other health technology to older adults. E.g., if the physician of an older adult or a doctor to an older adult patient tell them to use some kind of mobile health technology as part of their treatment of a health issue, they will do so despite of their attitude and possible reluctance to both health information and technology. Health technology such as telemedicine can benefit from this by its direct involvement with the users' personal physicians. Thus, the possibility of including health authorities in the development and use in mobile health technology should always be considered.

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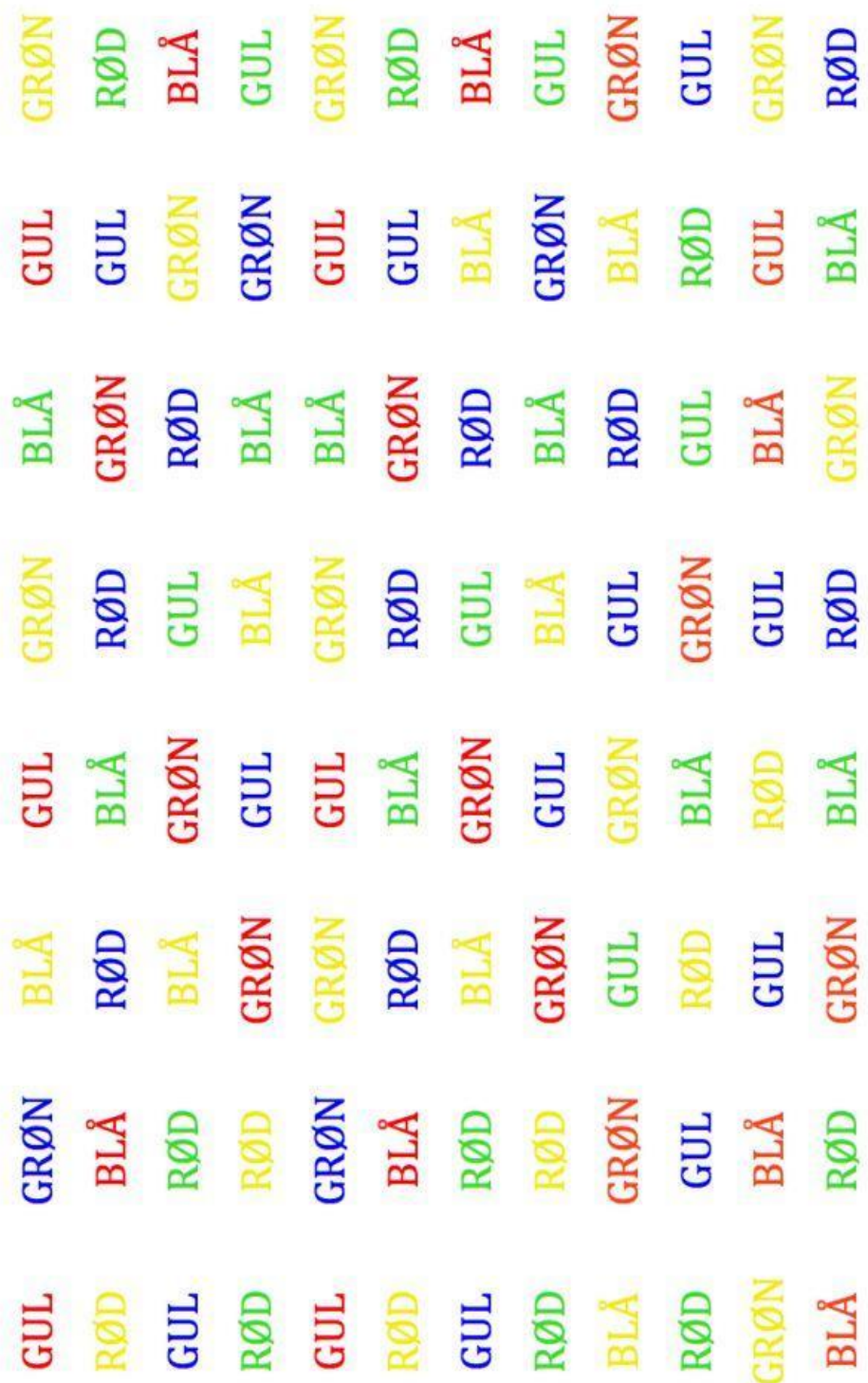
11 Appendix

11.1 The Stroop Test



11.2 HRV experiment and activity durations

TIME	Video Start	Stroop Start	Stroop End	Breath Start	Breath End	Walking Start	Walking End	Step Start	Step End
TS3	00:00:09	00:04:10	00:07:12	00:10:55	00:14:29	00:18:17	00:21:38	00:27:40	00:30:46
unedited		00:04:19	00:07:21	00:11:06	00:14:38	00:18:26	00:21:47	00:27:49	00:30:55
length			00:03:02	00:03:43	00:03:34	00:03:48	00:03:21	00:06:02	00:03:06
TS4	00:00:15	00:02:19	00:05:17	00:07:59	00:11:33	00:16:58	00:20:14	00:25:20	00:28:23
unedited		00:02:34	00:05:32	00:08:14	00:11:48	00:17:13	00:20:29	00:25:35	00:28:38
length			00:02:58	00:02:42	00:03:34	00:05:25	00:03:16	00:05:06	00:03:03
TS5	00:00:09	00:02:56	00:05:57	00:09:36	00:13:15	00:18:25	00:21:35	00:27:25	00:30:25
unedited		00:03:05	00:06:06	00:09:45	00:13:24	00:18:34	00:21:44	00:27:34	00:30:34
length			00:03:01	00:03:39	00:03:39	00:05:10	00:03:10	00:05:50	00:03:00
TS6	00:00:32	00:03:18	00:06:18	00:09:48	00:12:58	00:16:19	00:19:28	00:23:24	00:26:33
unedited		00:03:50	00:06:50	00:10:20	00:13:30	00:16:51	00:20:00	00:23:56	00:26:55
length			00:03:00	00:03:30	00:03:10	00:03:21	00:03:09	00:03:56	00:03:09
TS7	00:00:25	00:04:26	00:07:27	00:12:15	00:15:48	00:21:27	00:24:34	00:30:25	00:33:25
unedited		00:04:51	00:07:53	00:12:40	00:16:14	00:21:53	00:24:59	00:30:50	00:33:50
length			00:03:01	00:04:48	00:03:33	00:05:39	00:03:07	00:05:51	00:03:00
TS8	00:00:12	00:03:04	00:06:06	00:10:55	00:14:06	00:18:26	00:21:28	00:27:17	00:30:19
unedited		00:03:16	00:06:18	00:11:07	00:14:18	00:18:38	00:21:50	00:27:29	00:30:31
length			00:03:02	00:04:49	00:03:11	00:04:20	00:03:02	00:05:49	00:03:02
TS9	00:00:08	00:03:13	00:06:15	00:11:36	00:14:37	00:19:17	00:22:29	00:27:26	00:30:27
unedited		00:03:21	00:06:23	00:11:44	00:14:45	00:19:25	00:22:37	00:27:34	00:30:35
length			00:03:02	00:05:21	00:03:01	00:04:40	00:03:12	00:04:57	00:03:01
TS10	00:00:10	00:03:11	00:06:12	00:11:22	00:14:23	00:20:21	00:23:30	00:28:36	00:31:37
unedited		00:03:21	00:06:22	00:11:32	00:14:33	00:20:31	00:23:40	00:28:46	00:31:47
length			00:03:01	00:05:10	00:03:01	00:05:58	00:03:09	00:05:06	00:03:01
TS11	00:00:08	00:01:15	00:04:15	00:09:11	00:12:32	00:17:14	00:20:28	00:26:57	00:29:17
unedited		00:01:23	00:04:23	00:09:19	00:12:40	00:17:22	00:20:36	00:27:05	00:29:25
length			00:03:00	00:04:56	00:03:21	00:04:42	00:03:14	00:06:29	00:02:20
TS12	00:00:08	00:03:25	00:06:24	00:09:47	00:12:56	00:17:29	00:20:35	00:24:24	00:27:22
unedited		00:03:33	00:06:32	00:09:55	00:13:04	00:17:37	00:20:43	00:24:32	00:27:30
length			00:02:59	00:03:23	00:03:09	00:04:33	00:03:06	00:03:49	00:02:58

11.3 HRV data

Time Domain	Mean RR	TS3	TS4	TS5	TS6	TS8	TS10	TS11	TS12	Mean
	Software artifact correction level	medium	strong	very low	strong	very low	very low	low	strong	
	Baseline 1	624.2	765.2	862.5	818	965.7	905.5	575.1	865.9	**797.8**
	Stroop	615.3	546.2	773	828.2	1013.5	945.5	569.8	869.7	**770.2**
	Baseline 2	634.3	655.8	866.3	874.6	1049.3	947.5	600.4	872.4	**812.6**
	Breath	671.1	685	858.6	817.3	965.3	964.9	609.7	906.6	**809.8**
	Baseline 3	692.1	717.2	833.1	796.3	1036.4	956.2	613.1	858.9	**812.9**
	Walk	498.2	611.7	758.3	642.6	791.2	755	555.9	735.8	**668.6**
	Baseline 4	633.2	704	865.8	835.1	1014	930.9	592.5	839.1	**801.8**
	Step	431.2	488.8	630.8	570.9	520.4	622.9	480.6	614.3	**545.0**
	Baseline 5	533	576.6	797.8	767.1	860.4	822.1	542.4	738.9	**704.8**
	Baseline total	623.4	683.8	845.1	818.2	985.2	912.4	584.7	835.0	**786.0**
	pNN50									
Low Noise	Baseline 1	6.5	0	3.9	4.6	23.4	9.5	2.6	6	**7.1**
High Noise	Stroop	0.7	0.9	0	1.4	18.1	0	0	2	**2.9**
	Baseline 2	2.9	5.7	1.2	2.5	31.1	9.2	0	7.4	**7.5**
	Breath	28.4	12.3	3.6	7.8	29.6	7	0	10.7	**12.4**
	Baseline 3	37.7	5.1	5.4	2	22.3	10.8	0.4	0.6	**10.5**
	Walk	3.6	0.6	0.4	2.1	1.3	0	24.2	1.6	**4.2**
	Baseline 4	3.8	1.2	9.2	2.9	21.6	6.1	0	1.5	**5.8**
	Step	26	3.7	0	0	0.9	1	6.8	2.4	**5.1**
	Baseline 5	9.4	1.8	12.8	16.8	19.6	2	0.3	4.3	**8.4**
	Baseline total	12.1	2.8	6.5	5.8	23.6	7.5	0.7	4.0	**7.9**
Frequency Domain (FTF)	**LF Power**									
	Baseline 1	100	363	785	1038	668	1179	1363	240	**717.0**
	Stroop	75	13	175	277	280	97	14	362	**161.6**
	Baseline 2	160	560	482	768	1856	349	51	540	**595.8**
	Breath	357	165	1259	2335	3544	1027	167	995	**1231.1**
	Baseline 3	134	156	1161	2255	920	1071	93	253	**755.4**
	Walk	39	120	205	144	296	68	12585	367	**1728.0**
	Baseline 4	132	233	1738	1069	2679	464	35	222	**821.5**
	Step	74	13	14	10	4	3	10	152	**35.0**
	Baseline 5	246	45	2999	865	964	164	34	756	**759.1**
	Baseline total	154.4	271.4	1433	1199	1417.4	645.4	315.2	402.2	**729.8**
	LF/HF Power									
	Baseline 1	2.802	15.846	5.938	11.736	1.286	5.175	0.733	3.908	**5.9**
	Stroop	1.149	5.104	2.708	6.817	0.601	1.906	1.719	3.307	**2.9**
	Baseline 2	2.897	4.642	5.165	5.356	2.158	2.392	10.408	3.9241	**4.6**
	Breath	6.718	0.773	20.109	7.427	13.734	1.5	4.357	3.116	**7.2**
	Baseline 3	2.577	2.683	7.443	23.241	1.753	2.055	11.967	4.051	**7.0**
	Walk	0.45	1.296	5.089	3.523	4.251	2.844	4.485	7.031	**3.6**
	Baseline 4	1.803	7.526	13.142	11.243	3.293	2.005	3.862	3.6	**5.8**
	Step	0.601	0.744	1.471	3.318	0.149	0.602	0.24	2.071	**1.1**
	Baseline 5	1.297	0.732	8.212	0.648	1.271	1.105	1.778	2.219	**2.2**
	Baseline total	2.275	6.286	7.980	10.445	1.952	2.546	5.750	3.540	**5.1**
Nonlinear	**Poincare SD1**									
	Baseline 1	21.6	7.3	16.9	16.8	32.3	48.6	27.5	13.5	**23.1**
	Stroop	8.2	6.8	9.4	13.4	26.2	9.1	3.2	12.9	**11.2**
	Baseline 2	13.3	21.2	14.2	15.6	35.5	20	3.3	19.3	**17.8**
	Breath	30.6	27	18.2	24.1	32.3	40.4	7.2	24.5	**25.5**
	Baseline 3	32.3	18.1	24.8	13.2	38	29.8	6.3	10.1	**21.6**
	Walk	17.8	6.4	10.5	10.8	11.9	8.2	65.3	12.8	**18.0**
	Baseline 4	13.7	9.8	20.6	17	48.1	33.4	3.9	12.9	**19.9**
	Step	35.8	11.2	4.5	5.6	9.5	14.1	22.8	13.1	**14.6**
	Baseline 5	23.6	12.5	26.8	32.9	35.1	20.8	7.4	16.3	**21.9**
	Baseline total	20.9	13.78	20.66	19.1	37.8	30.52	9.68	14.42	**20.9**
	Poincare SD2									
	Baseline 1	46	120.2	73.6	110.7	78	89	50.1	33.6	**75.2**
	Stroop	24.4	34.1	45.6	34.7	69.2	41.5	11.5	33.3	**36.8**
	Baseline 2	47.5	116.3	78.7	73.8	112.1	63.7	32.4	63.4	**73.5**
	Breath	36.9	31.3	67	77.2	89	66.7	32.8	59.5	**57.6**
	Baseline 3	38	67.8	63.5	157.4	93.2	61.2	31.8	33.6	**68.3**
	Walk	72.7	31.3	39.2	57.5	69.7	19	275.9	56	**77.7**
	Baseline 4	64.3	94.5	128.3	114.4	174.5	138.5	40.7	62.3	**102.2**
	Step	75.4	80.8	32.3	61.3	116.4	77.6	51.5	91	**73.3**
	Baseline 5	132.3	119.6	163.1	137.5	268.5	170.2	69.3	131.5	**149.0**
	Baseline total	65.6	103.7	101.4	118.8	145.3	104.5	44.9	64.9	**93.6**

11.4 Code groups and number of occurrences among participants

Code Groups	Number of occurrences
Computer user	10
Smartphone user	6
Tablet user	5
Smartphone simple user	3
E-device no desire	5
E-device no need	6
E-device whip	4
Internet user	6
Tablet more than computer	2
Tablet easier than smartphone	1
E-device small text	2
E-device short battery life	1
Computer lesson	2
E-device lesson by relative	3
E-device need private lesson	1
Computer experience	3
E-device interest	1
E-device attitude privacy	3
E-device attitude too much	3
E-device bought as gift	4
E-device bought from relative	3
E-device bought to belong	1
E-device no money	2
E-device wish	2
Activity social	7
Activity need	3
Activity vs freedom	1
Exercise daily	3
Exercise weekly	7
Exercise history	4
Exercise accessory	4
Exercise for mobility	6
Exercise for well-being	2
Exercise for social	1
Exercise for duty	1
Exercise guilt	3
Exercise need whip	3
Health vs comfort	1
Stress	1
Sleeping irregular	4

11.5 Older adult participants demographic data

Test Subject #	Age	Gender	Weight (kg)	Height (m)	BMI	BMI class	Smoking	Alcohol	Civil status	Bloodpressure
TS1	74	M	78	1.79	24.3	normal	No	Regularly	Married	Pre-high
TS2	77	F	66	1.6	25.8	overweight	No	Regularly	Married	
TS3	67	F	47	1.61	18.1	underweight	No more	Rarely	Single	Normal
TS4	64	F	77	1.72	26.0	overweight	No	Regularly	Married	High
TS5	64	M	75	1.76	24.2	normal	No	Rarely	Married	Pre-high
TS6	72	M	65	1.75	21.2	normal	No	Rarely	Married	High
TS7	74	F	101	1.63	38.0	obesity lvl2	No	Rarely	Single	Pre-high
TS8	68	F	74	1.62	28.2	overweight	No more	Regularly	Married	Normal
TS9	62	F	95	1.64	35.3	obesity lvl2	No more	Regularly	Married	Pre-high
TS10	64	M	123	1.82	37.1	obesity lvl2	Yes	Regularly	Married	Pre-high

11.6 Interview manuscript for older adult physical activity habits and ICT readiness

Demografi

Age _____

Gender _____

Weight _____ kgs

Height _____ cms

BMI (weight kg / height m^2) _____

Waist circumference around belly button _____ cms

QSQ

1. Hvordan føler du generelt at du har det?
2. Hvordan vil du beskrive din balance mellem arbejde og fritid?
3. Hvor godt spiser du i løbet af dagen?
4. Hvor godt sover du om natten?
5. Hvordan vil du beskrive dit stress niveau i løbet af de sidste 3-4 uger?
6. Hvor tilfreds er du med din nuværende livsstil?
7. Sådan som du lever i øjeblikket, hvor sandsynligt tror du så det er at dit helbred vil blive ringere over de næste par år?
8. Har du opdaget at du har følt dig trist, deprimeret eller håbløs over de sidste 3-4 uger?
9. Hvor mange dage om ugen får du mindst 20 mins fysisk aktivitet? (hurtig gang, løb, jogging, cykling, fitness, m.m.)
10. Ønsker du at tabe vægt?
11. Kender du dit blodtryk? Tal?
12. Ryger du? Hvor meget?
13. Hvor ofte drikker du alkohol?
14. Tager du ofte en pause, en gåtur, en lur eller et hvil for at samle energi? Hvor ofte?

15. Bliver du ofte syg af forkølelse, influenza, feber m.m.?
16. Lider du i øjeblikket af nogen medicinsk lidelse eller sygdom? Eller får du medicinsk behandling?
17. (EGEN) Hvordan vil du beskrive vejret i øjeblikket? Og i dag?

Fysisk aktivitet

1. Rutine
    a. Typisk dag med/uden fysisk aktivitet? Hvilken slags? Hvor ofte? Yndlings slags?
2. Mål
    a. Hvad er dit mål med denne aktivitet?
3. Undvigelse
    a. Udsætter du nogle gange aktivitet? Hvordan og hvorfor?
4. Motivation
    a. Hvad er det der i første omgang får dig til det?
5. Prioritet
    a. Hvad er den vigtigste egenskab du vinder ved det?
6. Indflydelse
    a. Hvad har indflydelse på om du laver din aktivitet?
7. Bestræbelse
    a. Hvordan ser du dig selv træne om fem år?

Teknologi

1. Benytter du, eller har du benyttet, noget udstyr, teknologi, eller andre former for assistance eller komplementer til dine aktiviteter og sundhed? (f.eks. Edmondo, dagbog, HRM, kalender, blodtryksmåler)
2. Hvordan bruger du det, vis og fortæl
3. Har du set eller kender du andre som bruger det?
4. Overvejer eller ville du ønske at du brugte noget?
5. Er der en eller flere grunde til at du ikke bruger noget?
6. Hvordan er hjerterytmemåleren? Hvis du havde en liggende i et skab, ville du så få den brugt?

11.7 Interview manuscript for older adult ICT willingness and health information need

Faseafklaring

- Har du problemer med dit helbred, der generer dig fysisk, mentalt eller socialt?
    - Hvilke indikatorer tager du notits af?
- Har du nogle mål i forhold til din sundhed som du forsøger at gøre noget ved?

    - Hvorfor er dette vigtigt for dig?
- Ved du hvad du konkret skal gøre for at nå dit mål / løse dit problem?

Hvis ja - Maintenance

- Hvordan fandt du ud af hvad du skal gøre?
    - Gør du så det du har fundet ud af?
        - Fortæl om sidste gang
        - Hvad fik dig til det?
- Måler du dine aktiviteter?

Hvis nej - Discovery

- Hvordan har du prøvet at få information?
    - Hvad ville du gerne have fundet?
- Hvad skal der til for at du kan gøre noget ved dit mål / problem?
- Måler du dine aktiviteter?

Ønsker om mere/bedre information

- Hvordan kunne det være bedre?
- Hvis den her telefon var fra fremtiden og kunne alt, hvad ville du så have den til?
- Hvis du kunne få information om at du var i risiko for at blive syg, ville det så gøre dig tryg eller utryg?

11.8 Interview manuscript for concept co-design session

1. Ejer du en smartphone?
2. Har du før brugt en smartphone?
3. Har du erfaring med berørings-skærme?
4. Hvad bruger du en smartphone til?
5. Har du erfaring med at bruge Apps?

1. Kan du finde Søren Telmans telefonnummer?
2. Kan du finde Lone Henningsens adresse?

"Jeg vil gerne lave apps der er nemme at bruge. Hvad er gode måder at præsentere information på?"

1. Skal design være flot eller nemt at bruge?

2. Hvad er nemt på din telefon, hvad er svært?
3. "Hvis man skulle kunne finde motionsklub, hvad info er nødvendig/ rar at have?"
4. Hvordan bliver information nemmest at overskue?
    a. Dropdown
    b. Dynamisk søgefelt
    c. Lister eller tabeller
    d. Blokke/felter
    e. Ikoner
5. Blade, magasiner, reklamer, indbydelser
    a. Hvad virker / virker ikke?

1. I hvilke situationer tænker du over helbredsproblemer?