Designing a remote lifestyle intervention for older adults using empathic design

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Contents

Abstract

Just like many other countries in the world, the Netherlands experiences population ageing. The number of older adults has significantly increased in the last three decades. With age come certain health challenges that require specific ways to be addressed that are designed with the a priority for the user needs. As the recent pandemic has challenged the country's healthcare stability, eHealth has shown it's importance in remote healthcare and is steering more and more into using the Internet-of-Things. Home therapy and lifestyle interventions have been offered to people to try to get them to be more physically active. This thesis researches how a remote lifestyle intervention for older adults can be designed using empathic design and proposes a design for a home physiotherapy training system. A practical usability case study on a developed home physiotherapy technology was used to form the base concept of the system and highlight different user needs. To ensure clarification on and the prioritization of the user needs throughout the design process, an empathic approach for the design of this remote lifestyle system was applied using a co-design brainstorm session. The combined findings of these respective practical studies presented the research population's user needs and design requirements. This user-centered design approach results in a proposed eHealth system that catered to challeges older adults may face, while motivating themselves to stay physically and prospectively mentally active. The final design proposition is a combined eHealth installation, consisting of an electronic operating device paired to a digital physiotherapy training application, where users conduct clinical physiotherapy exercises, track their progress, are socially connected with peers; while involved healthcare professionals are able to monitor and interact remotely. This thesis is concluced with the final design proposition for the home physiotherapy system and an interface mock-up design of the digital application.

1. INTRODUCTION

1.1 Background/Motivation

With health improvements and increased wealth, life expectancy has seen a substantial increase over the last two centuries (Roser, Ritchie, & Ortiz-Espina, 2013). Every country is experiencing growth in size and proportion of their elderly population (e.g. population ageing; the Dutch term 'Vergrijzing', literally translated 'gray-ing'). As the elderly population rises, so does the number of people requiring more frequent or additional health care, as with age health complications develop and/or worsen. Population ageing has been a familiar term in the Netherlands. As of January 2022, a fifth of the Dutch population was aged 65 and older, where that number stated 12,8 percent merely thirty-two years before. With this surge of older adults and healthcare being of noticeable importance, improving or at least maintaining physical health is important.

Globally, it is estimated that around 2.4 billion people are dealing with a health condition that require rehabilitative services (World Health Organization, 2021). Rehabilitation is defined as a set of interventions designed to optimize functioning and reduce disability in individuals with health conditions, i.e. diseases, illnesses and injuries, in interaction with their environment. Physiotherapy is often a significant part, if not the full rehabilitation treatment, increasing the demand for physiotherapy and physiotherapists. Physiotherapy helps people affected by illness, injury and disability through movement and exercise, manual therapy, education and advice (Chartered Society of Physiotherapy, 2018). Physiotherapy helps people of all ages maintain/improve health, manage pain and prevent disease.

Where health is the state of complete physical, mental and social well-being (World Health Organization, sd), this applies to all ages. However, requires more prevalent attention for elderly ageing individuals as deterioration of either physical, mental or social well-being has severe and faster effects on the others and overall well-being. Elderly people are generally considered a separate part of the population for a number of reasons related to their age and stage in life. The elderly population is typically defined as people who are over a certain age. This age is significant, because it is associated with a number of physical, mental, and social changes that can impact an individual's daily life. Elderly people are more likely to experience chronic health conditions and disabilities. These health issues can affect an individual's quality of life, mobility and ability to participate in social activities. Also, as people age, they may experience changes in their social roles and relationships. For example, retirement from work may lead to reduced social interaction, and the loss of friends and loved ones can result in social isolation. Additionally, elderly people may require specific services and support to help them maintain their independence and quality of life. These could include healthcare, home care, transportation, and social programs. Generally, elderly people are a distinct part of the population because they have unique needs and experiences related to their age, health, social roles, and support requirements. Understanding these factors is important for ensuring that they receive the appropriate care and services they need to thrive in later life, especially in the field of eHealth. This shows the importance of involving this part of the population with designing and systems usability, to showcase the groups specific user needs.

eHealth, or electronic health, is the use of digital tools and technologies to support and improve healthcare (Eysenbach, 2001). eHealth is a rapidly developing field that has the potential to transform the way healthcare is delivered and accessed. eHealth is developing in different fields for healthcare: telemedicine, wearable technology, Electronic Health Records (EHRs), Artificial Intelligence (AI) and mobile health (mHealth), to name a few.
Telemedicine is the use of video conferencing, messaging, and other remote communication tools to provide healthcare services to patients who are not physically present in a medical facility (Cambridge Dictionary, sd). With the development of telemedicine, healthcare providers can remotely monitor and treat patients, expanding access to care and improving outcomes. Wearable technology, such as smartwatches and fitness trackers, can collect and transmit health data to healthcare providers. This information can be used to monitor patients' health and identify potential health issues, allowing for early intervention and prevention. EHRs are digital records of a patient's medical history, including diagnoses, medications, and test results (Stephens, 2020). EHRs allow for easy and secure sharing of patient information between healthcare providers, improving continuity of care and reducing the risk of errors. Artificial Intelligence is being used to develop predictive models and decision-support tools that can aid healthcare providers in diagnosis and treatment. AI can also be used to analyze large amounts of health data to identify patterns and trends, allowing for improved public health initiatives and research. Mobile Health involves the use of mobile devices, such as smartphones and tablets, to support healthcare. mHealth apps can be used to monitor health conditions, provide health education, and support medication adherence.
Overall, eHealth is a rapidly evolving field with enormous potential to improve healthcare access, quality, and efficiency. As digital tools and technologies continue to develop, it is expected to see further innovation and advances in eHealth.

When designing a (new) system, a designer might underestimate certain visualization aspects of an interface. This could be due to the designer not fitting the target user group. When a system is designed with a specific purpose and for a specific user, it is important that the system can be interacted with and understood by the user as intended. If this is not the case, this might result in a different operation of the system, undesired usability outcomes or even

unmotivation to use the system. It is therefore important during the design process, the system focuses on usability and meeting user requirements and needs.
Human-centered design (HCD) and empathic design are two related but distinct design approaches that focus on understanding and meeting user needs. Human-centered design is a broader approach that emphasizes designing for user needs, while empathic design emphasizes developing an emotional connection with users to deeply understand their needs and desires.

Home therapy and lifestyle interventions have been offered to people to try to get them to be more physically active. In the current study, I investigate how a lifestyle intervention intended for single-users at home can be designed using emphatic design. We test this in the context of a large European project Pharaon and with a lifestyle intervention from one of partners in this project: the Motiphy+ from the company Clynx. Below I describe the project and the technology, before I explain the other research questions.

1.2 Motiphy+, Clynx and the PHARAON-project.

Traveling for acquiring physiotherapy could possibly be challenging for those with physical complications. Based in Portugal, Clynx was founded in 2018 and has designed a solution that allows for remote physiotherapy: Motiphy+. Motiphy+ was designed for older adults or people with physical complications to make physiotherapy an enjoyable experience by combining technology with gamified approaches. This is done by combining body movement detection and a motivating treatment experience. The portability and innovative character of this digital solution enable it to be used both in-clinic and at home, ensuring that the physiotherapist is always informed, able to track progress even remotely (EU-Startups, sd). Remote physiotherapy has shown its possible importance since the CoViD-pandemic, where in-person appointments and physical contact were often not possible without significant risks for the physically disadvantaged individuals.

In October 2022 Clynx partnered with the European PHARAON-project to test the usability of Motiphy+ technology for remote physiotherapy and digital coaching. PHARAON's objective is to provide support for Europe's ageing population by integrating digital services, devices, and tools into open platforms that can be readily deployed while maintaining the dignity of older adults and enhancing their independence, safety, and capabilities (Pharaon, sd). PHARAON aims to utilize existing digital services and products to enhance the living quality of Europe's ageing population.
The PHARAON-project is spread over five pilot sites across Europe, which focus on specific goals in relation to healthy and active ageing. One of these pilots is in The Netherlands, led by the University of Twente. The objective of the Dutch PHARAON pilot is to promote community building and to promote a healthy lifestyle of the BoodschappenPlusBus (hereinafter PlusBus)

of the National Foundation for the Elderly (NFE). The PlusBus is a community transport service of the NFE that focuses on older adults who desire to have more social contacts and/or go outside (more often). People in this community make use of a platform called Regicare, which is offered by PHARAON partner, to sign up for said roadtrips. In a previous study (RP 2021-160 and 2021-194), it was tested whether people can use this certain software, Regicare, to register for lifestyle interventions. PHARAON wanted to expand the Regicare platform with the Motiphy+ solution offered by Clynx, with the motivation that physical activity monitoring does not necessarily result in motivational coaching and Motiphy+ was designed for that reason.
My participation in this Dutch pilot for this study aimed to investigate the usability of the Motiphy+ interface and how a remote physio training system can be optimized using empathic design, that allows for swift and more desired use of a home training system.

1.4 Research questions

As said previously, the overall question of this study is to investigate how a lifestyle intervention intended for single-users at home can be optimized using an empathic design aproach. Therefor, this study will be answering the following research question:

How can a remote physical training system for older adults be designed using empathic design?

In addition, the following questions will be addressed:

- What are the differences between human-centered and empathic design?
- What factors help people to be motivated to use lifestyle interventions?
- Which systems already exist that allow users to physically train at home?
- What challenges does a system that is not user-centered face?
- What are the design requirements for a remote lifestyle intervention for older adults?

1.5 Target Group

The project focuses on older adults, aged 50 years old and over. These adults are either in or nearing retirement. They live independently, so they do not find themselves living in nursing homes or other closed communities. They generally spend most of their time at home or in their home vicinity, limiting their physical activeness. Another important aspect is that these older adults need to be somewhat physically mobile and do not find themselves physically vulnerable, as they are living independently. They need to find themselves in either a need or a desire for more physical activeness. This need could come from suggestion or urgency by an external medical professional or concern from peers. The desire could simply be wanting more physical activity in their daily routines or wanting a (partial) substitute for outdoor physical activities.

1.6 Additional info & limitations

There are a few practical aspects to take into consideration during the scope of the project.
The research and accompanying tests are run through PHARAON, a European project, which makes the testing for the project dependent on their timeline. The first user study will begin as early as the end of October/beginning of November. This is earlier than for other GP projects. Lesser user testing is needed at the end of the project to compensate.
With COVID-19 still providing an unstable situation in the nearby future, any safety precautions that may be instilled by the government or the testing location could possibly hinder testing or even cease the testing process all together in its current setting.

2. BACKGROUND RESEARCH

To determine the difference between human-centered- and empathic design; to investigate what systems already exist that allow users to train at home and what motivational factors could be for use of lifestyle interventions, a background research is conducted. In the first section of the background research, a literature research is conducted to determine between human-centered- and empathic design. Then, motivationals factors are researched, as they could indicate what aspects need to be considered for continuous usability and the requirements for final proposed solution. After, the focus lies on human-centered design and it is researched on its importance for designing user systems. The second section of the background research consists of research and analysis on the state-of-the-art.

2.1 Literature Research

2.1.1 Human Centered Design versus empathic design?

Human-centered design (HCD) and empathic design are two related but distinct design approaches that focus on understanding and meeting user needs.

Human-centered design is defined by the International Organization for Standardization as an approach to interactive systems that aims to make systems usable and useful by focusing on the users, their needs and requirements, and by applying human factors/ergonomics, and usability knowledge and techniques (International Organization for Standardization, 2020).

Human-centered design is a broad approach that prioritizes designing for the needs, behaviors, and preferences of end-users. It involves gathering insights through research and iterative design to create solutions that are usable, useful, and desirable. Empathic design, on the other hand, emphasizes deep understanding and empathy for the user. It involves developing an emotional connection with users to gain insights into their unmet needs and desires.

When it comes to methodology, human-centered design involves a range of research methods, including interviews, observations, surveys, and usability testing. These methods are used to gather data on user needs and behaviors, and to refine design solutions. Empathic design, on the other hand, emphasizes direct engagement and connection with users through techniques such as role-playing and immersive experiences.

The ultimate goal of human-centered design is to create user-centered solutions that meet the needs of the target audience. These solutions can take a variety of forms, including products, services, or systems. Empathic design emphasizes the emotional connection and understanding of the user, and the resulting solutions may be more focused on delivering a specific emotional experience or connection.

In summary, both human-centered design and empathic design are user-focused design approaches that aim to understand and meet user needs. However, human-centered design is a broader approach that emphasizes designing for user needs, while empathic design emphasizes developing an emotional connection with users to deeply understand their needs and desires.

Additionally, one could argue there to be a difference between user-centered and human-centered design, with a human-centered approach of designing a system focusing on a majority of humans and a user-centered approach focusing on a more select group of users of said system. However, both terms are often used interchangeably.

2.1.2 Motivational factors in lifestyle interventions

What motivates or demotivates people to adapt their physical activity? There may be several reasons for this.

First, we should distinguish between extrinsic and intrinsic motivation (Kotte, 2022). Extrinsic motivation is defined as a motivation to participate in an activity based on meeting an external goal, garnering praise and approval, winning a competition, or receiving an award or payment (Thomson & Jaque, 2017). Once an individual gets accustomed to executing the activities and is no longer in need of external motivation to continue these activities, it turn into intrinsic motivation. Intrinsic motivation is necessary for enforcing healthy habits, as extrinsic reasons can shift or perish over time. If the external motivation attempts are not persistent or motivating enough for the individual to persist into turning the extrinsic motivation into intrinsic motivation, the individual is likely to cease the activities. Extrinsic motivation is the first step to intrinsic motivation, thus is a key determinant for the (continuous) use of lifestyle interventions.

Social comparison has shown to be a possible demotivator when it comes to physical activity. (Laranjo, Quiroz, Tong, Bazalar, & Coiera, 2020) found several cases where social comparison had a negative effect on motivation for physical activity.

A 6-month pilot study showed that participants mentioned that social comparison of weight, BMI, or step count can be pointless if participants' characteristics, goals, and lifestyle are not known. However, it was found that the preferred type of comparison varied between individuals. They found that participants only find motivation in social comparison when they can relate to the people they are being compared to. Meaning there need to be similarities between participants, as that leads to more understanding of other users and their motives.

However, when participants are able to relate to others users, most participants in this study mentioned they felt motivated by the competition aspects enabled by social comparison, especially with regard to physical activity. This means competition can serve as a motivational factor, when compared appropriately.

Thus, important factors to motivate people for physical activity seem to be: successful extrinsic motivation and social comparison and competitiveness between said peers. While factors such as insufficient or unsuccessful extrinsic motivation, social comparison and competition to contacts they cannot relate to, seem to demotivate people.

2.2 State-of-the-Art of lifestyle interventions for remote use

In this section I review systems that make us of technologies similar to Motiphy+ or operate under a similar objective, being to make remote physiotherapy an enjoyable experience by using gamified approaches. Additionally, I provide examples of systems that aim for social connectivity. For this research, the focus for the state-of-the art lies with, remote physical activity, the use of gamified approaches and social connectivity.

PHYSIOMATE

PhysioMate is an application developed by physiotherapists and other professionals that aims to encourage physical exercise in order to combat both physical and cognitive deterioration, functioning as a complement to the work of physical therapists, with and without their live supervision (Madeira, Costa, & Ostolache, 2014). PhysioMate uses gamification and Virtual Reality through Natural User Interface (NUI) devices. Natural user interfaces (NUI) is a field of interface design where natural human abilities are leveraged to weave in technology (Kramer, 2012). NUI is an area that focuses on traditional human abilities, such as vision, touch, speech, handwriting, motion, as well as cognition, creation, and exploration to replicate real world environments to optimize interaction between physical and digital objects.
Initially, the PhysioMate project focused on the rehabilitation of patients dependent on wheelchairs, whether they are victims of stroke or elderly people.

ePHYSIO

ePhysio is a platform for remote management of musculoskeletal diseases enabled by wearable sensors (Vallati, Virdis, Gesi, Carbonaro, & Tognetti, 2018). ePhysio is not yet a developed technology, but it is presented as a possible large-scale and flexible platform for sensor-assisted physiotherapy and remote management of musculoskeletal diseases. The system leverages networking and computing tools to provide real-time and ubiquitous monitoring of patients. ePhysio is not yet on the market, however does provide valuable insights in the use of wearables for physical health treatment.

The patient using the platform is wearing a set of wearable sensors that monitors the patient's exercises and collect various data. Such data is then made available to professionals by means of a web interface. This professional interface is used by physicians and physiotherapists to monitor the correct execution of the exercises and gain an insight in the patient's progress, with possibilities of comparing the effectiveness of the exercises of different patient categories. Additionally, the interface allows professionals to allow feedback to their patients. Data mining techniques could be used to help professionals extract high-level behaviors with the possibility of considering data coming from multiple patients over different periods of time.

XBOX KINECT

Kinect is Microsoft's motion sensor add-on for the Xbox 360 gaming console. The device provides a natural user interface (NUI) that allows users to interact intuitively and without any intermediary device, such as a controller. The Kinect system identifies individual players through face recognition and voice recognition. A depth camera, which "sees" in 3-D, creates a skeleton image of a player and a motion sensor detects their movements. Speech recognition software allows the system to understand spoken commands and gesture recognition enables the tracking of player movements. Although Kinect was developed for playing games, the technology has been applied to real-world applications as diverse as digital signage, virtual shopping, education, telehealth service delivery and other areas of health IT and continues to service possibilities within these fields.

LEAP MOTION

The Leap Motion Controller developed by Ultraleap is an optical hand tracking module that captures the movement of users' hands and fingers so they can interact naturally with digital content (Ultraleap). Small, fast, and accurate, the Leap Motion Controller can be used for productivity applications with Windows computers, integrated into enterprise- grade hardware solutions or displays, or attached to virtual/augmented reality headsets for AR/VR/XR prototyping, research, and development (Ultraleap, sd). The controller is capable of tracking hands within a 3D interactive. Leap Motion's software is able to discern 27 distinct hand elements, including bones and joints, and track them even when they are obscured by other parts of the hand. The Leap Motion Controller has several fields of application, one of which is healthcare. The controller is applicable for use of stroke habilitation, training, mirroring, medical imaging, lazy eye treatment and more.

WII - WII SPORT

The Nintendo Wii is a gaming console for home use, that was released in 2006 (Nintendo, sd). Initially, the gaming console makes use of Wii-remotes that detect a user's movements using sensors for its motion sensing capabilities: motion sensing, gesture recognition and pointing. The Wii-remote is operated and physically held by one hand.

Wii Sports is an interactive videogame for the Nintendo Wii console for users of all ages (7+) and level of athleticism (Nintendo, 2006). The game consists of a number of sports that users play using the Wii-remote in a subjectively intuitive and realistic manner. The game is operated using the Wii-remote to register various movements significant for each sport.

STRAVA

Strava was founded in 2009 by Co-founders Michael Horvath and Mark Gainey to bring back their years of friendship and competitiveness at university (Strava, sd). Strava is a social fitness platform with more than 76 million users in nearly every country worldwide (Strava, sd). Users are able to connect on the platform by befriending each other, registering their activities on their Strava-feed, react to these activities, join challenges and show others admiration for their accomplishments. Different types of groups of people have formed clubs on Strava to organise activities and form communities with acquaintances, brands, sport shops and more. Strava allows for registering over thirty different sport activities, e.g. running, cycling, swimming.

2.2.3 State-of-the-art Conclusion

I investigated which systems already exist for users to electronically physically train at home.
The researched existing technologies show to have different
However, there are no existing technologies that combine a focus on physical health, remote monitoring and entertainment, with a sole priority on the different challenges that older adults may face. This provides for ample opportunity in the field of physiotherapy and the progression of eHealth for older adults.

3. METHODOLOGY

The Creative Technology Design Process (Mader & Eggink, 2014) consists of different phases within the design development (see Appendix A): Ideation, Specification, Realisation and Evaluation. The Ideation phase consists of the initial stages of the process, where the problem is defined, relevant information is acquired and an idea for solving the given problem is generated along with its requirements. In the Specification phase, a number of prototypes are used to explore the design space along with a short evaluation and feedback loop, to conclude the product specification. After the determined product specification, the proven methods of engineering design are specified in the Realisation phase. This is characterized by decomposition of the start specification, realization and integration of the components and evaluation. Lastly, the process needs to be reflected on in the Evaluation phase.

Since this project revolves around an already developed technology, the methodology of this project deviates from the Creative Technology Design Process. After the previously conducted literary research is where the project gets more practical.
The practical part of this project is divided into three phases: 1) the Motiphy+ usability case study, 2) co-design ideation and 3) prototype conceptualization.
The first two practical phases are part of this project's ideation phase, where the requirements for the design are determined by the tested technology and co-design brainstorm.

For this project, it is important that the test participants are questioned on their individual experiences and the technology's limitations. The requirements for the proposed group integration solution will be composed of the prior literature research, usability test findings and co-design session findings.

3.1 Phase 1: Case Usability Study N = 9

After the conducted literature and state-of-the art research, the usability testing initiated according to PHARAON's pre-determined time period. In this phase, the case study of Motiphy+ determines the factors required for a user-centered home training system, with the main focus on the systems interface. Motiphy+ is an already developed technology for which a usability test is conducted. Participants of the usability study had filled in System Usability Scale (SUS) questionnairres (Appendix C) and After Scenario Questionnaires (ASQ) (Appendix D) to easily measure the technology's usability. These scores of these questionnaires conclude how human-centered the system is designed. The findings that arose after the usability testing were analyzed to help determine what the requirements are for the empathically designed solution.

3.2 Phase 2: Co-design   N = 7

Additional to the usability test, a co-design brainstorm session was held. This brainstorm session was initiated to offer possible additional insights to the usability desires of the user and possible additions to the proposed solution. The session took place in the Connect space of the Design Lab at the University of Twente.
This co-design session consist of two main brainstorms: 1) mind-mapping on the topic of 'health' and 2) initiating ideation of a newly designed home physio trainer for older adults.

The first brainstorm uses mind-mapping as a brainstorming method, where participants will make a mindmap around the central concept of 'Health to determine what they deem to be key values. Mind-mapping is a simple way to brainstorm thoughts without having to worry about an order and structure. A Mind Map is a diagram for representing tasks, words, concepts, or items linked to and arranged around a central concept or subject using a non-linear graphical layout that allows the user to build an intuitive framework around a central concept.

The second brainstorm held between the subgroups continues to build on the topic of health, but progresses to a more specific way of thinking. The concepts that the first brainstorm determined, helped the participants to keep in mind what important concepts are regarding the subject. This second brainstorm was divided into three stages, where in each stage the ideas get more specific and lead to their most important requirements for their final idea. These requirements served as an indication for general requirements that fit the research population of the study and additional components to the system based on the suggestions by the participants.

The overarching brainstorm method is rolestorming. Rolestorming was developed in the 1980's by personal development consultant Rick Griggs, who combined role-playing and brainstorming to keep people on track and avoiding fear and ridicule within a brainstorm (Griggs Achievement, sd). Rolestorming helps the participants reduce or even eliminate possible feelings of embarrasment and increase imagination and honesty. However, rolestorming could possibly be difficult for some people when they hardly relate to the role they are trying to get into. In this case, participants require additional assistance and exercises to aid the process.

3.3 Phase 3: Prototype Conceptualization

The results of phase 1 and phase 2 were concluded into set lists of requirements and user needs. These serve as the basis of the proposed solution.

Phase 1 focused on the design requirements for the digital interface of the final system. The results of the usability case study determined key system functions and aesthetic elements for the interface of this project's final proposed system design.

Phase 2 focused on the needs of the research population when it comes to the subject of health and a home physio trainer, where the basis of the user needs, setup requirements and additional design components were determined.

The results of these two phases conclude into the final proposed system design, with an overview of the different components of said system and visualizations of a new interface design.

3.4 Project Timeline

This project operates on a timeline with stages that deviate from the Creative Technology project, visualized in the figure . Previously, the necessary background research has been done on relevant aspects to the project and the state-of-the-art. Then, the Motiphy+ usability case study was held. In this stage, the interface and system were tested how user-friendly and human-centered the technology rates at. This forms the ideation basis for the digital interface that is the main part of the final result of this project. In the next stage, the co-design brainstorm study session was held. The results of this stage show where the needs and focus of the research population lies, when it comes to remote physical health, and form the ideation requirements for the final design. In the final stage, the specification of the different components of the design are determined to form the overall final system and a proposed final systemis designed, which consists of a proposed interface design and system attributes.

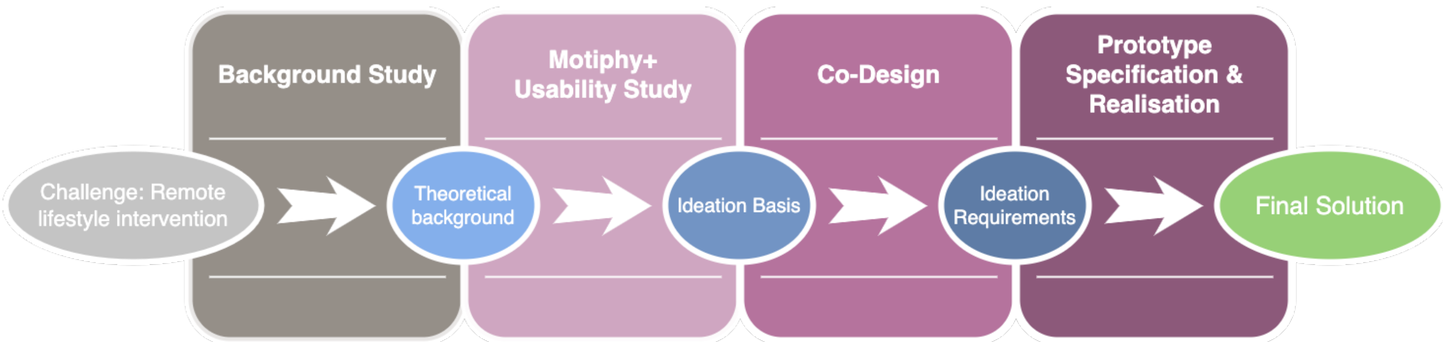

Figure 1: Timeline of the research project in different phases.

3.5 Research population

This study focuses on older adults aged 50 years and above. An inclusion criterium for the research population is that they live independently, so they do not find themselves living in nursing homes or other closed communities. They generally spend most of their time at home or in their home vicinity, limiting their physical activeness. Another important aspect is that these older adults need to be somewhat physically mobile and do not find themselves physically vulnerable. If they require some physical assistance in getting around, e.g. to the supermarket, that is permitted as long as they do not require constant mobility care. This means that they should not suffer from balance issues and physical disabilities that keep them from walking without external support, plus they should feel confident in conducting (light) physical exercises.

4. Usability Study

The experimental procedures involving human subjects described in the work of this section were approved by the Institutional Review Board of the Computer & Information Sciences (CIS) Ethical Committee (request no. 220103). Prior to interaction with the Motiphy+ technology, developed by the company Clynx, all participants were asked to go through and sign an informed consent procedure. Additionally, they were requested to fill in additional information to measure the demographics of the researched population.

Participants were recruited through the Research and Development department of the Roessingh Research Institute. The department was able to reach out to people in their participant archive from previously conducted studies.

Participants have to meet the previously mentioned inclusion criteria. Additionally, an inclusion criterium for study participants is that the older adults display sufficient digital skills. They will come in contact with technology and will make use of the digital signup platform Regicare, so for example having an email address or at the very least be willing to obtain one.

The information letter and consent form used for this study can be found in Appendix E.

4.1 Pre-validation

The usability testing was conducted in the eHealth House located in the Technical Medical Centre of the University of Twente. The eHealth House is a Living Lab and it simulates aliving environment – an one-bedroom apartment with a living room, kitchen and bathroom, where technology can be tested in a realistic but controlled setting (University of Twente, sd). Nine participants were welcomed in the Living Lab for a 1-hour test session in the living room of the appartment. During the individual sessions, two scenarios were tested with the participants: 1) participant orders the lifestyle intervention through the Regicare platform 2) the usability of Motiphy+. The first scenario falls out of the scope of this thesis.

4.1.1 PRE-OBSERVATION

Participants were given time to adapt by the testing team to familiarize and become comfortable with the laboratory environment in which the testing took place. Simultaneously, the testing protocol procedures were introduced and an introductory explanation of the Clynx installation was given. This introductory explanation did not serve to bias the usability and assessment of intuitiveness of participants, rather to make them aware and comfortable regarding the basics of using Motiphy+. Participants were explained that the application is meant to guide them on certain exercising and cognitive activities. They were informed of the contents of the testing procedure and basic mobility in regard to interaction with the technology. Participants have given consent before interaction with the technology and were asked for demographic information (see appendix B). The acquired demographic information are the participant's name, age, gender, living status, marital status, known physical disabilities or injuries. Additionally, if participants had any follow-up questions or were open to the second phase of this project or other related studies, they were asked for their contact information.

4.1.2 USABILITY TESTING OBSERVATION

During the participant's execution of the usability test, researchers observed them in the testing environment .
The observers had to make the following observations:

- Did the participant understand the given instructions?
- Was the participant able to start the solution and bring it on the screen?
- Was the participant able to successfully execute a complete training session?
- How many and which of the available exercises did the participant test?
- Did the participants repeat any exercise(s)? If so, why and what was the result?
- Number of bugs that arose during the testing procedures and which ones specifically.

Participants were requested to complete a questionnaire on their experience with the Motiphy+ technology and its usability after they had finished the physical interaction with the technology. The questionnaire consisted of the System Usability Scale, that determines the usability of the system and; the After Scenario Questionnaire, that determines the usage difficulties of the system.

4.1.2.1 After Scenario Questionnaire

The After Scenario Questionnaire (ASQ) is a questionnaire that is used to asses user satisfaction during participation in scenario-based usability studies, developed by (Lewis, 1995). The ASQ is given to the study participant after they have conducted a normal condition scenario.

The After Scenario Questionnaire consists of 3 statements, that are answered individually by a 7-point scale, scaling from 'Strongly Disagree' to 'Strongly Agree'. (Appendix C)

1. Overall, I am satisfied with the ease of completing this task.
2. Overall, I am satisfied with the amount of time it took to complete this task.
3. Overall, I am satisfied with the support information (on-line help, messages, documentation) when completing this task.

After the user has completed the ASQ, the ASQ score can be calculated by taking the average of the 3 questions (eHealth Observatory; The University of Victoria). Each of the three questions scored with a 4 indicate a neutral usability scenario. The higher the selected score with each statement, the higher the participant's usability satisfaction with the system.

4.1.2.2 System Usability Scale

Invented in 1986 by John Brooks, the system usability scale serves as a quick and staightforward way of measuring and evaluating the usability of a system or design. This method is widely used and standardized by the International Standardization Organization in ISO 1942-11 (International Organization for Standardization, 2020), which focuses on efficiency, effectiveness and satisfaction.

The System Usability Scale is determined by the 10 usability scale questions below, that are answered individually by a likert scale from 1-5 (scaling from 'strongly disagree' to 'strongly agree' (Appendix D):

1. I think that I would like to use this [system] frequently.
2. I found the [system] unnecessarily complex.
3. I thought the [system] was easy to use.
4. I think that I would need the support of a technical person to be able to use this [system].
5. I found the various functions in this [system] were well integrated.
6. I thought there was too much inconsistency in this [system].
7. I imagine that most people would learn to use this [system] very quickly.
8. I found the [system] very cumbersome to use.
9. I felt very confident using the [system].
10. I needed to learn a lot of things before I could get going with this [system].

The average of the scores to these questions are measured on a scale from 1-100, visualized in the figure below, with a score of 1 indicating poor usability and a 100-score indicating the best usability.

The figure below shows that a System Usability Score below 50 is considered a not acceptable usability score, a score between 50-70 is a marginal acceptability score and a score of 70 or higher is considered an acceptable score. A study on the SUS-scores of 500 studies determined that the average usability SUS-score is 68 points (Jeff Sauro, 2011), serving as a threshold for system usability. This means that a score of above 68 indicates that the design needs minor improvements or adjustments. Whereas a score of below 68 indicates that there might be more serious issues with the design that need to be re-evaluated and improved to be considered user friendly.

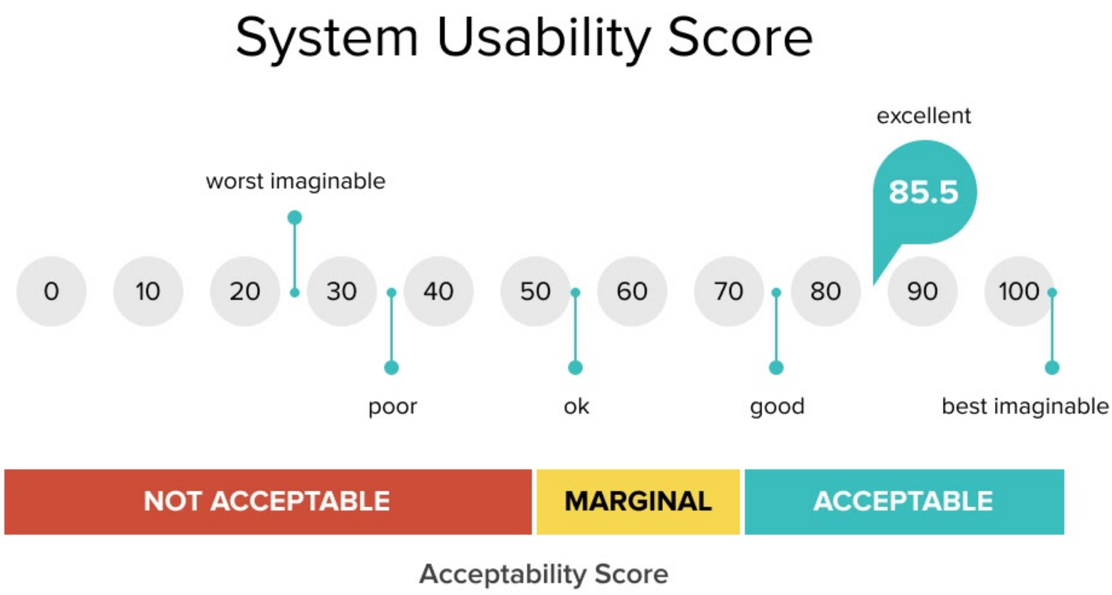

Figure 2: A System Usability Scale with indicative threshold scores (source: https://xd.adobe.com/)

4.1.3 POST-USABILITY TEST

After participants completed the questionnaire, the researcher returned to the participant and give further explanation on the system and/or ask more questions for clarification if necessary.

4.2 Results

4.2.1 Participant Demographics

A total of 9 people participated in the Motiphy+ usability study, of which 6 male participants and 3 female participants. With the lowest participant age of 50 years and the highest participant age of 78 years, the average age of the research population in this usability study is set at 66.8 years (rounded to 67 years).

All but one participants have a higher education background, with the six participants above the age of 65 already retired. All participants are married and live with their partner.

All participants indicated to have sufficiant digital knowledge, as they regularly or often use modern technological devices (computer, tablet, smartphone). Participants either used these technologies to stay in contact with others, to stay informed or stay active.

4.2.2 Observations

During the usability research, the following observations had to be made:

- Did the participant understand the given instructions?
- Was the participant able to start the solution and bring it on the screen?
- Was the participant able to successfully execute a complete training session?
- How many and which of the available exercises did the participant test?
- Did the participants repeat any exercise(s)? If so, why and what was the result?
- Number of bugs that arose during the testing procedures and which ones specifically.

Overall, instructions given by the system upon interaction were not sufficiently clear for the participants to continue their interaction without further explanation from the researchers. Even in the case of understandable instructions, the system would be hindered by technical functionality bugs where the motion by the user was not adequately mirrored.

Participants generally had no trouble starting the application and logging into the system with their given credentials.

Next to the gameified exercise there was also the progress exercise. Four participants conducted the progress exercise. This exercise served to track the user's progress by conducting the same exercises each session. This exercise showcase insufficient technical functionality and unclear provided information, instilling more confusion and even incompletion of the exercise.

No participants were able to successfully conduct any exercise without confusion as to the execution of the movements or reactability by the system. Only five participants were motivated to repeat an exercise after correctly understanding the aim of the gameified exercise. For the other participants, confusion demotivated them into continueing their interaction. The participants that repeated their exercises were more succesfull the second time, however that did not guarantee full understanding or entirely succesfull completion.

4.2.2.1 Interaction findings

There were several findings in the interactions with Motiphy+. Here are the most important ones:

- Multiple (trans)linguistic errors across the entire application, with sometimes questionable word choices. Good translations must therefore be made by a correct translator (person). Also, the home screen language switches back to the developer's language (Portuguese) after logging out.

- During the one-arm exercises, including calibration, there is no alternating between the right arm and the left arm. Just the right arm. This should also be taken into account during the number of exercise repetitions.

- Logging in takes a very long time, which caused confusion among users as to whether they logged in correctly. Also, the home screen language switches back to the developer's language (Portuguese) after logging out.

- During the exercises, three 'characters' are displayed: the sensor display, the avatar from the game and the 'ghost' that previews the movement. This caused a lot of confusion among users, it was not clear which character to follow or what to look at.

- The protractor caused a lot of confusion among all users. It was not explained anywhere what the level of degree exactly indicate and therefore it was not clear what the results represented in the exercise and session overviews.

- The score indication in different exercises was inconsistent. Some correct moves do not add a score, and sometimes a score is added if a totally wrong move is made.

4.2.2.2 Technical Bugs

Calibration	*After choosing and before starting an exercise, the system calibrates the camera's motion detection with the user's position in front of the camera. The user is not moving at this moment.*
	- Speed during calibration inconsistent - Calibration does not depend on user posture, system is 'calibrated' regardless of correct posture assumption
Avatar:	*The application makes use of an avatar to indicate the user's motion as if they were that avatar. Any movement the avatar makes, the avatar copies.*
	- Physical features not adjustable - Gender not adjustable
Progression exercise:	*The progression exercise serves as a standard exercise that can be conducted before and after every session to measure the user's progression.*
	- Avatar not mirrored, always switches between arms - Only at a certain arm height (angle/degrees between arm and body) the exercise is counted, if that fails, the game does not continue even though there is no indication - Not indicated when exercise is over, must be ended when no more measurements are made
Exercise 1:	*In this exercise, the user's avatar simulates walking in a nature like setting with a sword. The user's arm needs to be used to slice coloured blocks in half that cross the avatar's path.*
	- The system's comments during game practice are random and sometimes overlap, comments come even though they are made by user - Avatar cannot imitate user if correct diagonal movement with arm is done
Exercise 2:	*In this exercise, the user's avatar simulates being a football goalkeeper standing in a goal in a footballstadium. The objective of this exercise is to block the footballs of another soccer player trying to score, by copying a an additional animation 'ghost' of arms displaying different example movements.*
	- 'Ghost' example is not aligned with the football player's shot moment - Point counter does not count constantly, sometimes also counts up if the user does not imitate the exercise or is in the picture - Balls are not stopped in the correct position blue dots - 'degree gauge' not reactive during exercise

	- Remarks during exercise by the game are random and sometimes overlap
General	- Logging in takes a long time - Bad/wrong translations to NL in the system - When the session ends, the exit cross must be clicked repeatedly/too often (click>pain meter>click>click>session progress>click) - After logging out, the language of the system goes back to Portuguese

4.2.3 ASQ- & SUS-scores

4.2.3.1 After System Questionnaire-Results

Overall, the average ASQ score of the Motiphy+ technology rates at 52,5.

The graph in figure 3 shows the After Scenario Questionnaire-scores of the usability scenarios with Motiphy+: 1) login to the application and 2) conducting exercises.
The vertical axis shows a score scale from 0-100. The scores of the first scenario is indicated by the blue bars. The scores of the second scenario is indicated by the green bars. The horizontal axis shows the given scores by each participant* for each scenario. On the right, it shows the average ASQ-score of all participants for each scenario.

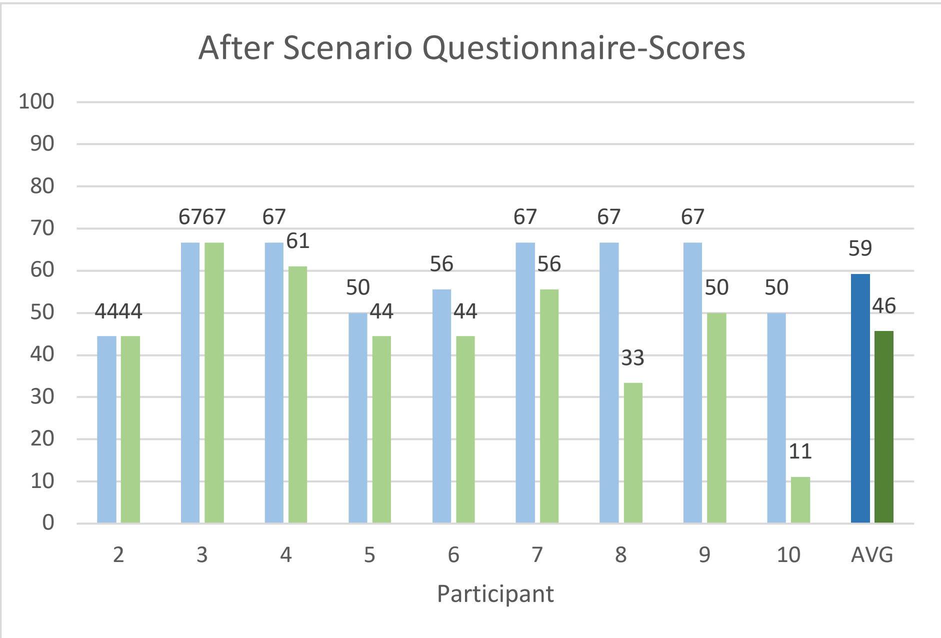

Figure 3: The After Scenario Questionnaire-score results of the Motiphy+ usability study, showing individual participant and average scores.

** Participant number 1 did not show up to the usability testing and therefor acquired no data.*

With a neutral score of around 50%, it can be observed that that the average ASQ-scores for both scenario's are relatively low, considering an as high as possible score is most desired to rate user satisfaction. The ASQ-score of 59 for scenario 1 (the log-in) theoretically rates at a sufficient score, however arguably does not suffice in user satisfaction. The ASQ scores indicate that operating the system only scores approximately half of the achievable points.

The ASQ-score for the actual interaction with the exercises and the application shows a lower rating, with a low score of 46. This is below 'neutral' and indicates that the user satisfaction did not suffice upon interaction.

4.2.3.2 System Usability Score-Results

Overall, the System Usability Scale scores were fairly positive, but presents the need for possible serious usability improvements with a SUS-score of 62, compared to an average of 68 out of 100.

The graph in figure 4 shows the System Usability Scale scores measured from each participant's ratings. The vertical axis shows a score scale from 0-100. The horizontal axis shows the given scores by each participant for each scenario. On the right, it shows the average SUS-score of all participants.

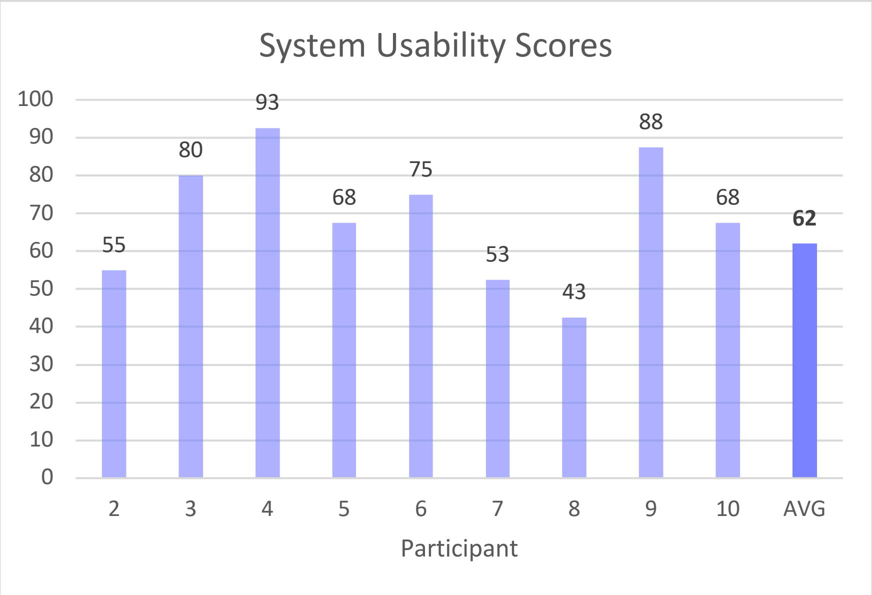

Figure 4: The Sustem Usability Scale Scores of the Motiphy+ usability study, showing indivial participant and average scores.

As mentioned in section 4.1.2.2, an average SUS-score levels at 68 out of 100, which indicates sufficient system usability with minor improvements necessary. With a lowest SUS-score of 43 and a highest score of 93, the SUS-scores measured from the participant's interaction with the Motiphy+ system averaged to a SUS-score of 62. Although the system scored close to average by this research population, an average score of 62 indicates that the system requires more serious improvements to its usability and it can therefor be concluded that it is not user-centered enough for appropriate user interaction.

5. Empathic Design: Co-Design Brainstorm

To give more insights to the requirements and needs of the user a home training system for older adults, an empathic design methodology is used.

For the session, five participants of the previous Motiphy+ usability study along with two UT students were invited and during the session this group was split into two randomly assigned and as equally divided as possible subgroups.
As mentioned in section 4.2, the co-design brainstorm session uses different brainstorming techniques to reach the conceptualization of a home physio trainer for older adults by the participants. While the session is initiated with a brainstorm using the mindmapping technique, the umbrella brainstorm technique is rolestorming. For rolestorming, the co-design session makes use of personas. This helps to generalize the user needs and make it easier for participants to relate to to similar needs for using the system.

The information letter and consent form presented to the participants can be found in Appendix F.

5.1 Personas

User personas are used to aid in the brainstorm technique of rolestorming.

The created personas fit the demographics and characteristics of the research population and participants of the PHARAON-project and the research population of this study. As this study and the researched system does not discriminate in gender or sex, there will be one female persona for one subgroup and one male persona for the other subgroup.

With the possibility of the individual participant not directly feeling the need to use a home physio trainer as of now, personas help people with understanding that different people do not have the same expectations, priorities and needs.
To further warm the participants up and aid them in relating to their assigned persona, they were asked to think of possible hobbies and interests that persona could have. Where it was important of the participants to imagine the life and ways of this persona to see what hobbies and interests they believe to be compatible to their given pesona. This pushes participants to carefully read the information about the given persona instead of merely briefly scanning over the information. This helps to initiate a thinking process before the actual start of the brainstorming.
The hobbies and interests indicated in the persona overviews below are a mere indication of possible outcomes. They were handed instead a blank space for hobbies and interests.

5.1.1 PERSONA 1: Ingrid[1]

<table>
<tr><td colspan="3">"I am slowly watching my physical mobility decline,
so I am trying my best to slow it down."</td></tr>
<tr><td rowspan="5"></td><td>Name:</td><td>Ingrid</td></tr>
<tr><td>Age:</td><td>70 years</td></tr>
<tr><td>Profession:</td><td>Retired Librarian</td></tr>
<tr><td>Marital Status:</td><td>Widow of 8 years</td></tr>
<tr><td>Family Status:</td><td>3 daughters; 2 live close by,
1 further away</td></tr>
<tr><td>Residential status:</td><td colspan="2">Lives alone in her family home.</td></tr>
<tr><td>Competences:</td><td colspan="2">Seniorphone, tablet, PC, electric bicycle</td></tr>
<tr><td>Hobbies en Interests:</td><td colspan="2">[Reading/Baking/Knitting/Nature walks]</td></tr>
<tr><td>General:</td><td colspan="2">After being a fulltime librarian her whole life, Ingrid now volunteers at that same library for a few days a week. She has met a lot of people throughout her career as a librarian. She is known and liked by everyone in town. They know her for her inviting smile, calm aura, wide knowledge of books and her kindness for anyone walking into those library doors. After having been married for over 40 years, Ingrid has been a widow for the past eight and has found herself in a nice daily routine.</td></tr>
</table>

[1] *The profile image of the persona was generated through a random face generator (https://thispersondoesnotexist.com/), the depicted person on the image does not exist.*

5.1.2 PERSONA 2: Jos[1]

"I am at home a lot, so I find it hard to stay physically active."		
	Name:	Jos
	Age:	58 years
	Profession:	IT Consultant
	Marital Status:	Divorced
	Family Status:	Single, no children
Residential status:	Lives alone in a small singular family home	
Competences:	Smartphone, tablet, PC/laptop, electric bicycle, car	
Hobbies en Interests:	*[Bird watching/Puzzles/Writing]*	
General:	Jos works remotely as an independent IT Consultant, so he spends most of his time at home. Because of this, he is not very physically active. Jos has dealt with heart complications ever since he suffered from a heart attack four years ago. He has to eat healthy and be somewhat physically active, but he can not put a heavy strain on his heart. Jos has also had asthma his whole life.	

5.3 Co-design Session Outline

The session was outlined as follows:

1. Welcome participants
2. Icebreaker.
3. Introduction to session
    a. Agenda
    b. Problem statement, aim of session
    c. Story related to use of home trainer by personas
    d. Signed informed consent forms
    e. Participants fill in demographics
4. Splt participants into two subgroups
5. Handout personas
    a. One persona for each group
    b. Explain purpose of persona
    c. Each group fills in hobbies/interests section together
6. First brainstorm: What is ‘health’?
7. Presentation of ideas by each group
8. Presenting results of usability study
9. Second brainstorm: A new hometrainer for older adults to stay active
10. Presentation of idea by each group
11. Closing

5.3.1 Brainstorm 1: What is ‘health’?

This first brainstorm served as as the initiation of the thinking process for the second and most important brainstorm, where they ideate their own solution catered to what they believe to be the needs of their given persona.

Here, mind mapping is used as the main technique for brainstorming. The mind mapping technique prepares the mind to use information and think logically, while stimulating the brain to think more visually (Parikh, 2016). The figure below shows an example of a mind map on the main topic of ‘sports’. It visualizes that sports can be separated into four different subcategories of kinds of sports, which individually can be further branched into specifically named sports that fit into those initial subcategories.

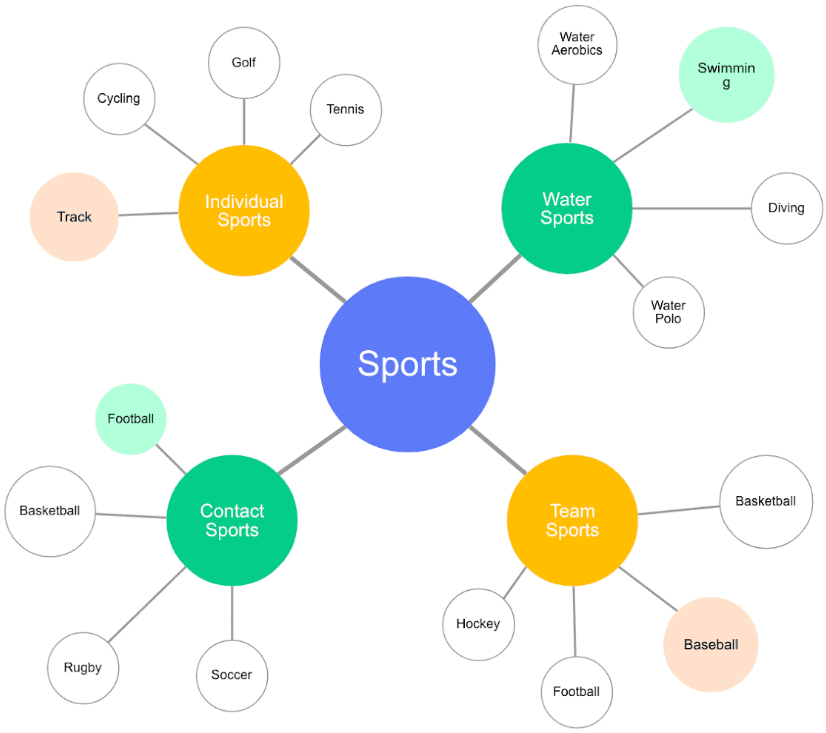

Figure 5: An examplatory mindmap on the main topic 'Health', branched into related subtopics and specific associated terms (source: https://nulab.com/)

Participants were asked to make a mindmap around the main topic 'Health' within their own group. In a mindmap, each first branch which each start a linear view to specific aspects revolving health. These specific aspects help the brainstormers realise the different essences of the main topic and see how these aspects relate to the main topic where they initially would have not seen a direct link. Simultaneously, it helps the observer see to what extent the brainstormers have an understanding of the main topic and how far their linear views reach. In the brainstorm on the main topic 'Health', it helps the participants in their final brainstorm to take into account these importances that they find while designing. Additionally, it shows the observer where the participants personal importances with health generally lie, which is indicative of personal needs. Participants were also instructed to interconnect the different aspects where possible, to give insights into interconnected aspects that could show overarching factors.

5.3.2. Brainstorm 2: A New Hometrainer for Older Adults To Stay Active

This second brainstorm is divided into three stages, where in each stage the ideas get more specific and lead to their most important requirements for their final idea. These requirements serve as an indication for general requirements that fit the research population of the study.

5.3.2.1 Personal Motivation

In this first stage, participants discuss what could be possible reasons for their persona needing or wanting to be physically active at home. They were reminded to keep their findings of the first brainstorm on the topic of health into mind. Additionally, the participants had to discuss reasons as to what their persona's personal motivations could be for wanting or needing to be/stay physically fit.

5.3.2.2 Key factors

Out of these two lists, each group was asked to select 2-3 points of each that they deemed to be the most important aspects related to their persona. They were asked to think of each point as a 'problem' and to discuss ways to solve each point. For example, if a reason for wanting to be physically active at home is 'physical strain', a way to 'solve' this could be 'simple and low-effort exercises'.

This resulted in and served as a list of requirements for their final design.

5.3.2.3 Ideation Requirements

The second stages progressed and build off on these initial motivations. Out of this list of reasons and motivations, they had to think of ways to achieve these requirements. they then had to answer the W's (and H):

- What setting is the system operated in?
- Where (in the housing area) is the setup supposed to be located?
- How is the system operated?
- What different systems or attributes does the setup use?
- What does the setup look like?
- What are the setup's limitations?

5.3.3 Final Idea

After the subgroups have each further ideated their own home training system, they had to visualize their design by sketching. The participants were free in how to visualize their design, as long as they limited textual visualization to merely give indications in their design to clarify what was designed or what functions different parts of the design had.

5.4 Analysis of needs and requirements

The findings of the usability study in combination with the findings of the co-design session are analysed to give the needs of the user and the requirements of the system designed for the research population. These requirements are used to optimize usability and user satisfaction of the proposed interface for a home training system for older adults.

To decide how human-centered the system results to be, is determined by the SUS- and ASQ-scores and observations of the studied technology.

The challenges or faults users have faced in the usability require to be addressed and improved for the proposed interface. Additionally, the ideas that result from the co-design session need to be analyzed on the proposed solutions and desires of the participants.
The proposed interface will be evaluated on its human-centeredness by briefly testing the interface with users, which will provide SUS- and ASQ-scores that will then be compared to the scores of the case study of Motiphy+.

5.5 Results

5.5.1 Participant Demographics

With a total of N=7 participants, the group consisted of 5 older adults, with ages between 50 and 78 years old, and 2 young adults, aged 22 and 23 years.
The seven participants were divided into two subgroups.
The participants of subgroup 1 were the older three participants of the group. Subgroup 2 consisted of the two young adults and the two youngest older adults, with the maximum age of 61.

5.5.2 Brainstorm 1

This first brainstorm served as as the initiation of the thinking process for the second brainstorm. Here, the groups had to make a mindmap around the general subject of health.

The created mindmaps as visualized in figure 6 and figure 7 showed that both groups generally agree on the different aspects that they associate with health: physical health, mental health, food health, social health. Where the first group didn't go further than these subtopics, the second group also mentioned: disease, consistency, learning and basic health.
The groups were then instructed to further branch these subtopics into more specifically related aspects.

Physical health
In relation to physical health, there were several aspects the groups could further branched to. Sports or exercise, physiotherapy, variety.

The findings indicate that the participants generally agree that physical health is a main component to an overall good health.

Mental Health

The groups had indicated in their mindmaps that mental health is one of the main pillars of health. Terms associated with mental health are loneliness, stress, mental exercise, goal setting,

Social Health

Another main pillar presented in the mindmaps is social health. Sociality can be applied and utilized by any other pillar to improve its quality. For example, playing sports with others can make a person more motivated to exercise and make it an overall more enjoyable experience. Another example how sociality can decrease the loneliness one might experience due to the lack of social interaction.

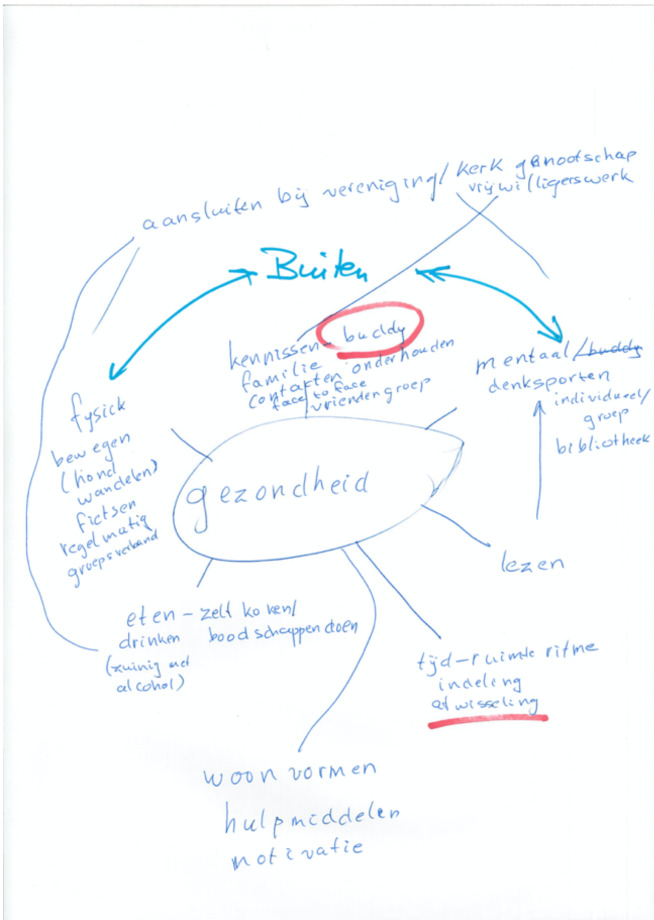

Figure 6: As result of the first brainstorm, a mindmap made by the participant group 1 on the topic of 'health'.

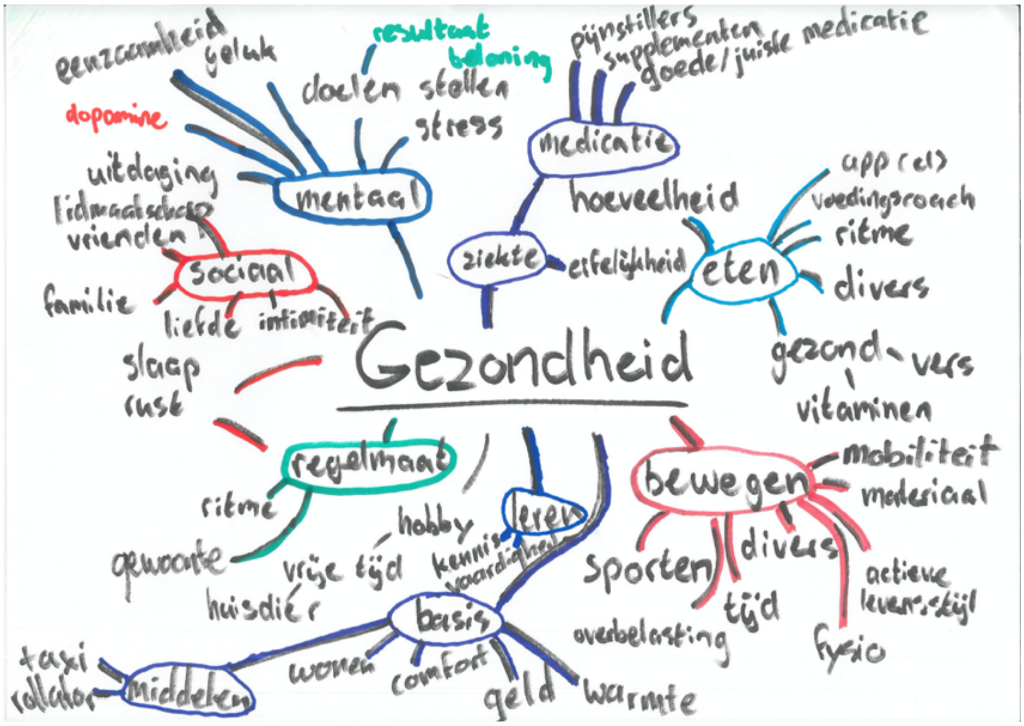

Figure 7: As result of the first brainstorm, a mindmap made by the participant group 2 on the topic of 'health'.

5.4.2 Final brainstorm concepts

The co-design brainstorm session ended in two conceptual designs for a home physio trainer, one for each group.

Figure 8 shows the final concept of the first group. They designed an installation that uses a bicycle hometrainer connected to a digital physio application with different functions.

The second group designed a smart home installation that makes use of additional physical components. The installation uses a motion sensing camera, light assistance, sound assistance and a sensory floorpad (figure 9).

Both groups showed that they believed a solution required a digital user interface.

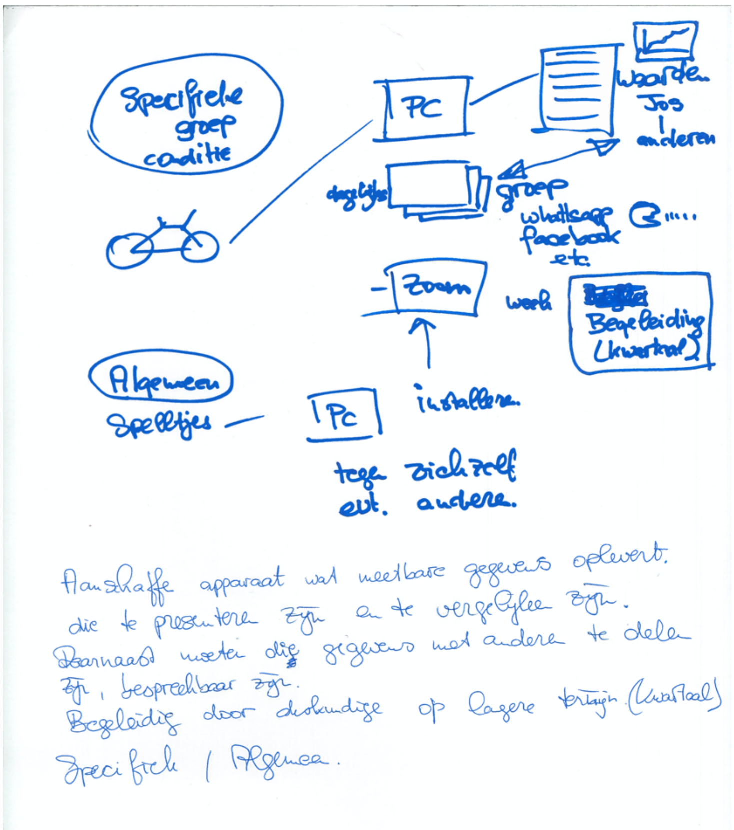

Figure 8: The final solution designed by participant group 1. Presenting a digital interface system with different functions, using a home cycle trainer

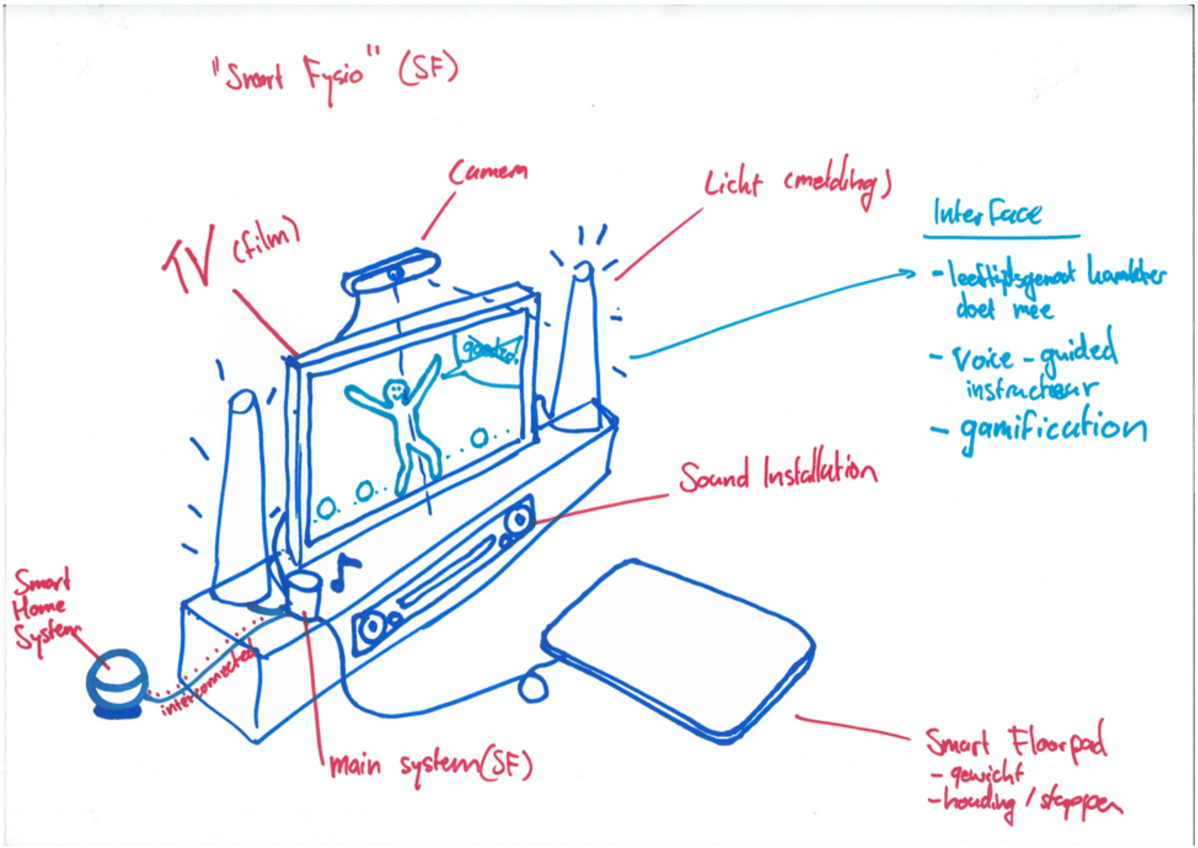

Figure 9: The final solution designed by participant group 2, showing a smart physio system integrated into a smart home, operated using voice assistance, assisted by light sensory visuals and a smart floorpad.

6. Prototype Specification

6.1 Requirements

There were findings with the user's operational understanding of navigating and how to use the application, findings with the operational usability and the interface design.

Additionally, the application was observed on its technical usability. This includes optimal functionality, desired set of functionality or if there are any other system bugs.

6.1.1 System

The target population is a specific group of people that vastly holds a different placement in society and therefor has different needs and desires compared to the average person.
It is important that any (technological) system is easy to install. This means little installation steps and the least amount of different system components as possible.

6.1.2 Application

6.1.2.1 Operational understanding and usability

Regarding the operational understanding of a system, how to operate and navigate the system needs to be obvious and uncomplicated. The system requires to be simple and the provided information needs to be clear and concise. With this target group, if it is not obvious how a system is navigated, additional explanation needs to be provided.
For the usability of a system, it is important that the interaction with the system itself needs to be straightforward. Different functions needs to be set up in an as optimalized as possible manner for the target group, so minor alterations or personalizations are required.

6.1.2.2 Interface design

Although graphical design was not an investigated aspect within the project, the results of the usability case study showed remarks regarding the application's aesthetics and design. Participants had indicated that high quality graphics and an appealing aesthetic help to motivate them to use and continue using a system.

6.1.2.3 Technological usability

Where the usability case study has showed certain issues with the system's functionality,

6.1.2.4 Social connectivity

It was found that social connectivity is an important aspect for extrinsic motivation.
The system requires for users to be socially connected to peers, with possible room for competitive aspects.

6.1.2.5 Aesthetics

Although users were aske during the usability case study if the interface and system were appealing to see and use, aesthetic design was not a specifically researched aspect. Nonetheless, there were desires regarding the application's avatar. This avatar is operated by the user to conduct the digital exercises. Users desired to change the physical appearance of their avatar.

6.2 Concept

The final concept consists of two physical components, showed in figure 10. The two main parts of the final design are the system's operating console and the accompanying digital application. This console is a singular device with different build-in functions, as it also has a motion sensing camera and a microphone build into the device. The microphone is used by the system's voice assistance technology. The system uses motion sensing to track the user's physical movements while conducting the digitally presented exercises. This is done by a motion sensing camera that is build into the console.
The installation is an entirely hands-off operated system. It makes use of voice assistance to operate the application.

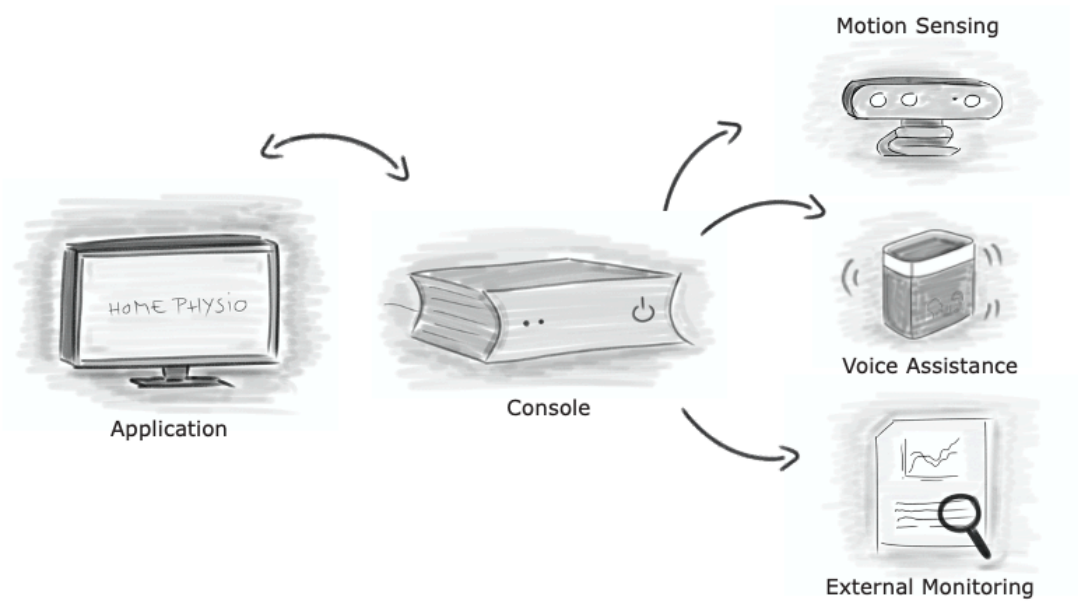

Figure 10: The final proposed prototype design of the home physiotherapy trainer for older adults. Consisting of a digital application and a console with build-in operational functions.

Additionally, the system uses external digital monitoring. With this function, healthcare professionals can track their patients' progress, reducing the need for frequent in-person visits, while the healthcare professional can be accurately updated and informed.

Lastly, the avatar that is operated by the user during the exercises is customizable to the user's liking. Users are able to change the avatar's gender, hair, body shape, clothing and individual colors.

7. Prototype Realisation

7.1 Final design

As mentioned in section 7.2, the final concept consists of two main components. The two main parts of the final design are the system's console and the home physiotherapy application, presented on any electronical display device (figure 11).

Figure 11: The conceptual external design of the final prototype. A simple design of the main console device and the digital application interface.

7.1.1 Console

This console is a singular device with different functions, as it also has a motion sensing camera and a microphone build into the device.

Motion sensing

The console has a build-in motion sensing camera to track the user's movements. While conducting the physiotherapy exercises, the user imitates the presented example movements. As the user operates the application's avatar, the user is able to reflect on their own movements using the avatar.

Voice Assitance

The system is operated using a build-in voice assistance function. The system can also be paired with existing smart home devices operated by using voice assistance, like the Google Home Mini (Google, 2019) smart speaker or any Amazon's virtual assistant Alexa devices (Amazon, 2014).

The system is activated using voice assistance. By default, the user has to say "Hello, Home Physio". However, voice assistance commands are easily customizable on user demand in the application settings.

External Monitoring

The system is paired with an external monitoring system, where a physio therapist can remotely monitor the user's progress and determine their patient's personal exercises. This external monitoring is connected with the user through the application, where the physiotherapist lists the exercises for the user and the user is able to see feedback given by the healthcare professional.

The state-of-the-art (section 2.2) presented a developed platform 'PhysioMate' (figure 12a-12b). Physiomate is a platform developed by and for physiotherapist to monitor the progress and administer their the exercise plans of their patients. Combining the home physiotherapy system with the external physiotherapist monitoring using a platform like PhysioMate, allows for easier connectivity between healthcare professional and patient and concrete statistics for the physiotherapist.

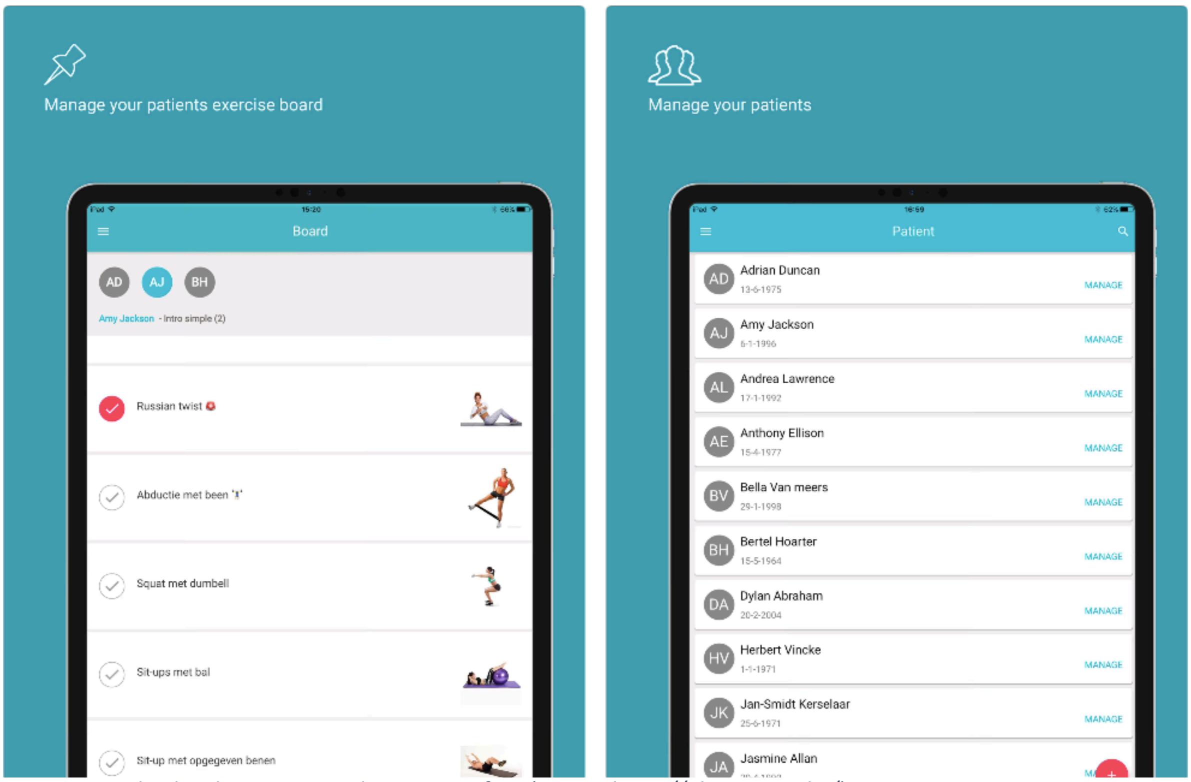

Figure 12a-12b: The PhysioMate application interface (source: https://physiomate.be/)

7.1.2 Application

For the suggested interface design, a mockup of a conceptual design is given below.

The application interface is at its core structure based on the Motiphy+ application interface. The user needs and design requirements concluded from the Motiphy+ usability case study (section 5) have been applied to the interface base structure and formed the final application interface design and usability. Figures 14-20 show the different main components of the application interface.

Each screen of the application has a function to elaborate the user on the different functions that that screen has. This is displayed using a questionmark (?) button. When the user presses this questionmark, a quick step-by-step tutorial on each function is given that the user can seep through at their own pace. Figure 14a-14g below shows a quick step-by-step functionality example tutorial for the application's dashboard. Here, the different functionalities are briefly explained to the user.

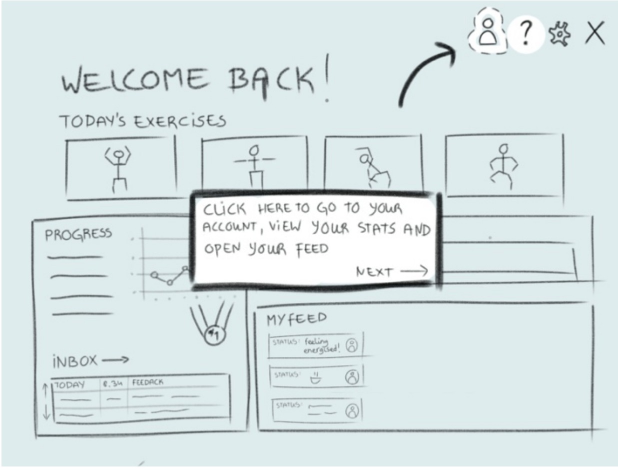

Figure 13a-13g: An examploratory quick tutorial on the different functionalities and of the dashboard. (From top to bottom, left to right: 13a-13g)

Figure 14 shows a conceptual opening and loading screen of the home training application, where the title 'Home Physio' and subtitle 'Healthy Ageing' can be substituted to a final conceptual home training system.

The log-in screen in figure 15 has a very simple, straightforward design, to minimize confusion and be entirely clear in functionality. Also here, a quick step-by-step tutorial can be utilized so the user is instructed exactly how to operate that screen.

Figure 14: The final conceptual design of the home trainer application interface - The opening screen with example title 'Home physio: Healthy Ageing'.

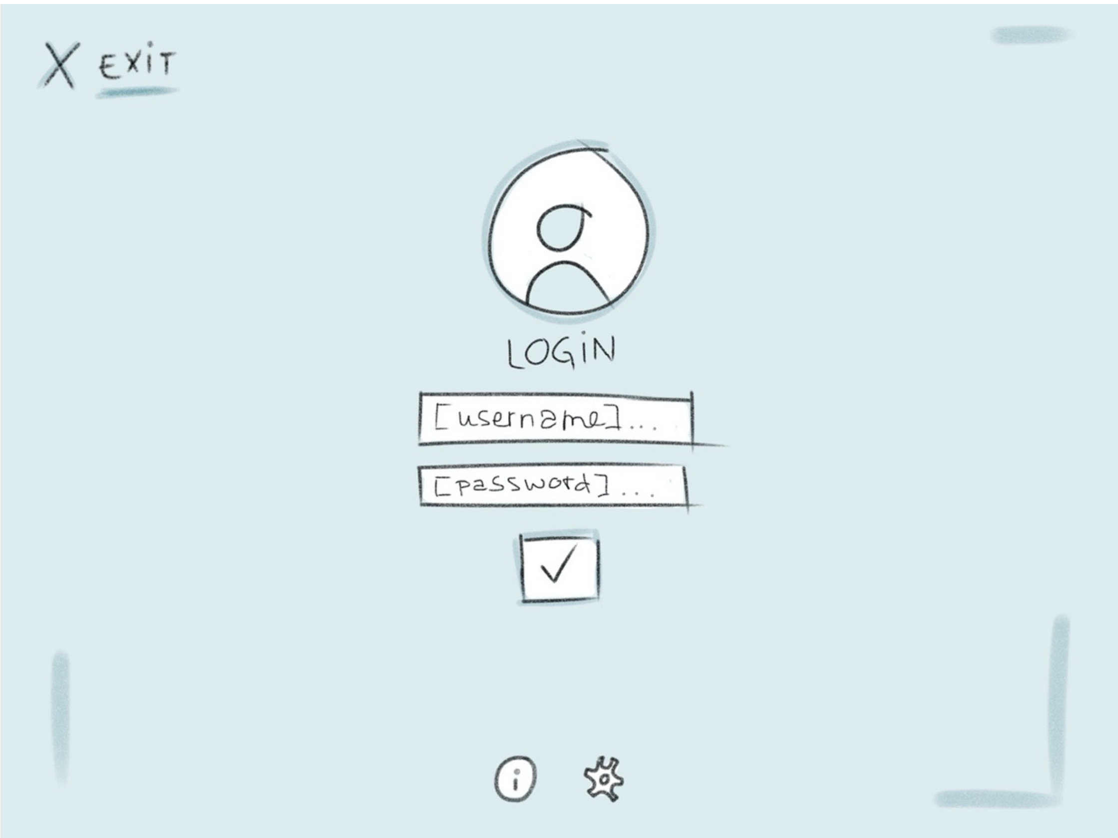

Figure 15: The final conceptual design of the home trainer application interface - The login screen.

Figure 16: The final conceptual design of the home physiotherapy system - The Dashboard

The application dashboard (figure 16) shows the user in one overview the the exercise plan for any specific day, a quick user's progress tracking overview and a quick social functionality for updating a user's status. Also here, users are able to

A repetitive aspect that arose during the usability case study was the user need for progress tracking. As shown in figure are now presented different personal progress statistics on several different moments: at the start of each exercise session to showcase historical user statistics and progress made so far, after conducting an exercise to show exercise specific user statistics and an updated progress overview at the end of each session. Additionally, users can gain insights into these different statistics through the dashboard at any desirable moment. Figure 17 shows the added progress tracking feature.

Lastly, the avatar that is operated by the user during the exercises are customizable to the user's liking. Figure 18 shows the external physical features that are interchangeable with different options. The user is able to change the avatar's gender, hairstyle, haircolor, body shape, skin shade, and clothing.

Figure 17: The final conceptial design of the home trainer application interface - The Progress overview, showing different user statistics over different time interfalls.

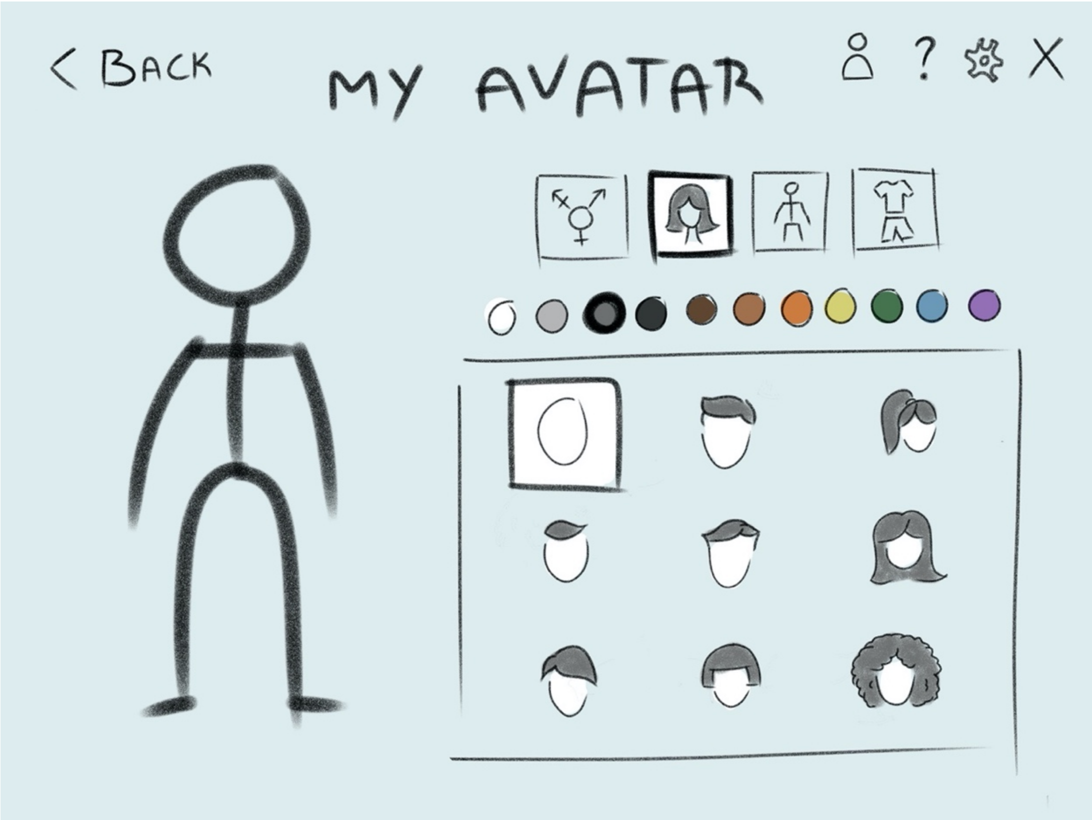

Figure 18: The final conceptual design of the home trainer application interface - The Avatar Customization screen, where the user is able to change the look of their avatar according to their desire.

8. Conclusion

The design of a remote physiotherapy system using an empathic design approach resulted in a digital interactive system catered to the needs of older adults.

Although human-centered design and empathic design are closely related, as they are both user-focused design approaches that aim to understand and meet user needs, they do find their difference in specification and emotional connection to their research population. However, human-centered design is a broader approach that emphasizes designing for user needs, while empathic design emphasizes developing an emotional connection with users to deeply understand their needs and desires.

Important factors to motivate people for physical activity seem to be: successful extrinsic motivation and social comparison and competitiveness between said peers. While factors such as insufficient or unsuccessful extrinsic motivation, social comparison and competition to contacts they cannot relate to, seem to demotivate people.

The state-of-the-art analysis showed similar technologies that cover different fields of the final prototype design: physiotherapy (clinical exercises), gameification, entertainment, social connectivity and personal treatment. However, there is no developed system yet that covers all mentioned fields. The conducted practical usability case study on the by Clynx developed technology Motiphy+ showed different interactional remarks, insufficient After System Questionnaire- and System Usability Scale-scores, and technical bugs. These helped to dermine the usability of a home physiotherapy system and specifice user needs based on user interaction and feedback. Additionally, the conducted co-design brainstorm session resulted in self-designed home lifestyle interventions, which aided to further specifice the needs of the target group highlighted importances with the design.
With findings in operational understanding, operational usability, interface design and technical usability, the conceptual design required to be: a simple and easy to interact with and operate the system, easy to install, providing clear and concise information, providing feedback and to be able to connect the user socially with peers and equals.

Using this empathic design approach, research participants gradually specifice user interests, Basing the design concept on an existing technology provided a solid foundation.

One could question the level of representation of the study’s research population in relation to the overall target group, where the study population of nine for the usability and seven for the co-design session would be insufficient to draw substantial conclusions.

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APPENDIX A

The Creative Technology Design Process (Mader & Eggink, 2014)

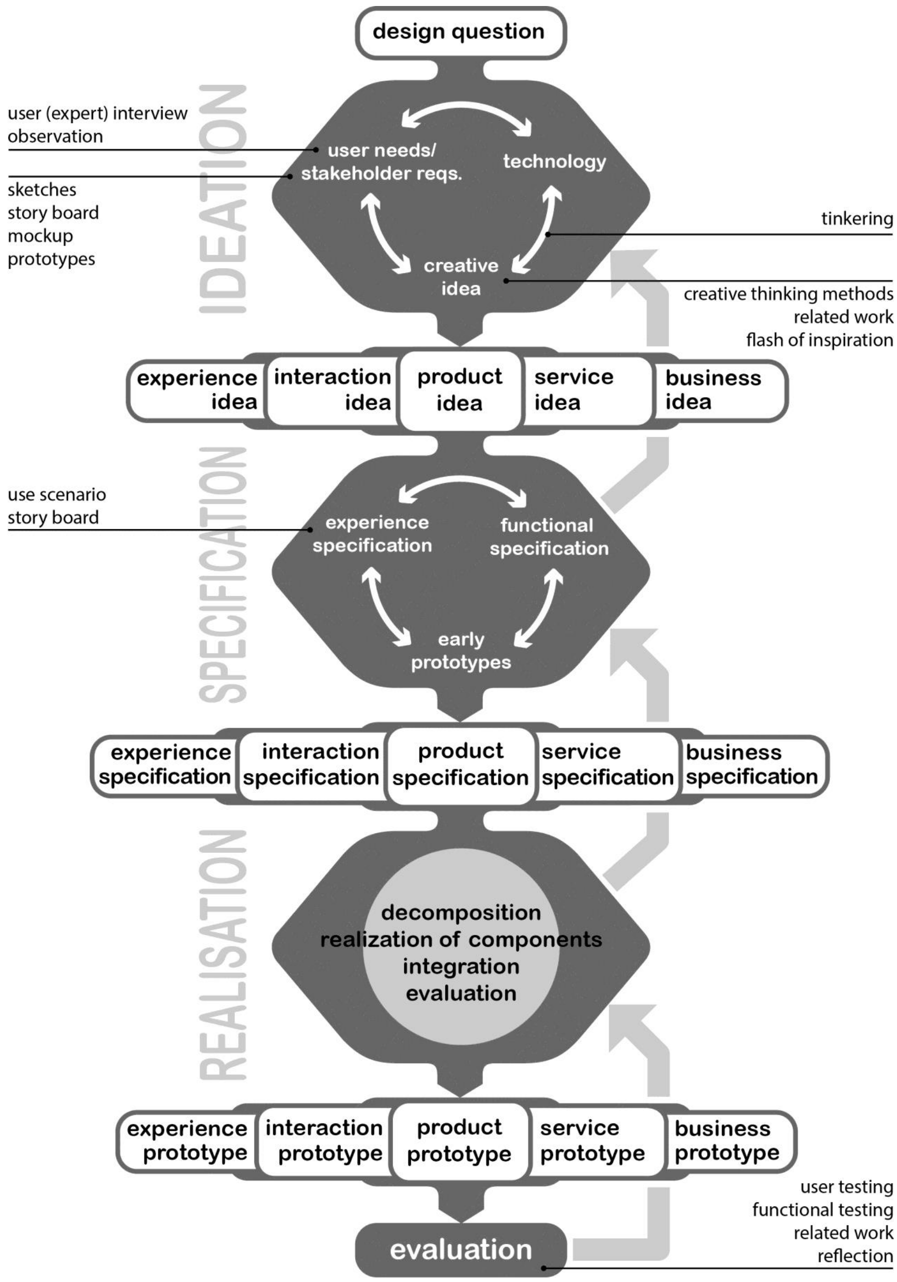

Figure 1. A Creative Technology Design Process

EPDE2014/209

APPENDIX B

Demographics form (in Dutch) filled in by the participants.

Geboortejaar: ___________

Geslacht: ☐ Man ☐ Vrouw ☐ Anders

Hoogst genoten opleiding:

☐ Geen
☐ Basisonderwijs
☐ Middelbaar voortgezet onderwijs (vmbo, mavo, mulo, lts etc.)
☐ Hoger voortgezet onderwijs (havo, vwo, mms, etc.)
☐ Middelbaar beroepsonderwijs (mbo, meao, mts, etc.)
☐ Hoger beroepsonderwijs (hbo, hogeschool)
☐ Universiteit
☐ Doctoraal
☐ Anders, namelijk: ___________________________________

Huwelijkse status:

☐ Getrouwd ☐ Gescheiden ☐ Vrijgezel
☐ Weduwe/weduwnaar

Werk situatie:

☐ In loondienst ☐ Zelfstandige ☐ Werkloos
☐ Gepensioneerd ☐ Vrijwilligerswerk

Woon situatie (1):

☐ Thuis ☐ Aanleunwoning/serviceflat
☐ Verzorgingstehuis ☐ Anders, namelijk: _____________________

Woon situatie (2):

☐ Met partner ☐ Met familie/vrienden ☐ Alleen

Gebruik van moderne technologie (computer, smartphone, internet etc.)

Heeft u een computer?

- ☐ Ja, en ik gebruik hem <u>regelmatig</u>
- ☐ Ja, en ik gebruik hem <u>af en toe</u>
- ☐ Ja, maar ik gebruik hem <u>niet</u>
- ☐ Nee

Heeft u een tablet?

- ☐ Ja, en ik gebruik hem <u>regelmatig</u>
- ☐ Ja, en ik gebruik hem <u>af en toe</u>
- ☐ Ja, maar ik gebruik hem <u>niet</u>
- ☐ Nee

Heeft u een smartphone?

- ☐ Ja, en ik gebruik hem <u>regelmatig</u>
- ☐ Ja, maar ik gebruik hem <u>weinig</u>
- ☐ Ja, maar ik gebruik hem <u>niet</u>
- ☐ Nee

Waarvoor gebruikt u op dit moment moderne technologie?

- ☐ Om gezond te eten *(bijv. online recepten of digitaal voedingsdagboekje)*
- ☐ Om voldoende te bewegen *(bijv. stappenteller of smartphone applicatie)*
- ☐ Om in contact te blijven met anderen *(bijv. Facebook of WhatsApp)*
- ☐ Om op de hoogte te blijven *(bijv. digitale nieuwsbrief of nieuws websites)*
- ☐ Geen van bovenstaande

Hoe zou u uw vaardigheden voor het gebruik van moderne technologie (computer, applicaties/programma's, internet etc.) omschrijven?

- ☐ Basis vaardigheden
- ☐ Gemiddelde vaardigheden
- ☐ Gevorderde vaardigheden
- ☐ Excellente vaardigheden

Appendix C

The After Scenario Questionnaire questions from the Motiphy+ usability case study (in Dutch).

Vragen over Taak 1

1. Over het algemeen ben ik tevreden met het gemak waarmee ik de taak kon voltooien.

Helemaal oneens						**Helemaal eens**
1	**2**	**3**	**4**	**5**	**6**	**7**
☐	☐	☐	☐	☐	☐	☐

2. Over het algemeen ben ik tevreden met de benodigde tijd die ik nodig had voor de taak.

Helemaal oneens						**Helemaal eens**
1	**2**	**3**	**4**	**5**	**6**	**7**
☐	☐	☐	☐	☐	☐	☐

3. Over het algemeen ben ik tevreden met de informatie (online hulp, berichten, documentatie) bij het voltooien van de taak.

Helemaal oneens						**Helemaal eens**
1	**2**	**3**	**4**	**5**	**6**	**7**
☐	☐	☐	☐	☐	☐	☐

<u>Eventuele opmerkingen:</u>

Vragen over Taak 2

1. Over het algemeen ben ik tevreden met het gemak waarmee ik de taak kon voltooien.

Helemaal oneens						**Helemaal eens**
1	**2**	**3**	**4**	**5**	**6**	**7**
☐	☐	☐	☐	☐	☐	☐

2. Over het algemeen ben ik tevreden met de benodigde tijd die ik nodig had voor de taak.

Helemaal oneens						**Helemaal eens**
1	**2**	**3**	**4**	**5**	**6**	**7**
☐	☐	☐	☐	☐	☐	☐

3. Over het algemeen ben ik tevreden met de informatie (online hulp, berichten, documentatie) bij het voltooien van de taak.

Helemaal oneens						**Helemaal eens**
1	**2**	**3**	**4**	**5**	**6**	**7**
☐	☐	☐	☐	☐	☐	☐

<u>Eventuele opmerkingen:</u>

Vragen over Taak 3

1. Over het algemeen ben ik tevreden met het gemak waarmee ik de taak kon voltooien.

Helemaal oneens					**Helemaal eens**	
1	**2**	**3**	**4**	**5**	**6**	**7**
☐	☐	☐	☐	☐	☐	☐

2. Over het algemeen ben ik tevreden met de benodigde tijd die ik nodig had voor de taak.

Helemaal oneens						**Helemaal eens**
1	**2**	**3**	**4**	**5**	**6**	**7**
☐	☐	☐	☐	☐	☐	☐

3. Over het algemeen ben ik tevreden met de informatie (online hulp, berichten, documentatie) bij het voltooien van de taak.

Helemaal oneens						**Helemaal eens**
1	**2**	**3**	**4**	**5**	**6**	**7**
☐	☐	☐	☐	☐	☐	☐

<u>Eventuele opmerkingen:</u>

Appendix D

The System Usability Score questions from the Motiphy+ usability case study (in Dutch).

Vragen over Motiphy+ - Gebruiksvriendelijkheid

1. Ik denk dat ik Motiphy+ zou willen gebruiken.

Helemaal oneens			**Helemaal eens**	
1	**2**	**3**	**4**	**5**
☐	☐	☒	☐	☐

2. Ik vond Motiphy+ onnodig ingewikkeld.

Helemaal oneens			**Helemaal eens**	
1	**2**	**3**	**4**	**5**
☐	☐	☐	☐	☐

3. Ik vond Motiphy+ makkelijk te gebruiken.

Helemaal oneens			**Helemaal eens**	
1	**2**	**3**	**4**	**5**
☐	☐	☐	☐	☐

4. Ik denk dat ik technische support nodig heb om Motiphy+ te gebruiken.

Helemaal oneens			**Helemaal eens**	
1	**2**	**3**	**4**	**5**
☐	☐	☐	☐	☐

5. Ik vond de verschillende functies van Motiphy+ goed met elkaar geïntegreerd.

Helemaal oneens			**Helemaal eens**	
1	**2**	**3**	**4**	**5**
☐	☐	☐	☐	☐

6. Ik vond dat er te veel tegenstrijdigheden in Motiphy+ zaten.

Helemaal oneens			**Helemaal eens**	
1	**2**	**3**	**4**	**5**
☐	☐	☐	☐	☐

7. Ik kan me voorstellen dat de meeste mensen snel met Motiphy+ overweg kunnen.

Helemaal oneens			Helemaal eens	
1	**2**	**3**	**4**	**5**
☐	☐	☐	☐	☐

8. Ik vond Motiphy+ omslachtig in gebruik.

Helemaal oneens			Helemaal eens	
1	**2**	**3**	**4**	**5**
☐	☐	☐	☐	☐

9. Ik voelde me zelfverzekerd tijdens het gebruik van Motiphy+.

Helemaal oneens			Helemaal eens	
1	**2**	**3**	**4**	**5**
☐	☐	☐	☐	☐

10. Ik moest veel over Motiphy+ leren voordat ik het goed kon gebruiken.

Helemaal oneens			Helemaal eens	
1	**2**	**3**	**4**	**5**
☐	☐	☐	☐	☐

Appendix E

Information and consent form Motiphy+ usability case study (in Dutch).

Informatiebrief en toestemmingsverklaring

Beste deelnemer,

Fijn dat u mee wilt doen aan ons onderzoek. In deze brief leest u meer over de achtergrond van dit onderzoek, hoe deelname aan dit onderzoek eruit ziet en wat er met uw inbreng gebeurt. Verder vindt u aan het eind van deze brief een toestemmingsverklaring. Wij vragen u deze te ondertekenen als u besluit deel te nemen aan dit onderzoek en akkoord bent met de voorwaarden.

Achtergrond van het onderzoek

Vanuit het Nationaal Ouderenfonds werken we continu aan het verbeteren en vernieuwen van onze diensten. Daarvoor testen wij bijvoorbeeld nieuwe technologieën. Dit doen we in samenwerking met een aantal Nederlandse partners, waaronder Universiteit Twente (zie logo's onderaan pagina).

Het is belangrijk dat onderzocht wordt hoe de nieuwe technologieën door de gebruikers ervaren wordt en hoe deze nog verder verbeterd kan worden. Inmiddels testen wij al drie technologieën in de praktijk voor onze dienst *BoodschappenPlusBus* en willen nog een vierde toevoegen genaamd Motiphy+ (zie figuur 1). Motiphy+ is een digitale beweegcoach die u helpt om fit te blijven.

Dit werk is onderdeel van het Europese Pharaon-project waarin, in verschillende landen, diensten voor ouderen worden ontwikkeld (www.pharaon.eu).

Figuur 1 Nieuwe idee voor de BoodschappenPlusBus; Een uitbreiding van de diensten van de BoodschappenPlusBus met een combinatie van online applicaties en een beweegmeter

Deelname aan het onderzoek

Deelname aan dit onderzoek bestaat uit een afspraak waarin u een technologie genaamd Motiphy+ test. Om deel te kunnen nemen moet u 50 jaar of ouder zijn, geen problemen met uw balans hebben en het comfortabel vinden om fysieke activiteiten door te voeren.

De afspraak vindt plaats in week 46 (14 nov. - 20 nov.). Dit is een individuele afspraak van ongeveer 1 uur. Hierin nodigen wij u uit om naar de Universiteit Twente te komen. U wordt dan gevraagd om een aantal taken uit te voeren, bijvoorbeeld bewegingen imiteren die u op een scherm ziet. Daarbij stellen wij u een aantal vragen over uw ervaringen, waaronder het gebruikersgemak.

Wat gebeurt er daarna?
De uitkomsten van dit onderzoek worden door ons en onze partners gebruikt om dit idee verder te verbeteren, zodat het er volgend jaar klaar voor is om in de praktijk getest te worden. In de toekomst zullen de verzamelde gegevens mogelijk ook gebruikt worden voor andere, nog onbekende, onderzoeksdoeleinden. Met alle gegevens zal vertrouwelijk omgegaan worden. Uw naam en contactgegevens zullen apart opgeslagen worden. Alleen het Nationaal Ouderenfonds en Universiteit Twente zal toegang hebben tot uw contactgegevens.

De uitkomsten van dit onderzoek zullen bovendien gedeeld worden met andere partners van het Pharaon-project, bijvoorbeeld om de verschillende diensten die in het Pharaon-project ontwikkeld worden met elkaar te kunnen vergelijken. Ook willen we onze bevindingen delen met de buitenwereld in bijvoorbeeld een wetenschappelijk artikel. Maar voordat resultaten gedeeld worden met anderen dan het Nationaal Ouderenfonds en Universiteit Twente zullen ze volledig geanonimiseerd worden. Hierdoor zal het nooit naar u terug te herleiden zijn.

Verder, als dit idee volgend jaar in de praktijk getest gaat worden, zullen we weer contact met u opnemen en vragen of u geïnteresseerd bent in deelname aan ook dit onderzoek. Het staat u dan uiteraard vrij om hier wel of niet aan deel te nemen. Er wordt dan opnieuw om toestemming gevraagd.

Heeft u vragen? Dan kunt u contact opnemen met ons via samenvitaal@utwente.nl.

Met vriendelijke groet,

Eva Siderakis	Nationaal Ouderenfonds
Simone de Graaf	Nationaal Ouderenfonds
Femke Nijboer	Universiteit Twente
Angelique Tinga	Universiteit Twente
Sefora Tunc	Universiteit Twente

Toestemmingsverklaring deelnemer

Hierbij verklaar ik dat ik vrijwillig meedoe aan het hierboven beschreven onderzoek.
- Ik heb voldoende uitleg gekregen over het doel van het project en wat er gebeurt met de gegevens die worden verzameld.
- Ik ben mij ervan bewust dat ik op ieder moment mag stoppen en hiervoor geen reden op hoef te geven.
- Als ik vragen had zijn deze naar tevredenheid beantwoord.
- Met mijn handtekening geef ik toestemming voor het gebruik van de gegevens verzameld in dit onderzoek door de onderzoekers.
- Mijn persoonsgegevens verzameld in het eerdere onderzoek over de virtuele gesprekspartner (contactgegevens, rol in BoodschappenPlusBus, leeftijd, geslacht) mogen ook voor dit onderzoek gebruikt worden.
- Na afloop van het onderzoek mag ik benaderd worden voor vervolgonderzoek.

Naam: ……………………………………………………………………………………………………

Plaats en datum: ………/………/………. te …………………………………………………………

Handtekening: ………………………………………………………………………………………

--Verklaring onderzoeker

Ik verklaar dat ik deze deelnemer volledig heb geïnformeerd over het genoemde onderzoek.
Wordt er tijdens het onderzoek informatie bekend die die de toestemming van de deelnemer kan beïnvloeden? Dan laat ik dit op tijd weten aan deze deelnemer.

Naam: ……………………………………………………………………………………………………

Plaats en datum: ………/………/……… te …………………………………………………………

Handtekening: ………………………………………………………………………………………..

Appendix F

Information and consent form co-design study (in Dutch).

Informatiebrief en toestemmingsverklaring

Beste deelnemer,

Fijn dat u mee wilt doen aan dit onderzoek. In deze brief leest u meer over de achtergrond van dit onderzoek, hoe deelname aan dit onderzoek eruit ziet en wat er met uw inbreng gebeurt. Verder vindt u aan het eind van deze brief een toestemmingsverklaring. Wij vragen u deze te ondertekenen als u besluit deel te nemen aan dit onderzoek en akkoord bent met de voorwaarden.

Achtergrond van het onderzoek

Dit onderzoek is onderdeel van een bachelor afstudeerproject van een Creative Technology student van de Universiteit Twente. Dit onderzoek sluit aan op het voorgaande uitgevoerde gebruiksvriendelijkheids-onderzoek van de Motiphy+ technologie, die werd getest in het kader van een groter onderzoek voor het PHARAON-project. Motiphy+ is een digitale beweegcoach die u helpt om fit te blijven.

Deelname aan het onderzoek

Deelname aan dit onderzoek bestaat uit een afspraak waarin u in groepsverband zal nadenken en brainstormen over manieren waarop oudere volwassenen fit kunnen blijven en u zal samen met nieuwe ideeën komen. Dit is een individuele afspraak van ongeveer 1,5 uur. Hierin nodigen wij u uit in het Design Lab van de Universiteit Twente te Enschede.

Om deel te kunnen nemen moet u 50 jaar of ouder zijn, geen problemen met uw balans hebben en het comfortabel vinden om (licht) fysieke activiteiten door te voeren. Deelname aan dit onderzoek is geheel vrijwillig. U kunt als deelnemer uw medewerking aan het onderzoek te allen tijde stoppen, of weigeren dat uw gegevens voor het onderzoek mogen worden gebruikt, zonder opgaaf van redenen. Het stopzetten van deelname heeft geen nadelige gevolgen voor u.

Wat gebeurt er daarna?

De uitkomsten van dit onderzoek worden gebruikt in een bachelor afstudeerproject en dienen als ondersteuning voor het ontwerp van een digitale home trainer. In de toekomst kunnen de verzamelde gegevens en de uitkomst van het bachelor afstudeerproject mogelijk ook gebruikt worden voor andere, nog onbekende, onderzoeksdoeleinden. Voordat resultaten gedeeld worden met anderen dan andere partijen buiten het afstudeerproject, zullen ze volledig geanonimiseerd worden. Hierdoor zal het nooit naar u terug te herleiden zijn. Met alle gegevens zal vertrouwelijk omgegaan worden. Uw naam en contactgegevens zullen apart opgeslagen worden. Alleen de Universiteit Twente zal toegang hebben tot uw contactgegevens. Heeft u vragen over het onderzoek? Dan kunt u contact opnemen met ons via k.h.b.vandervegt@student.utwente.nl .

Heeft u vragen over uw rechten als onderzoeksdeelnemer? Dan kunt u contact opnemen met het Secretariaat van de Ethische Commisse Informatie & Computer Science ethicscommittee-CIS@utwente.nl Hier kunt u tevens ook terecht voor verdere informatie, vragen of bezorgdheden over deze studie met iemand anders dan de onderzoekers. Ook kunt u de supervisor van deze studie benaderen bij behoefte of zorgen via femke.nijboer@utwente.nl

Met vriendelijke groet,

Kyana van der Vegt
Bacherstudent Creative Technology, Universiteit Twente

Toestemmingsverklaring deelnemer

Hierbij verklaar ik dat ik vrijwillig meedoe aan het hierboven beschreven onderzoek.
- Ik heb voldoende uitleg gekregen over het doel van het project en wat er gebeurt met de gegevens die worden verzameld.
- Ik ben mij ervan bewust dat ik op ieder moment mag stoppen en hiervoor geen reden op hoef te geven.
- Als ik vragen had zijn deze naar tevredenheid beantwoord.
- Met mijn handtekening geef ik toestemming voor het gebruik van de gegevens verzameld in dit onderzoek door de onderzoekers.
- Mijn persoonsgegevens verzameld in het eerdere onderzoek over de Motiphy+ technologie (contactgegevens, leeftijd, geslacht) mogen ook voor dit onderzoek gebruikt worden.
- Na afloop van het onderzoek mag ik benaderd worden voor vervolgonderzoek.

Naam: ………………………………………………………………………………………………………

Plaats en datum: ………/………/………. te …………………………………………………………

Handtekening: ……………………………………………………………………………………….

--Verklaring onderzoeker

Ik verklaar dat ik deze deelnemer volledig heb geïnformeerd over het genoemde onderzoek. Wordt er tijdens het onderzoek informatie bekend die die de toestemming van de deelnemer kan beïnvloeden? Dan laat ik dit op tijd weten aan deze deelnemer.

Naam: ………………………………………………………………………………………………………

Plaats en datum: ………/………/……… te …………………………………………………………

Handtekening: ………………………………………………………………………………………..

Bij vragen over uw rechten als onderzoeksdeelnemer kunt u contact opnemen met het Secretariaat van de Ethische Commisse Informatie & Computer Science ethicscommittee-CIS@utwente.nl Hier kunt u tevens ook terecht voor verdere informatie, vragen of bezorgdheden over deze studie met iemand anders dan de onderzoekers. Ook kunt u de supervisor van deze studie benaderen bij behoefte of zorgen via femke.nijboer@utwente.nl