Increasing the feeling of connectedness upon separation due to hospitalization among elderly via remote co-design

Maxim de Leeuw

s1807297

February - June 2019

University of Twente

Bachelor Creative Technology
Faculty of Electrical Engineering, Mathematics & Computer Science

Supervisor: Dr. Femke Nijboer (BSS)

Critical Observer: Dr. Alma Schaafstal

Abstract

Elderly couples that are separated by hospitalisation are impacted as their routine gets disrupted. This fact, together with the consequences of loneliness, results in increased spouse mortality. It raises the question of how co-design on a distance can help create a technology that increases the feeling of connectedness between an elderly couple of which one person is hospitalized. This thesis shows that the combination of happy eating and bringing together people on routinely based moments plays a huge role in decreasing loneliness among hospitalised elderly couples.

Words of gratitude

I would like to express my token of gratitude to all the people who have helped me during my thesis. Starting with my supervisor Femke Nijboer and my critical observer Alma Schaafstal, as they have helped me during this thesis in the form of motivational, emotional and academic support. I also want to thank Sefora Tunç and Floortje van der Geest for their contribution during the group meeting with Femke Nijboer. Secondly, I would like to thank Joanne and Frank for their openness and critical view as my partner during the design and testing phase of this thesis. Finally, I would like to thank every other person who has seen me go through the phases of this project, and have kept my mental health in check. Especially the last phases, when the home isolation was in an advanced stage, it has been more and more difficult to remain motivated and therefore everyone has helped me with being able to fight loneliness among others before I would have succumbed to my own loneliness.

Table of Content

List of figures

List of tables

1 Introduction

In this first chapter, a brief overview will be given about the current situation of elderly and the impact that abrupt separation by hospitalization has on them. This will be followed with the objective and the research question.

1.1 Background information

Over the past couple of decades, it has become clear that the demographic age is shifting. Where the median age globally was around 21.5 years old in 1970, this has shifted to 30 years old in 2019. This can also be seen by the percentage of people over 65, as this has increased from 5.3% to 8.3% respectively [1]. The group of elderly is growing significantly, together with their medical needs. One of the things that is easily forgotten when an elderly person gets hospitalized, is the relationship between the patient and the spouse, and the impact that the hospitalization may have on the patient and spouse. Most of these elderly have been married for over 40 years (some even around 60 years), and might have spent everyday together. Therefore, their household routines are matched to each other's presence. As humans really need routine in their daily life to be able to thrive, not having a matching routine can really impact the human being in general, let alone one who has matched his or her routine with their significant other's routine over the past decades. Through hospitalization, the patient and spouse are abruptly separated and this can impact their relationship but also on the health of the spouse [2]. Research has shown that mortality of the spouse increases when a patient gets hospitalized [4]. This increase in mortality can be the result of several reasons of which an example is loneliness and stress.

Although there are some existing technologies on the market that help fight loneliness and can help increase connectedness, these technologies are often very expensive or not easy to carry due to their size. The technologies will be explained more in the literature review (Section 2), which is done to find out what aspects of the existing technology is fitting to be used in the technology to be designed to increase the connectedness. The literature review will also help with answering the sub-questions.

If there would be a technical way to have both patient and spouse feel connected and together, even when they are apart, it could help improve the whole experience and therefore ease the process of being apart. With the help of co-design, a solution could be found to familiarize the experience of hospitalization and separation. Therefore, the goal for this thesis is to find a solution that will help with increasing the connectedness for patient and spouse when separated due to hospitalisation, via remote co-design.

1.2 Objectives & Challenge

Initially, a collaboration with the Deventer Ziekenhuis was established but this had to be cancelled because of Covid-19. Therefore, the user group for this thesis will be 2 elderly people with recent hospitalization experience. They will be discussed in section 2.3. As the elderly are part of the group most vulnerable for the COVID-19 to have fatal consequences, remote co-design is the only possible solution.

As the current Corona crisis has put a halt on being able to test ideas whilst being physically present, it has become pertinently clear that being able to design on a distance is the way forward. However, co-design on a distance with elderly, who have been separated due to hospitalization, seemed to not have been done before contrary to remote codesign with other target groups, which has been done. General research into possible co-designing methodology needs to be done. This should help in choosing which methodology will be the most fitting.

The main challenge will be to do a co-design on a distance, to find a solution to being lonely, and wanting to be together when this is physically not possible. This will be done with a couple who have had a recent encounter with being separated due to hospitalization. Unfortunately, the hospitalization did not occur because of no reason. Both elderly have a list of health issues that need to be taken into account. This list of health issues will become the foundation of the user personas, also enabling the designer to get a sense of limitations that need to be addressed.

1.3 Research Question

The research question that is aimed to address, is:
How can co-design on a distance help create a technology that increases the feeling of connectedness between an elderly couple of which one person is hospitalized?
The research question will be answered by the help of multiple sub-questions:

1. What is the impact of loneliness on elderly couples?
2. What are elderly couples currently using to stay in touch with each other when being physically together is not possible?
3. What are the expectations regarding the health history of the elderly couple?
4. What co-design methods are suitable to use for co-designing on a distance?

The sub-questions will be answered via literature research as well as qualitative research with an elderly couple (see section 4).

2 State of the Art

In this chapter, the literature study will be covered, aiming to answer the subquestions. At first the physiological impact due to separation on partner and spouse will be researched, after which there will be a section covering ways used to stay connected and in touch. From this, there will be a natural transition to online platforming and the benefits that it brings. Additionally, there will be some research into the known diseases that the elderly couple has. Lastly, there will be a lot of research into known distanced co-design methods.

2.1 Impact of separation

Being abruptly separated can cause several complications, which differ per gender. Complications such as anxiety, feeling of vulnerability, intense emotions and physical ache can occur [5]. Although there are many factors that can cause these complications, neurochemicals like Oxytocin and Dopamine play a big part [2]. In specific cases, combinations of these complications can lead to death of the spouse, which is more common for males than for females. The study, by Christakis and Iwashyna, showed that 5.6% of the men died after the spouse was hospitalized for the first time, whereas this was only 2,6% for women. Obviously, the reason for hospitalization differs. Risk of death does not significantly increase for colon cancer hospitalization but risk of death increases by 22% for males when a spouse gets hospitalized because of dementia. This is also supported by a study that looked into the differences in mortality among 61.676 elderly couples. The data showed that the death of a spouse resulted in a death of the male partner for 13.2% of the cases, whereas this was only 4.9% for the death of the female partner, all within eighteen months of the spouse's death [3]. It was also clear that a decline in physical health in a spouse is linked to a decrease in health in a partner. Next to that, it appeared that decline in mental health is even more burdensome than physical impairment [4].

Change in lifestyle after hospitalization is also very common. Twentyfour couples were interviewed about the impact of hospitalization for cardiac diseases. Couples had had a relationship lasting between four and sixty years, with the median being thirty-five years.The interview aimed to find distinct changes in lifestyle patterns due to the hospitalization. The result of the interviews showed the emergence of three distinct patterns. The first pattern that emerged was that the hospitalization was a positive, transformative, experience which meant that the couple wanted to use the experience to change something in their lifestyle and do it jointly. The second pattern was that the event showed them that the illness was a threat which imposes fear on the couple. The last one was that the hospitalization did not seem to have that much of an impact because they went back to living their lives like they were used to. These patterns emerged in 37.5%, 41.7% and 20.8% respectively [6]. This data can be used by nurses and our solution to help inform couples of how they could move forward from this and would be a nice addition to the technology.

2.2 Ways elderly couples stay in touch when physical presence is not possible

When it is not possible to physically be together at every moment, there is still the possibility to stay connected to each other. Items can be brought during a visit and can remain in the room with the patient when the partner leaves. The items will generally represent an item that reminisce events from the past, like pictures or perfume. There are also hospitals who allow family or acquaintances to send letters to the patients.

Another way elderly couples are able to stay in touch with each other is with the help of online technology. The elderly will call their spouse, or, if they are able to, video call them.

According to demographic research into usage of phones, Mohadisdudis and Ali [7] claim that the percentage of elderly, who are able to use a smartphone, is drastically decreasing to almost 0% when the age of 70 is reached. Some elderly are also able to use a tablet and send mails or play tablet compatible games. The latter can increase the feeling of connectedness if the games have a community-like option in-game. A big down-side to using games is that not all the elderly like to play games, either because they are not into it, or if they prefer spending their time in a different way. Games might not be as suitable, but it does set the stage to think of other things you can play with. For example, the idea of having a robotic doll or pet to help with battling loneliness or increasing connectedness comes to mind. Robot pets like Paro [8], a robot seal, are specifically developed for elderly. It is able to sense its surroundings with the five built-in sensors, and is able to change behaviour upon getting stroked or hit. Patients using PARO experience a reduction in stress, but it also reduces stress levels of the caretaker. It is a fitting technology for reducing loneliness.

Figure 1: Senior citizen cuddling with PARO

Another technology that helps with the reduction of loneliness is MiRo. MiRo has the ability to call family, send reminders for medicine intake and sense accidents at home [9]. MiRo uses a different perspective to combat loneliness as it is used in a home setting and helps ease the mind of the user as the user knows someone can keep an eye out for possible complications.

Keeping an eye on patients, but without the use of technology, is also used to increase connectedness. This is mainly in the form of cohabitation. Humanitas Deventer makes use of 6 students, which are living for free in exchange for 30 hours of work per month in the elderly home. This work exists of small choirs but mostly of giving the elderly some attention[10]. The general idea of having a young “neighbour” around is nice, but it is not really suitable inside a hospital. It is impossible to house a student inside of a hospital, and the elderly are generally spending less time in a hospital than in an elderly home. The usage of a student to help might not be as bad of an idea though. They could help out inside

the hospitals, with the general task of being friendly to the elderly, using a buddy system. This could be implemented by creating a software where hospital personnel could ask the patient about the possibility of having a buddy come visit when the family is not able to.

There exists a platform, named Amintro [11], that is there to foster platonic friendships for people aged fifty and above. This platform is also not very fitting for the hospital situation as the platform also requires the people to be able to meet up. Obviously this is not possible when someone is hospitalized.

It is clear that there exists technology intended to battle loneliness and increase sense of connectedness, but not every technology is as fitting to be used for elderly in a hospital setting, or for elderly at all, but does help in connecting people over distance. Bond Touch[12]. So far, technology intended for a hospital setting is mostly created for children. Chat Rooms and virtual designing platforms, like the LIFE platform[13] are used for children (ranging between the age of 8 and 19) who are hospitalized and therefore are unable to go to school. Accordingly, this helps them with reducing stress and the feeling of isolation. LIFE is able to maintain their contact with the school and help in participating in class activities [14]. LIFE is part of Ambient Assisted Living (AAL). The use of assistive technology is however very important as it supports 7 pertinent life domains such as physical functions and social / leisure engagement [15]. It has also been shown that people who are accepting rehabilitation are more easily able to use the assistive technology and were therefore better supported [16]. There is a positive edge about the current Corona crisis. AAL technology has seen an increase in development, with the elderly having to cope with isolation now that they are a risk group [17]. Most of these technologies, like Caru Home [18] or TinyBots' Tessa [19], are used in a home setting and should help with daily activities.

Figure 2: TinyBots' Tessa, seen in a domestic environment

There has also been an influx of AAL technology suitable for hospitals, like HalloZorg (ConnectedCare, same product) and LINK-AGES. HalloZorg [20] helps with the communication between patients and (in)formal caregivers, i.e. family care and professionals. The technology can be implemented to monitor the health status but also check movement using PIR sensors. LINK-AGES is used in a more conventional way. It facilitates communication channels between the patient, family and care institutes. It has voice- and text message options, allows for picture sharing and has a built-in diary all to be used in an easy and secure way as every portal has its own private network protection. The implementation of Remote Assistance makes it so that the family members can help with the usage of the portal, when the patient has some troubles handling it [20][21].

In conclusion, technology can have a positive impact on people during the hospitalization period. The current technology does look into combating loneliness but can be improved. The idea of using memories from the past is missing when comparing state of the art with the literature. VR is slowly being introduced and there is so much that can be done with that. There does not seem to be any portable device to combat loneliness, nor is it specifically made for hospital rooms. The idea of making technology and incorporating a way to decorate the room is smart and could be used inside the hospital rooms. All in all, technology can help with the familiarization of hospitalization. However. It is very important that the technology is made fitting for elderly usage specifically.

2.3 Personas & design restriction

During this thesis, two elderly people and two health care professionals will be aiding in the cocreation of a technology that reduces the feeling of loneliness during hospitalization. The personas below are based on a real elderly couple. Their names have been changed for privacy reasons. The two health care professionals are described in section 3.1.

Joanne and Frank are both in their 80's. They have been together for 53 years and used to do a lot together. They are both very outgoing people, having plenty of friends. Frank had his own meat factory, Joanne was a stay-at-home mother, sometimes helping with the administration at the factory. They always played golf and tennis with friends in their free time. Retirement would give them the time to be with family more, but also make plans to meet friends. it would also mean that they could move to that lovely house which was on sale but in a different place. Just after retirement, Joanne got in an accident that made her paraplegic. This caused her to have more complications over time.

Upon designing with an elderly couple, it might be possible that complications might arise, which limit the design options. This is why designers should personalize the design process to the co-designing user. By making an overview of the known diseases of the elderly couple, it is possible to cater the design process.

Joanne's accident caused her to always need to rely on her wheelchair. This has also caused her to have chronic Urinary Tract Infections (UTIs). According to Togan et al [22], UTIs are an important cause of morbidity and mortality for patients with a Spinal Cord Injury (SCI). This becomes even more clear when data shows that 22% of the patients with acute SCI develop their first UTI within 50 days of the injury. This means that professional healthcare is required, meaning that home care people visit the elderly woman at least twice a day. Therefore, it is not possible to use that time of the day for the design process.

Another result of the paraplegia, is the body being unable to have proper activity. Joanne has Osteoporosis which resulted in her breaking a bone as the bone structure had

weakened. Osteoporosis causes permanent physical pain, but can also experience feelings of isolation and depression [23]. Additionally, 22% percent of elderly people die within a year because of complications resulting from breaking a bone.

Approximately one month ago, Joanne's condition worsened, due to fluctuating salinity levels. Levels had decreased so much, that it almost resulted in her having a coma. The salinity levels appeared to be fluctuating because of adrenal dysfunction, which occured because of the body having been fighting against the UTIs all these 14 years. Addison's disease is very rare, as it affects approximately 1 in 100.000 people. The disease is very tough, and has a lot of complications, ranging from (extreme) fatigue to depression. The most critical complication is called the addisonian crisis, where acute adrenal failure induces severe weakness, deliria and low blood pressure. It is so dangerous that patients with Addison's need to have a crisis-pen, similar to an epinephrine pen for allergies. This can really limit the freedom needed to design something and unfortunately it is very much susceptible to stress. The on-going Corona crisis brings along a lot of uncertainties which therefore also induces stress.

Lastly, both Joanne and Frank have developed Diabetes type 2, also known as age-related diabetes. This causes both of them to use medication, preventing symptoms like fatigue, dry mouth and infections [24]. Although every disease is a struggle in it's own way, it is the combination of diseases that can be extremely inhibiting the elderly couple.

2.4 Existing methods for co-design on a distance

Co-design methods can be used to create a concept that helps the target group. Several co-designing methods exist, which can be used on a distance, but it is important to create a good fit with the elderly couple. Sanders [25] states that participatory design is the activity of designers working together with people not trained in design. Participatory design already started 40 years ago, in the northern parts of Europe. As it became increasingly popular, a large set of tools, techniques and methods were created. Together with Brandt and Binder, Sanders created the framework for participatory design, resulting in the Make-Tell-Enact method. The making refers to using mock-ups and storyboards. Telling refers to the tools and techniques with verbal support whereas Enacting refers to playing and acting. These activities can be combined to enhance creativity. Sanders does state that Make-Tell-Enact seems more fitting for the younger generations as the internet and social media facilitates a more active role in ideation. Therefore, it might not be the best fit to use this method with the elderly couple.

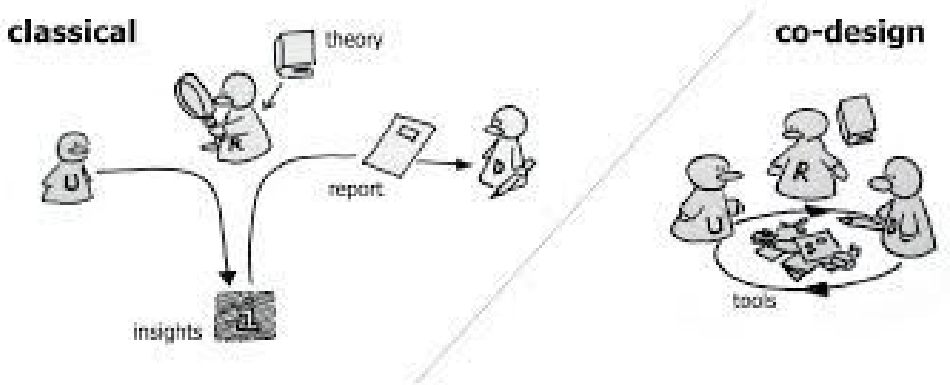

Figure 3: Difference between classical and co-design illustrated

There are two more methods that might be a good fit, empathic design and design fiction. In the case of empathic design, the designer uses his empathy to jump into the role of the user [26]. This can only be obtained when the designer follows the following 4 steps, as the designer attempts to gather a deep understanding of the user. In the Discovery phases, the interaction between the user and the designer raises curiosity and willingness to discover the situation. After the Discovery phase, the designer continues to the Immersion phase, which is the most important. It allows the designer to wander around in the situation of the user, leaving behind its own. The designer wanders around in the world open minded and without judging. In the connection phase, the designer recalls experiences and memories to increase creativity and connects on an emotional level. The affective and cognitive components are quite important in this stage. Lastly, in the detachment phase, the designer takes the helper role, whilst having increased understanding of the situation. This allows the designer to reflect, and therefore deploy new insights for ideation [27]. This is generally a method fitting for all target groups, so might be nice to be used alongside another method.

An example of technology being co-created, using empathic design is Evenset. “Evenset is a custom software company specialized in building products for healthcare and medical space with a focus on elderly population. In our portfolio, we have 5 products which are being actively used in the nursing homes, hospitals and senior care.” Important is that they ask for user input in the design phase, but use the same people in the test phase as well[28].

The last method that seemed fitting for the co-design on a distance is Design Fiction. In Design fiction, there is the opportunity to look into the future by asking the user what the future should look like ideally. These futures are presented in the form of a scenario, being provocative[28] to facilitate debates [29]. These scenarios can be written alone, but can also be written together. In its simplest form, this could already be a helpful way to combat loneliness. Futurist Scott Smith even describes design fiction as “a communication and social object creates interactions and dialogues around futures that were missing before. It helps make it real enough for people that you can have a meaningful conversation with" [30]. It is clear that the communication between designer and user alone is able to create an example for the future to come. Within this futuristic view, there is a difference in sub-method. The first sub-method uses a future where details are told through narratives, and the prop can be materialised, and is called Actually Futuristic. The second method uses an imaginary object which is also an intervention of the present. This method is called Rhetorically Futuristic [30]. A great example of using Design Fiction to create a new idea is Futuring the Smart City [31]. Futuring the Smart City was a joint effort of the 4TUs of the Netherlands, where 120 people used design fiction to create a future city. This shows the endless possibilities it can bring up, as well as the capabilities of working together.There does not seem to be any limitations that rules out one of those 2 sub-methods and therefore both can be used. This method is very favourable, as it requires the couple to think beyond their imagination, letting go of all their inhibitions. The Design Fiction might be formatted in such a way that it increases the imagination even more.

2.5 Conclusion

From the literature review, we conclude that hospitalization is extremely impactful for both the patient and the spouse. There is emotional and physical ache involved, and routines are disrupted. As there has been research into the routines after hospitalization, it would not be that unlogical to already try to convey this information during the hospitalization, given that there is at least improvement visible and there is a high chance that the patient will be discharged. This can be done in any form of communication. This way of communication is online and offline, but most importantly, this online method can facilitate the idea of communication between the homefront as well nurses being able to inform the spouse of

information if they are unable to come home. It has become very clear that couples, so both patient and spouse, who are accepting of technology during hospitalization, can increase the rehabilitation process. Both the partner and the spouse would have the possibility to get in touch with each other via the technology. The technology should reduce the feeling of isolation as well as be able to stimulate the mind. Most importantly, it should help with the feeling of being together. As stated, this was mostly done by bringing items to reminisce over.

Apart from age limitations, the elderly couple might have difficulty using the technology because of their known diseases. This disease overview also creates the persona of the person that will be designed for, showing limitations but also reasoning of hobbies. Although there shouldn't be a lot of variety, it is a nice touch to give the elderly the possibility to personalize the technology. This could be done to their liking, but it is more important to have a possibility to personalize their needs induced by the diseases.

The current State of the Art does look into the possibility of combating loneliness among elderly but a fitting solution for elderly separated by hospitalization is not there yet. It requires something that incorporates both patient and partner, but has to be done remotely as well. It needs to be used by the elderly, and feel natural to them.

Although these ideas are collected from the literature research, it is not clear if this really helps with the reduction of loneliness. This is mainly due to the fact that there is not a lot of academic literature about reducing loneliness levels. Also the impact of stress on given diseases misses literature to really give a proper view. Therefore, it needs to be tested if this is also what the elderly couple have in mind when asked for their opinion and compare this with the findings of the literature research. This does mean that the method requires a way to have the elderly couple give their opinion in the most free way possible, without any restrictions due to presented ideas. Using the Design Fiction method, it is possible to let their imagination go freely in the search for the solution. This Design Fiction method can be formatted to in a way to increase the levels of creativity even more. Using the Empathic Design method mentioned earlier, it became clear that it was useful to jump into the mind of the user. Creativity is mostly stimulated if the user has the feeling of home, therefore feeling at peace. The elderly couple used to have their breakfast, whilst reading the paper. Writing a newspaper with the elderly couple would be a way to improve this creativity and therefore find a solution to reducing loneliness amongst elderly.

3 Method

In this chapter, the method that will be used in this thesis is explained. The method is being split up in multiple phases, and is discussed phase by phase. From Phase 1 onwards, Joanne and Frank will be helping. Informeer content was obtained from This requires them to sign an informed consent. The informed consent template can be found in Appendix A (which is in Dutch due to English skills of Joanne and Frank). Figure 5 shows how the method can be illustrated.

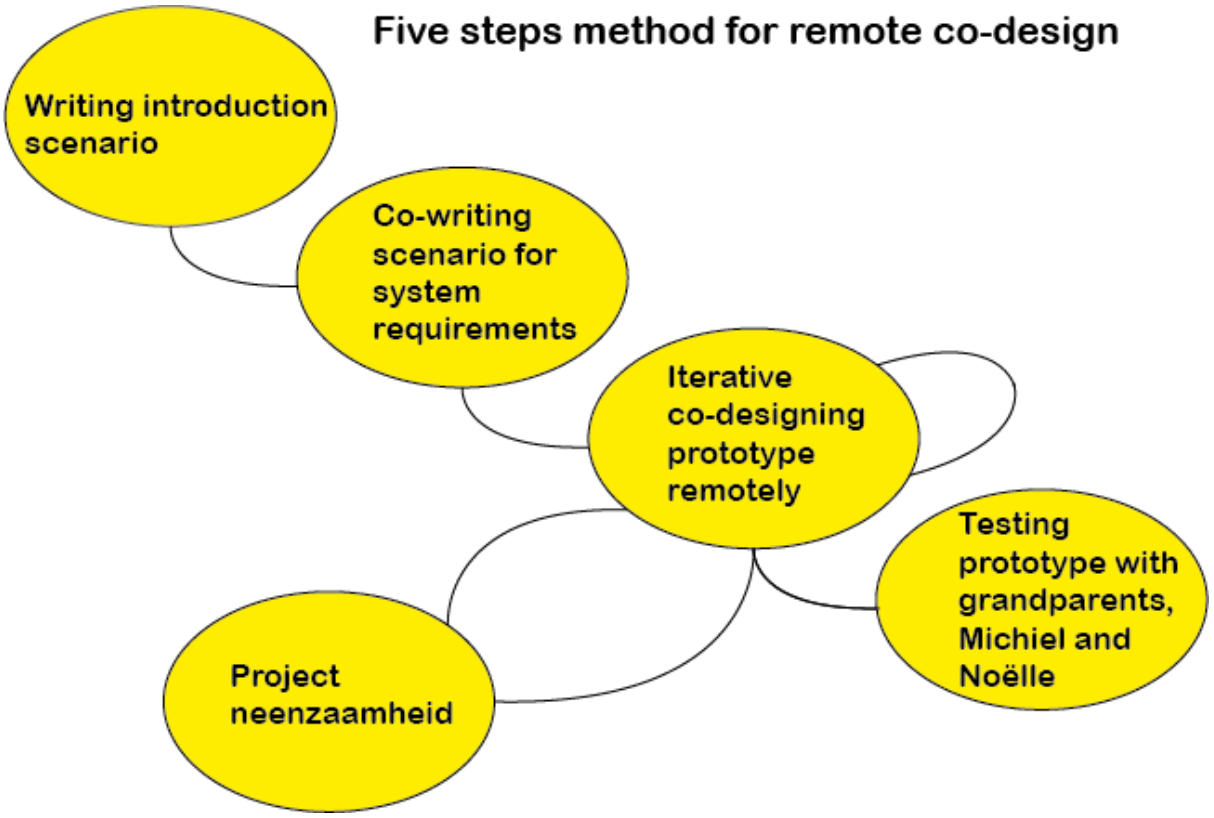

Figure 4: Method illustrated with interaction lines.

3.0 Phase 0: Who are the testers?

Before getting into the explanation of figure 4, it is important to know who will be participating in the co-creation part. These people are of great importance to the design process and it is therefore important to explain who these people are.

First of all, there is Joanne and Frank. They are a retired elderly couple who live in the east of Overijssel, close to their children and grandchildren. They have been asked to help in this project as they had the unfortunate experience of recent hospitalisations, and are therefore also keen on helping with finding a solution that decreases the loneliness upon hospitalisations. Joanne is also paraplegic, meaning she is bound to her wheelchair, after a falling accident approximately 15 years ago. She and Frank are still living together and Frank

is taking care of her most of the day. Only for getting out of bed and going in, home care is helping as this is too much labour for Frank to be doing alone.

Secondly, there is Michiel Klitisie. Michiel Klitisie is a medical technician and psychogeriatrician in a care center and also software developer. Michiel is also portfolio holder of Care and Technology, with CareAZ. Michiel has a lot of hands on experience with helping elderly with technology and is therefore a perfect expert to test the prototype on.

Subsequently, the project has asked the aid of Noëlle Hagen, who is a nurse in the geriatric ward of the Deventer Ziekenhuis. She also has knowledge and experience on helping elderly, but now from the hospital view. This is contrary to the view of elderly housing care given by Michiel, but both views bring something to the table. Both are eager to help in this stage of the project and are a big contribution to the feasibility of the prototype.

Finally, there is the influence of Project Neenzaamheid, which is discussed in 3.5. As the Project Neenzaamheid is being published regionally, readers are able to send in their stories, experiences and advice from their experiences with loneliness and hospitalisations. This completes the design process as the project is using inspiration from the general population, whilst being designed with end-users, after which it is tested with experts in the field.

3.1 Phase 1: Personal Scenario Writing

In the first phase, one scenario will be written. In this scenario, a situation likewise to when Joanne and Frank are abruptly severed from each other by hospitalization will be described. Joanne and Frank will read the scenario and react to it. The phase is mainly used to explain how the scenario writing works, and try to have them relive that experience. This phase should already bring some results to, but more results are expected in phase 2. After phase 1 has been completed, there will be the smooth transition into phase 2, where Joanne and Frank will write a scenario themselves.

3.2 Phase 2: Scenario Writing with Joanne and Frank

Joanne and Frank will work together and co-create a new scenario, with the help from the researcher. In this scenario, the needs during the hospitalization will be described. It is important that Joanne and Frank have complete freedom during this phase, making it possible for them to put all their fantasy into the scenario writing. From this scenario, a brainstorm session will be held to generate ten ideas of which the pro’s and con’s will be discussed with Joanne and Frank. Using the How-Now-Wow method, the ideas will be categorized on how well the idea is. The How-Now-Wow method representation can be seen in figure (4).

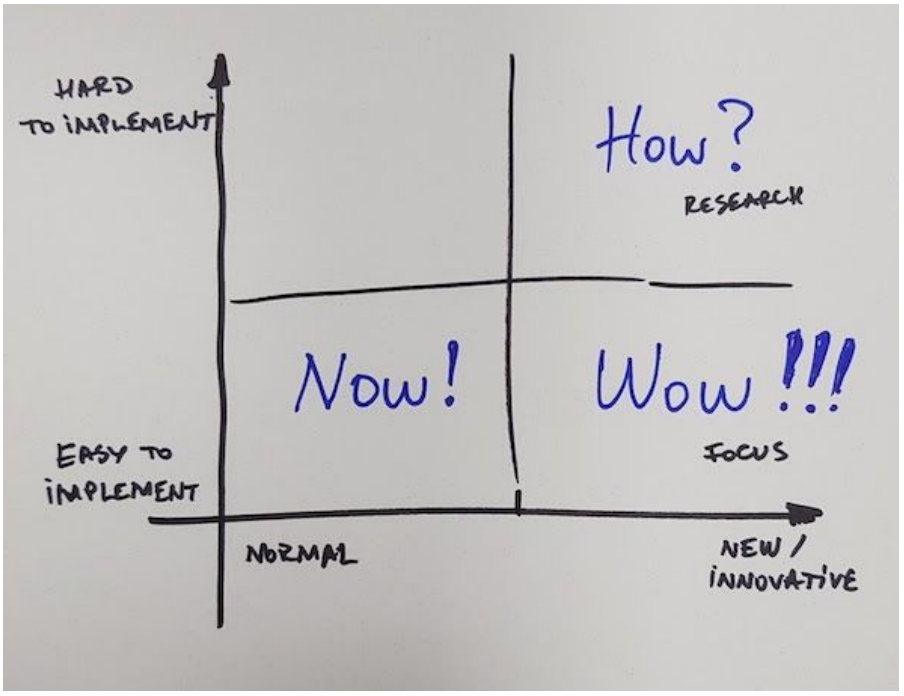

Figure 5: How-Now-Wow Matrix illustrated

After the categorization, one idea will be worked out into a concept that will improve connectedness. This concept will be worked out into a prototype, which will be described in phase 3. If the scenario writing is presumed to harvest results, more scenarios might be written as this is also helping with bringing variety to their daily activities, restricted due to the current COVID-19 situation.

3.3 Phase 3: Creating prototype

After the first scenario has been written, there is room to start making a first prototype. This prototype should give an idea of the product that should help with the increase of connectedness. It is to be expected that the prototype will be a representation of a technological solution, used in the future, after being perfected. The prototype will be made in a 3D modeling software, called Maya. After the prototype is finished, Joanne and Frank will be asked to test the prototype in phase 4. The prototype will also be subjected to feedback from two experts.

3.4 Phase 4: Testing prototype with panel

The fourth phase is there to test the prototype created from the scenario writing with Joanne and Frank and see if they have new insights or improvements for the product. Therefore, every iteration will be tested. This does mean that phase 3 and 4 will happen multiple times to ensure an optimal prototype. Once the prototype is finalised, the prototype will be tested with Joanne and Frank. This will be done via a video calling and seeing how they are coping with using such a video calling platform. Making the prototype into a real VR environment will not be possible as the VR sets are currently unavailable. Testing eating on a distance should also already show the feasibility of using a more advanced technology with the elderly target group Joanne and Frank are representing. Like mentioned before, it would be nice if Joanne and Frank could also write a final scenario based on the prototype as is. They will be giving

the assignment to do this practically alone to not bias the outcome, but can ask about technicalities.

Phase 4 will be split up in three sections, each one separately discussing the results of the three panel possibilities as feasibility will also be tested with two experts who are willing to help. Testing will be done by (video) calling the two experts and explaining what the system does, answers will be sent in as a survey. 4.4.1 will discuss testing the prototype with Joanne and Frank and will give more insight on the usage. 4.4.2 will discuss the results of testing the prototype with medical technician Michiel Klitsie whereas 4.4.3 will discuss the results of testing with geriartric nurse Noëlle Hagen.

3.5 Phase 5: Project Neenzaamheid

The last phase of this thesis is phase 5. In this phase, there will be the possibility of testing the prototype via the local newspaper, Twentsche Courant Tubantia. The project, dubbed project Neenzaamheid, is a four piece special edition in the newspaper, where supervisor Femke Nijboer and her graduating students will talk about loneliness among elderly and the fight the team has started. Neenzaamheid is a Dutch wordplay between the words “nee” and “eenzaamheid”, which are translated in English to “No” and “Loneliness” respectively. The idea is that the project literally says “No to Loneliness”. Readers will be asked to send in personal stories, ideas and general comments to the newspaper to help fight loneliness. As every graduating student has its own case regarding loneliness, there will be a variety of responses and ideas that will be sent. These ideas can be used to furthermore finalize the prototype.

4 Results

4.1 Personal scenario writing

The scenario written about Joanne and Frank yielded some results. Mainly, it showed how the scenario writing was done, and how Joanne and Frank could write scenarios together too. Appendix C and D show that they have managed to do that. It must be said that the scenario could be handled a bit more delicately. It was clear that even though the names were changed, Joanne and Frank could see that they were used in the scenario, making them relive those moments in their past. They were able to cope with this and used the emotions that arose to write their own scenario.

Joanne and Frank's ideas were tested in an online ideation session with partners of a European project called Pharaon. Nine participants participated in online ideation workshops about several challenges that older adults have to face. One of those challenges was the challenge from Joanne and Frank.

4.2 Scenario writing with Joanne and Frank

Phase 2 has shown quite some results, mainly stating the moments Joanne and Frank were most lonely. As could be seen in the State of the Art, or, one of the problems with loneliness was the abrupt disruption of routine, and partner and patient worried more about the other than about themselves. This was verified by Joanne and Frank in a very special way. Frank asked what could be done when visitation hours could not be as long as before. It made Joanne and Frank think once more about when they missed each other the most and wanted to be together. They stated that during the day, Joanne and Frank both had their own thing to do, but they were always together during breakfast, lunch and dinner. During breakfast, there was still the paper to be read or a game to be played, so lunch and dinner were more important than breakfast. Upon this fact, the ten ideas were created by combining random words with the aforementioned system requirements, as can be seen in table 2.

How-Now-Wow Matrix		
Idea:	Result:	Commentary:
Talking plant	Now	Hard to visualise so should not be used.
Buddy system in hospital	Now	It is feasible and could help, But not really any new technology used.
Lion cuddle pet	Not good	Not wanted.
Patient card	Not good	Less wanted than buddy system.
Vibrating cuddle pillow	How / Now	Good when in need of

		touch, remote technology can be faulty.
Conferencing lamp	Now / Wow	Creates ambiance in the room as lamps change colour according to mood. Also used to contact nurses.
Customisable wall	How / Wow	Very hard to implement, and will be very expensive but would be very good to create a customisable room inside the hospital.
Book of wisdom	How / Wow	Inspirational speeches read to you using your partner's voice seems like a good substitute when your partner is not available.
VR cooking room	How / Wow	Creating a recipe with ingredients given by the hospital creates a community of people in the hospital but leaves out the role of the partner and partner should be included.
Room guest book	How / Wow	Also does not involve the partner but it does help patients when they are able to read messages from people who were in the room before you, and it might get you through the day.

Table 2: How-Now-Wow matrix made with Joanne and Frank

In this table, the outcome of the How-Now-Wow Matrix [32] method was also mentioned. The How-Now-Wow matrix method lets you place items in a 4 cell grid, using the tags: How, Now, Wow and Not good. “Not good” is characterised by being hard to implement and not being innovative. “Now” and “How” are each other’s counterparts as “Now” is an easy to implement idea but not as novel whereas “How” is exactly opposite of this . “Wow” is being characterized as being easy to implement but also very innovative. Ideas with a “Wow” tag are therefore the way to go.

Initially, the idea arose in which patients can use the kitchen to create a recipe, with the list of groceries provided by the hospital, for the cook to make that evening. This was because of a profound love for cooking that both Joanne and Frank experience. This did however mean that the spouse was left out in the solution. This meant that the previously

mentioned fact, that the spouse is easily forgotten when someone gets hospitalized, would still be upheld. It was essential that the spouse was included in the solution too. This inspired the idea of the patient and spouse being connected virtually twice a day. The scenario, seen below in italic style, was co-written with Joanne and Frank and describes their optimal hospitalisation.

“It is April 2025. Joanne has been living at home with Frank again for 5 years. All seems well but Frank is having some problems with his knee. He has had knee surgery before as he had a really bad accident when he was younger. He is doubtful: “is there something wrong with the knee prosthesis?”

Frank goes to his docter and unfortunately, he has to undergo surgery again. This poses a lot of problems. If Frank needs to go to the hospital, who will take care of Joanne? Luckily, the family is willing to spend the 3 to 4 weeks living with Joanne whilst he is in the hospital. Frank and Joanne think back to Joanne’s last hospitalization, and they get a bit anxious. They know for certain that physical visitation hours have decreased. Joanne also doesn’t have the strength to come and visit Frank everyday.

Luckily, the hospital has put a lot of resources into finding a suitable technological solution for increasing the connectedness of patients and spouses who live remotely. Twice a day, the hospital uses a technology to have a perfect video connection, and the walls are covered with a layer that ensures privacy. This allows for them to be in touch with each other, even though they can not physically visit each other. Frank is also more at ease in his room, as he can use the tablet to change the colour of the walls, resembling the walls of his own bedroom. If Frank needs something from the nurse, he can always use the built-in call option of the lamp on his bed stand.

Frank is able to go home in the last week of April, being able to still visit his grandson’s birthday that week. Luckily, the impact of the hospitalization was not that much.“

As can be in the scenario, the hospital room had changeable hospital walls, which is something that could be done in the future but would not be feasible on short notice. It is important to understand the meaning of these walls. The reason why it would be nice to change the walls is to be able to get rid of the blank walls and create a room that resembles a room in your own house. This resemblance would help with the reminisce the situation at home, which was still well, and therefore decrease the loneliness. Subsequently, being able to change the walls could make it look like you are together in the same room as your partner. This was the key message that was needed to get to a feasible solution. A virtual dining room in which you can eat together with your partner. This idea was not mentioned in the How-Now-Wow Matrix but is an adaptation of the VR cooking room. The virtual reality dining room will be the idea that will be worked out in phase 3.

4.3 Creating prototype

The conceptual prototype is a virtual dining room where a patient and his / her partner, or any other person, can meet each other and eat together remotely in the setting of a dining room which resembles the one they have at home. For this, the room should at least be

partly customisable. Like mentioned above, this phase will be about giving form to the virtual reality dining room. The dining room is a representation of the kitchen of Joanne and Frank, yet made slightly different. The kitchen can be seen in figures 6, 7 and 8, respectively showing process through time as more feedback came in. The kitchen has been made with a lot of details to make it more living, but also more realistic. The cutlery, located next to the plates on the table, is very part of the interactive environment. The idea is that people slide a joystick chip over the cutlery used, meaning that they are able to see the cutlery moving in the virtual reality when used in the real world. Patient and spouse can communicate when either is going to eat, the other can subsequently make sure that they are able to have food ready. Upon entering the room, both are able to sit at the dining table and eat their food. Audio input helps with talking as well as video. This video input is also helping with being able to see yourself and your surroundings, to help with eating. For now, the kitchen is finalised as a prototype, having been exported from Maya [33] to Unity [34] to be able to walk through a virtual kitchen.

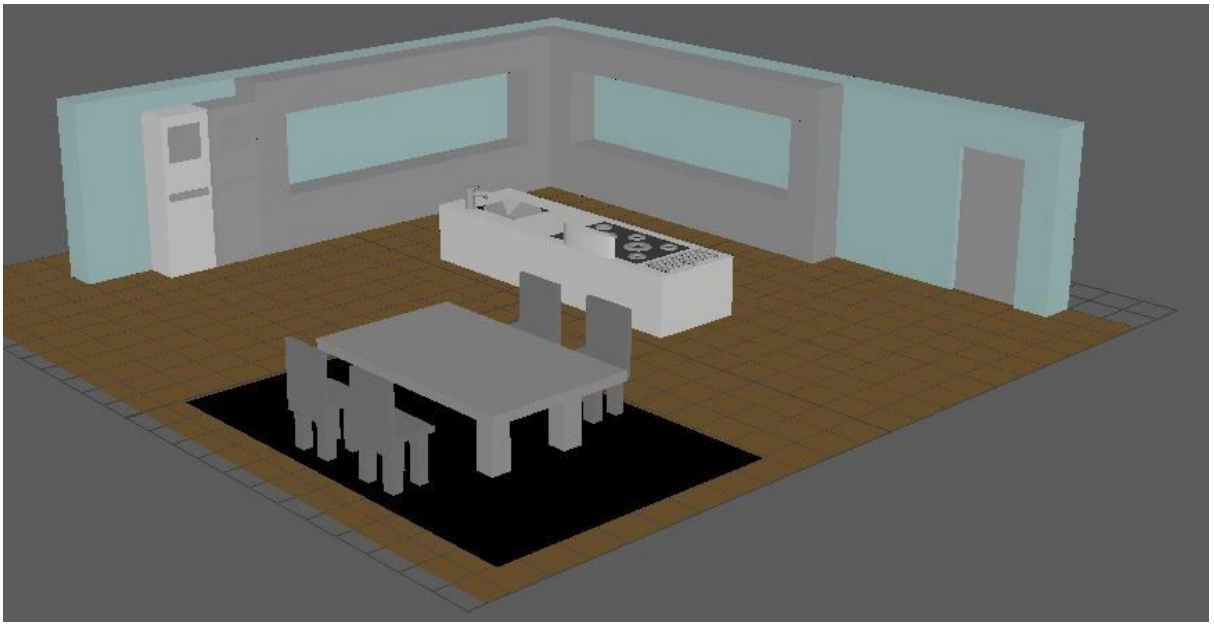

Figure 6: First prototype ideation of 3D model kitchen

Figure 7: Second prototype ideation showing more detail

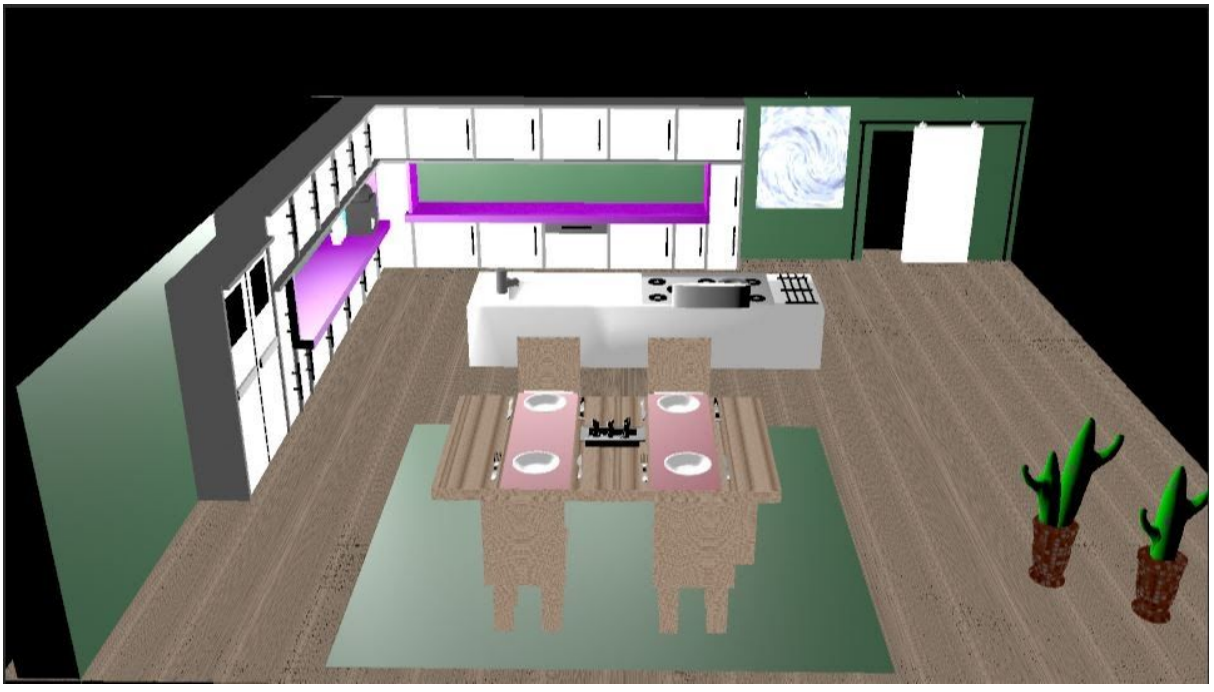

Figure 8: Third and final prototype being optimised for testing

4.4 Testing prototype with panel

Like mentioned in section 3.4, testing the prototype was not really possible, as the virtual reality sets of the university were not available. This was due to the fact that the Covid-19 crisis restricted students from entering the buildings of the university, therefore making it impossible to get a virtual reality set for testing. This section will therefore talk about a fitting

solution, as well as the results of testing this solution with Joanne and Frank, Michiel Klitisie and Noëlle Hagen. The latter being experts in the field of working with elderly.

4.4.1 Testing with Joanne and Frank

The solution, created to make sure that the prototype was tested with Joanne and Frank so that they could give their final feedback, was created with the core functionality of the prototype in mind. Eating together on a distance via video calling. This solution was also the inspiration for the scenario Joanne and Frank wrote completely on their own. The scenario was written in Dutch, but translated into English and afterwards sent to Joanne and Frank to ask if the translated scenario was still corresponding to the original. Joanne and Frank's written scenario, about the prototype and tested solution, can be found below. This is the translated version of the scenario. The original can be found in appendix C.

"Jolanda, of age 66, has to be hospitalized after a horrendous car accident. There is minor damage to her organs but, more importantly, she now has thoracal 4-5, complete, paraplegia. After being fired from the hospital, she has to rehabilitate meaning she still will not be home for another 8 months.

Home is 40 kilometers away from the clinic, in a small village where she lives with her partner Bert. Jolanda has meetings everyday with multiple disciplines, creating a physical and mental burdening. Corona also prevents Bert and her children from visiting a lot, and it is even a bigger burden she is not able to hug her children and grandchildren. As time goes by, she becomes more and more dejected. Luckily, there is something that catches her eye: a newspaper article about a study trying to reduce loneliness. One of the ideas is the possibility to plan meals and eat them together at different places. Whilst the patient eats in the clinic, the partner eats at home. Jolanda daydreams a bit, and she sees her partner Bert eating whilst communication with her through video and sound. She can hear the sound of Bert using his cutlery and him asking her how her food is tasting. She wonders if it is at all possible to recreate a kind of "home environment. She thinks it would really increase her mental health. What would be possible in the future with the help of advanced technology and creative, out of the box, thinking? She gets carried away in her endless fantasies and hopes that the study yields some solutions to reduce the terrible loneliness."

As separating Joanne and Frank would have been bad for Joanne's health condition, Joanne and Frank were eating together in the same room, whilst video calling with their grandson in a different location. Both sides were asked to change the background, using a rendered photo of the kitchen created. The age difference was easily spotted when this was requested. The grandchild was able to effortlessly change the background of the video calling software, whilst Joanne and Frank did have a bit more struggles with this. Surprisingly, it was not the background image location in the settings that inhibited them, but the directory of the photo. The rendered image, of the dining kitchen, was sent over email and saving the image resulted in it being stored somewhere in the files. With a little help from the grandchild, Joanne and Frank were able to change the background. They would have been able to get it fixed on their own, but downloading the image, used as background for the video calling, was difficult as the save directory of the email was changed. The grandchild was able to have Joanne and Frank save the background to the desktop, so that

Joanne and Frank knew where they had to look for the image. This resulted in them being able to talk and have lunch whilst being in different locations, but appearing to be in the same room. This can be seen in figure 9.

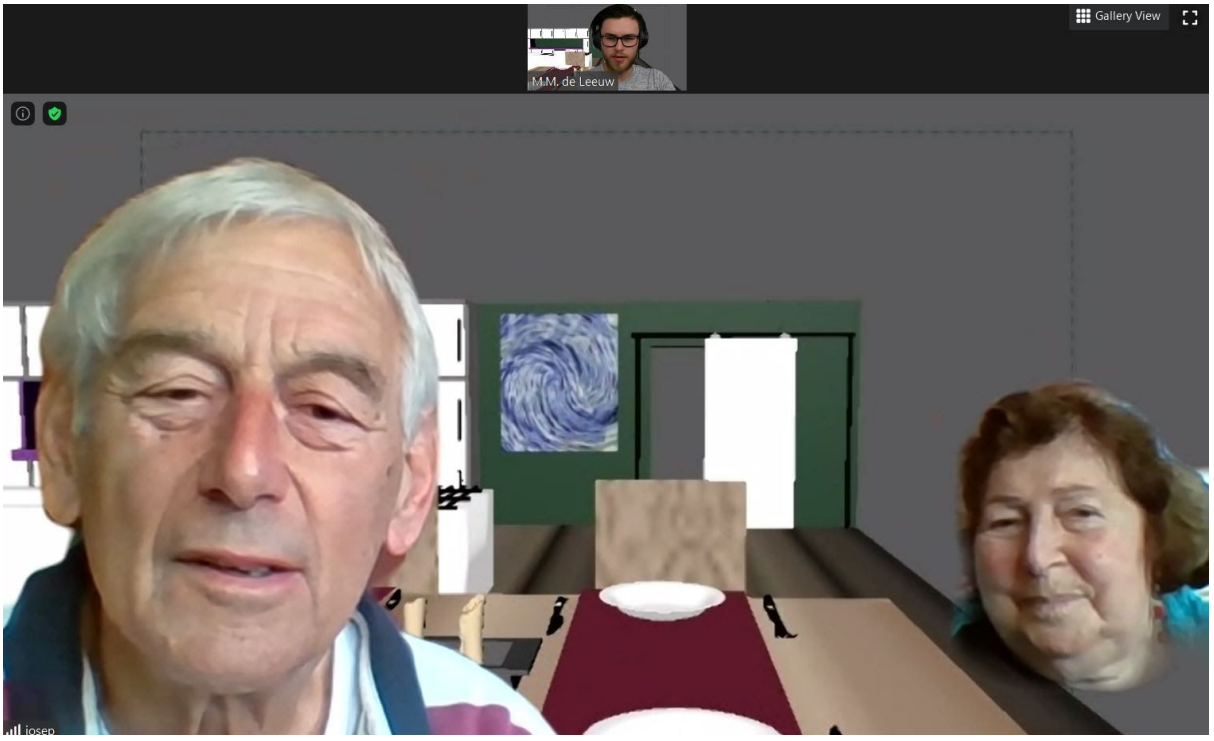

Figure 9: Testing rendered image whilst eating lunch

Frank described it as having a good representation of the communication exchange between partner and spouse / visitor, whilst being able to eat. Although both sides knew they were apart, the conversation felt natural. Both Joanne and Frank were convinced that eating like this would already establish a good foundation for battling loneliness, and stated that they didn't think eating the same meal would contribute to the experience. Rather, it would be a necessity that both partner and spouse would eat the same course amount of meals, i.e. a one or two course meal and that these would be eaten synchronously. The kitchen was not an exact replica of the one Joanne and Frank have but it was a good representation of the kitchen. The dining table was initially placed in such a way that it filled up the complete space, but this resulted in the perspective's view looking straight at the door next to the kitchen as can be seen in figure 10.

Figure 10: Eye-view render of 3D model kitchen after first testing.

Therefore, the position of the dining table and the plants were interchanged. The painting on the wall reminded Joanne and Frank of a painting Joanne once made, which was very nice to them. This led to a small discussion about the possibility of being able to put a personalized photo on the canvas to make the room more personalized. They stated that they could make a picture of their (grand-)children and place it up there, which for them would enhance the experience even more. Surrounded by their loved ones, they would be able to forget the distance between them for a little while. More images of the rendered 3D model can be found in Appendix D.

There was one minor problem that arose. Whilst video calling, the background image was flickering because of the room Joanne and Frank were in. This resulted in Joanne disappearing from the screen on a few occasions. Fortunately, this is something that seems possible to be fixed. Recommendations will be discussed in section 6.

4.4.2 Testing with Michiel Klitsie

In the beginning of June, I was able to video call with Michiel Klitsie about the idea that was created. There was a lot to talk about, as not only the current idea was discussed but also further implementations. This is why the call lasted just short of one hour. In this video call, the idea tested with Michiel Klitsie was the completed and perfected solution of eating together in a VR room. Michiel Klitsie stated very clearly that older adults differ in the amount of technology they want to accept. This is something he noted from the group of elderly people he is treating. Luckily, Michiel is able to state that the majority of the elderly are currently accepting more and more technology. Some of the elderly are getting too many impulses when they need to talk and see their loved one and having to eat too. Michiel is charmed by the idea of eating together. He sees that a lot of the elderly have been affected by their separation, which consequently affected their eating patterns. Happy eating is a step in the right direction.

Michiel does see technical and logistic problems that can arise when having to eat at a remote location. How do you make sure the meals are served at the same time? How many restrictions arise when having to eat, whilst wearing a VR headset? It is important to keep in mind that doing something remotely is important when there is no other option. With the current Covid-19 regulations, it is more fitting but outside of these regulations, benefits of remote eating would only be maximized if the patient is hospitalized far away from the home of the partner (and family). Michiel states that being able to change the background of a video calling software would already do a lot, confirming the results from 4.4.1. Michiel concludes this part of the question with the fact that the challenges that need to be overcome are still a bit harsh to overcome in the period left to finish the graduation project, but would be perfect as a futuristic vision.

Michiel is also very interested in looking at the application of remote eating outside of the hospitalized population. Companies, such as tafeltje dekje, could use this technology to revolutionize the dining experience for everyone. 2 people in 2 different locations get requested to have an empty table at a given time, and caterers from such companies would create a possibility to have a romantic dinner remotely. Think about dining remotely but with the same scented candles and the same red tablecloth. Food getting served to you at the same time. The principle of table d'hôte [35], combined with delivering all the components prepared only to be constructed, could be a really nice addition to this idea. One last idea was having a tabletop simulator, where you combine AR and VR to eat in the room whilst eating the food in front of you. The system lets these companies respond to the demand of social interpretation.

4.4.3 Testing with Noëlle Hagen

The idea of remote eating using video call software was something that would really help some elderly, was the first thing Noëlle said. She thinks that it would work really well on the patients that are still well cognitively, but hospitalized for a longer period of time on the geriatric ward. She gives the example of a patient she is currently having at the geriatric ward, who is together with his partner for over 60 years. He now has to leave his partner behind and has no-one to talk to or to eat with.

The idea would need assistance from the nurse, who checks if the glasses stay worn. Some patients might not understand that it needs to be worn throughout the whole duration. The design of the glasses could help with that.

Noëlle Hagen treats a lot of different kinds of patients and thinks that patients who are cognitively deteriorated would not benefit from the solution. She does add that it is likely that these patients would not benefit from any form of technological aid. These patients are very confused, restless and practically in need of constant attention. During Covid-19, these patients get a slightly different treatment where 1 visitor is always present as otherwise the patient would deteriorate very quickly. Video calling could be used, but only in the simplest form. Background changes, or other specialities, would not work at all.

Noëlle describes the room of the patient, and clearly states the fact that all the patients have a tablet attached to their beds. These could be used but most apps are too small to be read. Again, the usage of ergonomic design makes this problem solvable. Nurses do help the patients with the usage of the tablets, but not a lot of time goes into this. It is usually a single act, and that concludes it as well as the fact that it definitely doesn't occur on every shift. If the video call software were to include some sort of cognitively

stimulating game, that would also help with the boredom most patients experience. The cognitively well patients are therefore even more aware of this boredom, which also increases the feeling of loneliness and restlessness.

Usage of such a system would be very helpful in hospital wards with generally longer stays such as the geriatric ward, Noëlle concludes.

4.5 Project Neenzaamheid

The last phase in this project in phase 5. The local paper Tubantia has published the four editions of Project Neenzaamheid, and a total of 42 reactions were sent in to the survey as well as around 71 emails and letters. This was way more than was ever imagined. Readers mostly sent in their own experiences and stories, and there was one scenario written. This meant that there was not really a solution given by the readers who had sent in an answer. What could be derived from this data was the fact that their answers did correspond to data found in the literature review / state of the art, found in chapter 2. Figure 11 shows the researchers holding the edition of the local Tubantia covering Project Neenzaamheid.

Unfortunately, it appeared that the readers did not really write any stories for the scenario of separation due to hospitalization, but there were a lot of letters and reactions about elderly having a hard time dealing with the loss of their loved ones. This meant that there were not any direct responses that really helped with the testing of the solution, but dealing with the loss of a lost one is something that could also be improved with the usage of the system. This was, understandably, also because the local paper, seeing that there were not any direct responses to this particular problem of loneliness, decided to not really focus a part of their newspaper to a collaboration between this project and someone willing to be in the paper with their experience. All the sent-in answers did however give an even bigger drive to solve loneliness among elderly (patients and spouses).

The main message that could be gotten out of the responses, which was not clearly stated in chapter 2, was the fact that most elderly want to accept the technology in order to help battle loneliness, but do not want to become completely dependent on this technology. The technology created should aid them in their way of living, not make them feel like they are “becoming old” and human contact can be replaced by robots. Human contact is essential for the elderly to maintain their quality of life or even thrive.

Another thing that the paper did help with, is the fact that loneliness among elderly became even more discussed, so more awareness was created. To this day, there are still messages coming in from Dutch people, living in foreign countries, who have read the paper and were moved by the paper.

Figure 11: Project Neenzaamheid on front page of local newspaper Tubantia

5 Conclusion

In this chapter, the evaluation of the project and the prototype will be discussed. Next to that, the research question will be answered and if the goal, set for this project, has been reached.

5.1 Research question & goal

This project aimed to investigate how*co-design on a distance can help create a technology that increases the feeling of connectedness between an elderly couple of which one person is hospitalized?* Together with the research question, also sub questions were formulated in chapter 1, which were answered in the literature review. This also made the goal of this project easier: increasing connectedness among elderly who are separated through hospitalization.

Together with Joanne and Frank, who were the counterpart of the remote co-design method of this project, it was discovered that they were missing each other the most during routinely agreed moments. These moments, moments in which you are together without really thinking about it such as meals and drinking coffee or tea, are moments which do not take long but are essential in the day to day life. During these moments, you talk about your day, discuss your feelings and envision a carefree future, and every time you get a little closer. Spending these moments of your day separated from each other whilst you are used to being together were the foundation of evergrowing loneliness. It appears that there is only one mention of such moments in literature. According to Lottridge, Masson and Mackay [36], who call these moments “empty moments”, couples have the time to get in touch with each other when they are not physically together. Their idea of MissU lets you hear thoughts and music of the partner using a private radio station. This does mean it lacks the visual stimulation.

This set the stage for answering the initial research question. What do you create? You create a way for these moments to be together even when you are apart. You want to see each other and experience what the other person is experiencing. Twice a day, having some time together virtually helps with fighting the boredom, as described by Noëlle, as well as help with the eating patterns which were affected by the separation, like stated by Michiel.

Although there is still a lot that can be improved, this way of thinking is what made the project reach a solution for loneliness, which is also demographically accepted as the technological solution should aid in the day to day living, not take over.

5.2 Remote co-design with older adults

Due to COVID-19, it was necessary to do remote co-creation. Both Joanne and Frank have experience with technological interventions in day to day life, which made it easier for them to imagine themselves using the technology. Creating novel technology was more difficult for them but with the right steps there was some progress. It was easier for them to think about a thought of, but novel, technology than to think of one themselves. Using the How-Now-Wow method, the ten ideas were categorized, yet some ideas might have been discharged by Joanne a bit too quickly but as she stated she was not able to envision this technology being created and used, she was a good counterpart for sticking to an idea for

too long. Introducing the How-Now-Wow method into the remote co-design session helped Joanne and Frank getting a grip on how the design process was going, but there does not appear to be any literary support.

Throughout the complete project, they have grown in multiple ways. The way they think about technology has improved, and they even were able to write a futuristic scenario based on fictional technology by themselves. Lastly, testing the video calling software with their grandson needs to be discussed. It was a bit unfortunate that the rendered image had vanished and that they had to be helped. It would have been nice if they could have shown that they mastered the technology needed to change the background of the video calling software. It would have created a clear conclusion that they, as a representation of their user group, were able to use this kind of technology, and might be able to use more advanced technology too. Realistically, it is not weird that they might need some help with the current technology and presumably some more help when it comes to more advanced technology but that is not so bad.

The interviews held with Michiel and Noëlle were also very helpful and interesting. They were very critical about the usage of technology on the patients but also saw the options it could enable. It was unfortunate that the solution could not be tested with them or that more experts were able to discuss this idea as it could have given more insight and information on what can and can not be done.

Thus, remote co-creation with older adults is something that can certainly be done in the future. They might need some help but as Michiel and Noëlle also stated, more and more elderly are getting the hang of advanced technology.

5.3 Prototype

The prototype that was created was a high definition rendered image of a virtual dining room kitchen. This rendered image could be used as the background of a video calling software to create the idea of being in the same room whilst eating. The current prototype is definitely not optimised. There is still a lot that can and has to be improved to be able to use it to its fullest potential. The flickering background that occurred during the meal between Joanne, Frank and their grandson, means that the usage of background editing technology really needs a solid wall to be able to perfectly reflect the rendered image on there.

The fact that the VR sets were not able to be used meant that the prototype could only be made to a 3D model. Although the model can be accessed from each corner of the dining room, it only slightly helps with the experience. It was also difficult to model the organic forms very well but this seemed to not have bothered Joanne and Frank that much. In order to fully transition into a working VR environment, it is important that it is possible to see your plate, such that you are not eating blindly. It seems possible to create a way for the controller chips to be slid over the cutlery so that it is also possible to see the cutlery moving. There was however not a way for this to be tested.

The ambiance of the room was nice as Joanne and Frank could envision themselves in this kitchen. This is also because of the fact that the kitchen was partly based on the kitchen Joanne and Frank own personally. For others to feel comfortable in this dining kitchen, it might be nice to have a way to place personal items inside of the room and keep the basic model a bit less detailed.

The last thing that is important to state is the way the service could be distributed in the future. Like mentioned in chapter 2.1 of the State of the Art, 80% couples who

experienced a hospitalisation, changed their lifestyle after the hospitalisation. Hospital staff could have a role in explaining the impact of the hospitalisation, as well as stating the possibility of video calling twice a day. The hospital staff could show the provided tablet in the hospital room, to the partner and spouse and explain to the spouse that the technology is present on the tablet and can be downloaded using the health care portal. If the software would be expanded outside of the hospital population, the software could be changed a bit to have a hospital software as well as a public software for remote eating, which can be found on a custom-built website.

6 Discussion

In this final chapter, the project will be reflected upon. This means that every proces, result and goal will be thoroughly looked into to see where something went well or wrong, and what could be improved. The improvements are of great importance to the enchiridion, which means that people who want to do a graduation project on the same subject already have information to go on.

6.1 Conclusion

The conclusions that were gotten from this project were relatively simple. Loneliness needs to be solved, but it does not require a lot of advanced technology to do so. This was quite clear from the information that was required from the literature review, Joanne and Frank, and the 2 expert reviews. Human contact can not be replaced by technology when searching for ways to decrease loneliness, technology can however be used as a supporting aid. A quote from Joanne started this project and is a perfect representation of the literature. In the middle of the night, Joanne woke up in a hospital room and she did not know where she was or how she got there. She became slightly scared and asked for someone, to which a nurse responded to her call. It would be inhumane to keep the words she uttered, when the nurse entered the room, from you. Joanne said: “Where is Frank? Where am I and how did I get here?”. The first thing she wanted to ask was where her partner was and only after that moment she wanted to know where she was and how she got there.

This thesis was looking into decreasing loneliness, using a form of online personalizable place. A place where people can be together virtually, when it is impossible to be together physically. The explorative research that has gone into this virtual place has set the stage for further research as it can become the pillars on which new softwares can be built so that loneliness among every population group can be decreased.

The fact that loneliness among other population groups could also be decreased with the usage of this technology, means that the technology could be scalable. It is true that the technology was created specifically for bringing together hospitalized elderly, but like Michiel Klitsie stated, the technology can be used to have almost every person eat together virtually with only small changes. People all over the world could be eating together virtually when loneliness surges and needs to be decreased.

This thesis has also shown that co-designing remotely with elderly population is possible. Joanne and Frank are able to use an online software to communicate, such as video calling, and are able to help design using this way of communication. The internet connection nowadays is stable enough to really get what the other person is stating, and it appears that the critical thinking is not reduced when using remote co-design. Sub-methods, such as How-Now-Wow [32], were also feasible as long as the method is explained and the designer takes the co-designers by hand and walks them through the steps.

6.2 Limitations

As the thesis progressed, two major limitations emerged. First, the prototype could not be matured into a working virtual reality room in which you are able to see your partner and eat together. This was mostly due to the fact that the Covid-19 crisis made the virtual reality sets unattainable. Therefore, it was impossible to mature the system into a room that could be tested in real life so the technical issues that the hardware could create were not tested. Only the concept could be tested and it did mean that the remote co-design method had to be used. For now, the interaction with the concept yielded positive and promising results, but this could still change upon the interaction with the hardware adaptation of the concept. Next to that, the room was also only tested by 4 people, being Joanne and Frank, Michiel Klitsie and Noëlle Hagen. Testing the prototype with more people could yield more quantitative results.

Secondly, Joanne and Frank's personal connection with the researcher could introduce biased results, as Joanne and Frank could help with the graduation process. This was however immediately avoided as they were asked to be representatives of their population group and remaining critical throughout the process would increase the quality of the technology. Therefore, it can be concluded that increasing the number of test participants will increase the quantitative data but should yield the same qualitative results. Joanne and Frank were always very strict to themselves regarding this role they were playing, and were from time to time if they were still “in role”. Joanne sometimes had troubles with the technological possibilities that were stated, and she made this very clear. She would say that she was not able to visualize the technology, nor it being used and always continued this sentence with the fact that she might be too short-minded for this. She did however help with the realisation that researchers might have the idea that technology is suitable for the people they are designing for, but the fact that Joanne thought about herself as short-minded, which she definitely is not, meant that the technology was just not suitable to be introduced to this target group. Therefore, ideas could be dismissed prematurely.

6.3 Recommendations

Lastly, there are the recommendations that arose during this thesis. These recommendations are there to further enhance the technology that was created and are of great value for researchers continuing the work as they do not have to start from scratch. The first recommendation is to make the room even more customizable. For now, the idea to have a customizable painting was enough, but having more objects in the room would give everyone the possibility to reminisce on items they put in the room. Like mentioned in the literature review, chapter 2, reminiscing was also part of being able to decrease the feeling of loneliness as it reminded of the past where everything was still well. Upon entering the room, a pop-up interface would ask for preferences in colour palette, items that are already in the room could be enabled or disabled, the light could dimmed, brightened or glow in a different colour. Giving people the possibility to personalize the room as they see fit, would be the optimal solution for bringing people together, whilst being separated over distance.

Secondly, zooming in on the hospitalized elderly, there is the recommendation of introducing cognitive games which could challenge the brains from time to time. This could be used when a partner is not able to be online during the discussed times and being able to keep your mind busy will help delay the feeling of loneliness. Upon the introduction of the

cognitive games, as suggested by Noëlle Hagen of the geriatric ward of the Deventer Ziekenhuis, the technology should be made into a complete app.

Lastly, there is the recommendation of scaling up the technology. Upon the increase of matureness of the technology, it would be best to test the technology on a much larger scale to also get more personalized requests. The technology could be introduced to other target- and population groups quite easily. It would, however, be very wise to clearly state the reason why this application was given the light of day, as it can help raise more awareness for loneliness and give people the chance to do something with this. With that, the best recommendation was saved for last. The last recommendation should be the first part of further research as it would be wise to get more quantitative data before looking into the completion of the app, including the cognitive games.

References

[1] "Age Structure - Our World in Data." https://ourworldindata.org/age-structure (accessed Apr. 28, 2020).

[2] E. Westly, "Separation Anxiety for Adults," *Scientific American Mind*, vol. 20, no. 1, pp. 12–13, Feb. 2009, doi: 10.1038/scientificamericanmind0209-12a.

[3] N. A. Christakis and T. J. Iwashyna, "The health impact of health care on families: A matched cohort study of hospice use by decedents and mortality outcomes in surviving, widowed spouses," *Social Science and Medicine*, vol. 57, no. 3, pp. 465–475, Aug. 2003, doi: 10.1016/S0277-9536(02)00370-2.

[4] N. A. Christakis and P. D. Allison, "Mortality after the Hospitalization of a Spouse," *New England Journal of Medicine*, vol. 354, no. 7, pp. 719–730, Feb. 2006, doi: 10.1056/NEJMsa050196.

[5] M. G. Titler, M. Z. Cohen, and M. J. Craft, "Impact of adult critical care hospitalization: Perceptions of patients, spouses, children, and nurses," *Heart and Lung: Journal of Critical Care*, vol. 20, no. 2, pp. 174–182, Jan. 1991, Accessed: Apr. 28, 2020. [Online].

[6] R. Mahrer-Imhof, A. Hoffmann, and E. S. Froelicher, "Impact of cardiac disease on couples' relationships," *Journal of Advanced Nursing*, vol. 57, no. 5, pp. 513–521, Mar. 2007, doi: 10.1111/j.1365-2648.2006.04141.x.

[7] H. M. Mohadis and N. M. Ali, "A Study of Smartphone Usage and Barriers Among the Elderly A Study of Smartphone Usage and Barriers Among the Elderly," in *3rd International Conference on User Science and Engineering (i-USEr)*, 2014, pp. 109–114, doi: 10.13140/2.1.1732.8321.

[8] "PARO Therapeutic Robot." http://www.parorobots.com/ (accessed Apr. 28, 2020).

[9] "The robot startups that want to stop us feeling lonely | Sifted." https://sifted.eu/articles/no-isolation-companion-robots-loneliness-tech-founders-elder-care-cutii-miro/ (accessed Apr. 28, 2020).

[10] "Humanitas Deventer en haar Woonstudenten." https://www.humanitasdeventer.nl/wonen/humanitas-woonstudenten (accessed Apr. 28, 2020).

[11] "Amintro - Social Platform and Information Hub for Those 50+." https://www.amintro.com/ (accessed Apr. 28, 2020).

[12] "Bond Touch | Be together, even when you're apart." https://www.bond-touch.com (accessed May 05, 2020).

[13] D. Maor and K. J. Mitchem, "Can technologies make a difference for hospitalized youth: Findings from research," *Journal of Computer Assisted Learning*, vol. 31, no. 6, pp. 690–705, Dec. 2015, doi: 10.1111/jcal.12112.

[14] P. Antón, A. Maña, A. Muñoz, and H. Koshutanski, “Live interactive frame technology alleviating children stress and isolation during hospitalization,” in *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, 2011, vol. 6693 LNCS, pp. 92–100, doi: 10.1007/978-3-642-21303-8_13.

[15] L. N. Gitlin, “Assistive technology in the home and community for older people: Psychological and social considerations.,” in *Assistive technology: Matching device and consumer for successful rehabilitation.*, Washington: American Psychological Association, 2004, pp. 109–122.

[16] M. Lilja, A. Bergh, L. Johansson, and L. Nygård, “Attitudes towards rehabilitation needs and support from assistive technology and the social environment among elderly people with disability,” *Occupational Therapy International*, vol. 10, no. 1, pp. 75–93, 2003, doi: 10.1002/oti.178.

[17] “People Who Are at Higher Risk for Severe Illness | CDC.” https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-at-higher-risk.html (accessed Apr. 28, 2020).

[18] “CARU | sprachbasierter Family Chat & Notruf — CARU – Omas und Opas digitaler Mitbewohner.” https://www.caruhome.com/ (accessed Apr. 28, 2020).

[19] “Tinybots: Nood Tessa.” https://www.tinybots.nl/zorgorganisaties/tinybots-nood-tessa (accessed Apr. 28, 2020).

[20] “AAL Solutions Supporting Older Adults during the Coronavirus Outbreak - AAL Programme.” http://www.aal-europe.eu/available-aal-solutions-supporting-older-adults-to-cope-with-the-consequences-of-the-coronavirus-outbreak/ (accessed Apr. 28, 2020).

[21] “Link-ages Tech - Digital Communication for Everyone.” https://www.link-ages.com/ (accessed Apr. 28, 2020).

[22] T. Togan, O. Kurt Azap, E. Durukan, and H. Arslan, “The prevalence, etiologic agents and risk factors for urinary tract infection among spinal cord injury patients,” *Jundishapur Journal of Microbiology*, vol. 7, no. 1, Jan. 2014, doi: 10.5812/jjm.8905.

[23] “Learn What Osteoporosis Is and What It’s Caused by.” https://www.nof.org/patients/what-is-osteoporosis/ (accessed Apr. 28, 2020).

[24] “Wat is diabetes type 2?” https://www.dvn.nl/wat-is-diabetes/type-2/wat-is-type-2 (accessed Apr. 28, 2020).

[25] “Perspectives on Participation in Design.” Accessed: Apr. 28, 2020. [Online]. Available: www.ideo.org.

[26] M. Kouprie, & Froukje, and S. Visser, “A framework for empathy in design: stepping into and out of the user’s life,” 2009, doi: 10.1080/09544820902875033.

[27] “Designing Technology Products for the Elderly.” https://evenset.com/blog/2018/06/26/designing-technology-products-elderly/ (accessed May 05, 2020)

[28] D. Hales, “Design fictions an introduction and provisional taxonomy,” *Digital Creativity*, vol. 24, no. 1, pp. 1–10, Mar. 2013, doi: 10.1080/14626268.2013.769453.

[29] “Design fiction - Wikipedia.” https://en.wikipedia.org/wiki/Design_fiction (accessed Apr. 28, 2020).

[30] “Insights: Scott Smith - Design Friction - Medium.” https://medium.com/design-friction/insights-scott-smith-354d1b6cffd6#.jvxa0vu8c (accessed Apr. 28, 2020).

[31] J. M. Castaño and A. Geenen, “Futuring the smart city Stories from the Dutch Design Week 2019.” Accessed: May 05, 2020. [Online].

[32] “How Now Wow, How Now Wow Matrix - GroupMap.” https://www.groupmap.com/map-templates/how-now-wow-matrix/ (accessed Jul. 05, 2020).

[33] “Maya”- https://www.autodesk.nl/products/maya/overview (accessed Jul. 13, 2020)

[34] “Unity” - https://unity.com/ (accessed Jul. 13, 2020)

[35] “Table d’hôte - Wikipedia.” https://en.wikipedia.org/wiki/Table_d%27h%C3%B4te (accessed Jun. 23, 2020).

[36] D. Lottridge, N. Masson, and W. Mackay, “Sharing empty moments: Design for remote couples,” in *Conference on Human Factors in Computing Systems - Proceedings*, 2009, pp. 2329–2338, doi: 10.1145/1518701.1519058.

Appendices

Appendix A

Informed consent

Onderzoek naar impact van een
Ziekenhuisopname onder ouderen

In dit onderzoek, probeer ik te achterhalen hoe ouderen die door een ziekenhuisopname van elkaar gescheiden zijn, een blijvend gevoel van connectie kan geven. Om dit te kunnen doen is het noodzakelijk om mensen die dit hebben meegemaakt, te vragen naar deze ervaring.

Op ethische gronden is het verplicht om de participant te vragen of het duidelijk is aan welk project wordt deelgenomen. Ook moet het duidelijk zijn dat deze deelname volledig vrijwillig is, en dat er op elk moment, zonder een reden te noemen, terugtrekken van deelname mogelijk is.

Uw deelname zal bestaan uit het maken van een scenario en reactie te geven op een initieel scenario, waarbij dit proces wordt opgenomen.
Dit is zodat dit teruggekeken kan worden voor studiedoeleinden.

Consent:

- Naam participant : _____
- Datum van consent: _____
- Bij deze geef ik consent aan onderzoeker Maxim de Leeuw om mijn data te gebruiken bij het onderzoeksproject (omcirkel uw antwoord):
    - Ja
    - Nee

Appendix B

Scenario 1 - *Hospitalization (written by Maxim de Leeuw)*

Joanne and Frank are an elderly couple, around in their 80s. Frank used to have his own business and Joanne was a stay-at-home mother. 10 years ago, Joanne had an accident that caused her to be in a wheelchair. Joanne was full of life, played a lot of tennis and golf and played bridge with her friends. The accident caused her to give up on all the sports activities. Everyday around 10, the home care people help her out of bed and wash her. Joanne will always go to the kitchen where Frank would be with coffee and breakfast. Frank has also laid out her medicine on the table.

A few months back, Joanne felt terribly ill. It was of such severity that she had to be taken to the hospital. It appeared that Joanne had gotten a bladder infection, which caused her to have a fever. She was also having symptoms of dehydration. Frank, who was caring for her all the time, was suddenly in an empty house by himself and was not sure what he needed to do. Joanne was not allowed to have visitation over all the time, so was feeling lonely as well. Normally she would play bridge, or any other game, on her Ipad but all of a sudden she did not feel like it and a similar tablet that was in her hospital room, seemed hard to use. She did not want to eat a lot.

Joanne and Frank were thinking of each other the whole time, worrying more about their partner than they did about themselves. Frank appeared to feel like he had more freedom than he was used to, and went to friends from the society he is a member of, but felt like there was an empty hole. As he did not have to care for Joanne, he did not (want to) cook and bought store-ready meals.

Appendix C

Scenario 3 - Patient and Spouse write Design Fiction in Dutch (Written by Joanne & Frank)

Jolanda (66 jaar) belandt, na een ernstig auto-ongeluk, in het ziekenhuis.
Naast schade aan organen houdt ze aan het ongeval een thoracaal 4-5, complete, dwarslaesie over. Na ontslag uit het ziekenhuis wordt ze opgenomen in een revalidatiekliniek. Ze hoort daar dat ze gedurende acht maanden moet revalideren voordat ze naar huis mag.

Ze woont met haar partner Bert in een dorp, dat op ongeveer 40 km. van de kliniek ligt.
Als ze daar is opgenomen moet ze de hele dag afspraken afwerken met verschillende disciplines. Dat ervaart ze als een enorme belasting, zowel fysiek als mentaal. Mede door de corona crisis is bezoek van haar man en kinderen beperkt en ze lijdt zwaar onder het feit dat ze haar kinderen en kleinkinderen niet kan knuffelen. Naarmate de tijd verstrijkt wordt ze steeds neerslachtiger. In de krant leest ze met grote belangstelling dat er een studie is gestart om iets aan die eenzaamheid te doen. Er wordt o.a. nagedacht over een mogelijkheid om gezamenlijk maaltijden te gebruiken op een vooraf te plannen tijdstip ,op verschillende plekken. De partner eet thuis en de patiënt in de instelling. Jolanda droomt weg en ziet Bert al etend met haar communiceren via beeld en geluid. Ze hoort in gedachten het tikken van vork en mes en ze hoort Bert vragen hoe het eten haar smaakt. Ze vraagt zich af of je wellicht een “thuisomgeving” kunt creëren. Dat zou haar welzijn een extra boost geven. Wat zou er in de toekomst allemaal mogelijk zijn met geavanceerde technologieën en creatief “ out of the box “ denken? Ze laat zich meeslepen in onbegrensde fantasieën en hoopt vurig dat de studie oplossingen biedt om die vreselijke eenzaamheid wat te verlichten.

Appendix D

More pictures of the 3D model kitchen

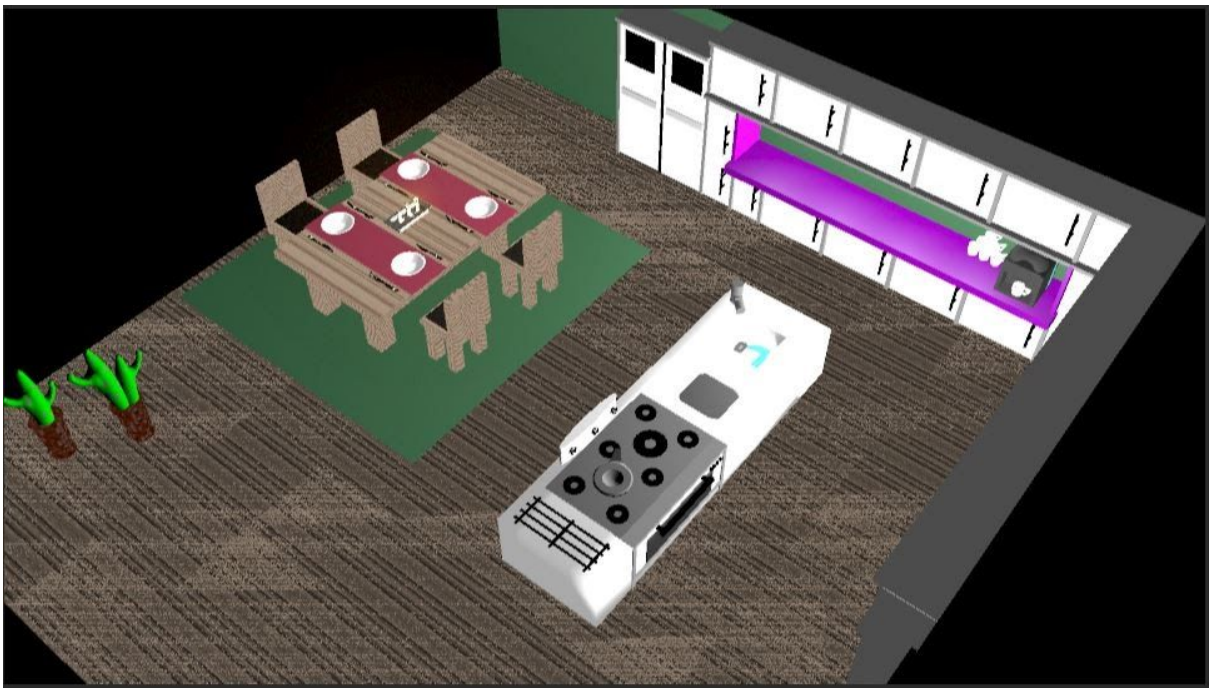

Fig 12: 3D image of rendered kitchen - top view

Fig 13: 3D image of rendered kitchen - lateral view