Designing a playful product for people living with moderate to severe dementia to support emotional well-being

Master Thesis by Maartje de Rond
April 2019
Design
for
Connectedness

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April 2019
Preface

This thesis presents the results of my master graduation project within the Design for Interaction master of the faculty of Industrial Design Engineering at Delft University of Technology.

This project formed a perfect combination of my interests in psychology, healthcare and playful design. Therefore, it was a great pleasure to work on this project and be able to contribute to the quality of life of people living with moderate to severe dementia.

It seems like yesterday that I started with this project, with only some basic knowledge about dementia. I, thankfully, did not have experience with this disease in my personal surroundings. Therefore, I spent many hours inside nursing homes to learn about the disease and empathize with stakeholders. This led to lots of personal stories, funny moments and inspiring insights.

We often only hear stories about the awful symptoms of dementia, and of course, dementia is a horrible disease. But we sometimes forget to see the person instead of the dementia. I experienced how a conversation, a touch or just some attention can brighten up the days of these people. This truly inspired and motivated me within this project.

Finally, I want to take this opportunity to compliment the caregivers of nursing homes for people with dementia, as they do not always get the respect that they deserve. It was truly inspiring to see how they approach the situations they face every day with a positive mindset and strive to make life as pleasant as possible for their clients.

Enjoy reading my report!

Maartje
The analysis on the daily life of people with moderate to severe dementia living in a nursing home, reveals that these people spend a lot of their time in static environments every day. This means that they are surrounded by static objects and non-responsive, apathetic fellow residents. These static environments cause people to become apathetic or restless, which negatively impacts all three types of connectedness and hereby decreases emotional well-being (Alzheimer’s Society, n.d.-a; Anderiesen Le Riche, 2017; T. P. Ettema et al., 2005; Perrin et al., 2008a).

As the moments where people spend time in static environments happen when care givers are busy with their caring duties, I envision to offer something for these moments that can be used by a resident without the help of care givers and can be used individually, without the need for fellow residents. Therefore, the design phase of this project focusses on the individual side of connectedness: personal and physical connectedness. The goal is to design a playful product that enables moments of physical and personal connectedness for people in the mid to late stages of dementia, to support emotional well-being in static nursing home environments.

To guide the design process, an interaction vision was created based on the design goal and an analysis on design principles suitable for people living with moderate to severe dementia. The interaction vision and its qualities are formulated as follows: The interaction should feel like playing with a ladybug: proactive, lively, explorative, enchanting, subtle and open-ended.

In an iterative design process, multiple idea directions were explored, and a concept was developed through the creation and evaluation of several prototypes. This resulted in the final concept: Twinkle.

Twinkle consists of a sphere, with an interactive dynamic light inside of it. This light can move across the surface of the sphere to proactively try to attract the attention of residents and trigger the curiosity in them to initiate interaction. When an interaction is started, the behavior of the light will change depending on the actions of the user. This way, it allows the user to explore the possibilities of the object. This way, Twinkle provides both cognitive and sensory stimulation to enhance personal and physical connectedness and thereby support emotional well-being for people living with moderate to severe dementia to bring back the twinkle in their eyes.
Table of contents

1 Introduction 10
   Active Cues and the Tovertafel 11
   Aim of this project 12
   Project approach 13
   Structure of this report 16

2 Analysis of connectedness in dementia 18
   Connectedness 19
   What is dementia? 27
   Quality of life and well-being in dementia 31
   Life in a nursing home for people with dementia 37
   Disconnectedness in dementia 48
   Conclusion 55

3 Analysis of design principles for dementia 56
   Interaction principles & play experiences of the Tovertafel 57
   Field study with probes 59
   Exploration as a play experience 63
   Conclusion 65

4 Design brief 66
   Design goal 67
   Interaction vision 68

5 Design process 72
   Ideation 73
   Concept development 76
   The final concept: Twinkle 82

6 Discussion 86
   Evaluation of the final concept 87
   Recommendations for further development 94

7 Acknowledgements 96

8 Personal reflection 98

9 References 100

10 Appendices 104
Introduction

About 50 million people around the world are living with dementia. This number will increase with approximately 10 million new cases every year, which means that there is one new case every three seconds. It is expected that the number of people living with dementia will increase to 152 million in 2050 (World Health Organization, 2017a, 2017b).

While the number of people living with dementia keeps increasing rapidly, there currently is no cure for the disease nor a way to alter the progressive course of it (Alzheimer’s Society, 2018; World Health Organization, 2017b). Dementia shortens the lives of those affected, but the greatest impact is on the quality of life of the person living with dementia and the lives of their family members and caregivers (Prince et al., 2015).

Given the fact that dementia is such an impactful disease, we should focus on how to optimize the quality of life of those affected by the disease, besides trying to find a cure (T. P. Ettema et al., 2005).

Because the disease is of a progressive nature, the lives of people in the early stages are affected in a different way than those of people in the later stages (Alzheimer’s Society, 2019). Which is why a more specific focus is needed. This project is initiated by Active Cues, whose main target group is people with moderate to severe dementia living in a nursing home. Therefore, this target group was also chosen as the focus for this project.

1.1 Active Cues and the Tovertafel

This project was initiated by Active Cues; a Dutch company based in Utrecht. Active Cues develops games for specific target groups, like people with dementia and people with learning disabilities. They feel that everybody has the right to play because it can contribute to everyone’s health and quality of life. Active Cues’ mission is to create moments of happiness in residential care and education (Active Cues, n.d.-b).

The games Active Cues develops are especially made for their product called the Tovertafel (magic table) (see Figure 1). This product emerged from the PhD research of Hester Le Riche; one of the founders of Active Cues. The Tovertafel is an interactive projector in a casing that can be mounted on the ceiling above a table. This box projects the games on the table. The projections respond to hand and arm movements, which makes it possible to play with the light itself. In this way, the Tovertafel stimulates physical and cognitive activity and encourages social interaction (Active Cues, n.d.-a; Anderiesen Le Riche, 2017). For each target group, a different set of games is developed. The Tovertafel Original games are especially developed for and with people in the mid to late stages of dementia.

The Tovertafel was designed to stimulate people with moderate to severe dementia to become physically active. Dementia reduces people’s capability to initiate activities, which is why they need external stimulation to remain active (Anderiesen Le Riche, 2017). 90% of people with dementia, living in a nursing home, suffer from apathy (Kolanowski, Litaker, & Buettner, 2005). This means that they are unwilling to take action and show no energy or interest. Apathy is a lack of feeling, emotion, interest or concern (Anderiesen Le Riche, 2017). Because carers do not have enough time to fulfill the task of taking the initiative and activate residents with dementia, the Tovertafel Original was designed to help in this process.

The games of the Tovertafel are based on intuitive interactions. It helps to activate people, preventing apathetic behavior, encourages social interactions and contributes to the quality of life of the person with dementia. It creates treasured moments with family members and carers (Active Cues, n.d.-a).

Figure 1: People with moderate to severe dementia playing with the Tovertafel.
1.2 Aim of this project

The Tovertafel Original has proven to be successful in preventing apathetic behavior, but there are still other areas which can be explored. An important aspect of the Tovertafel is the social interaction which is involved. However, social interaction is part of a broader research topic: connectedness. Therefore, this project is focused on exploring the theme ‘connectedness’ in the context of people in the mid to late stages of dementia living in a nursing home.

Connectedness can be described as: the state of being connected and having a close relationship with other things or people (Cambridge Dictionary, n.d.-a). We all experience feelings of connectedness. We feel connected to our family and friends, to our home, to the world we are living in and to life in general.

People living with dementia are not assured of this feeling anymore. Due to cognitive difficulties, it becomes harder for them to initiate actions, which makes them more dependent on the actions initiated by others and on the things their surroundings have to offer. Therefore, they cannot decide for themselves when and how to increase their feelings of connectedness.

However, it is still important for people living with dementia to feel connected. They may suffer from disabilities caused by the disease, losing their memory and ability to make decisions, but there are also things that are not likely to be affected by dementia. A person with dementia stays capable of feeling negative emotions, like fear and pain, and positive emotions, like interest and happiness (Perrin et al., 2008a; Plaats & Kits, 2016). Therefore, it is important to contribute to feelings of connectedness, to make people experience positive emotions and hereby support emotional well-being.

In this project, the concept of connectedness is explored to understand the concept in the context of people with dementia. The main aim of this project is to understand how we can contribute to a feeling of connectedness for people living with moderate to severe dementia in nursing homes to improve their quality of life. The insights that are gained through this research are translated into a design solution or concept.

1.3 Project approach

In this project, I worked with a user centered design (UCD) approach. This approach was also used in the development of the Tovertafel (Anderiesen Le Riche, 2017). UCD is an iterative design process which is focused on the users and their needs, capabilities and behavior. Users are involved throughout the process, first to get inspired through empathizing with the target group and gaining an explicit understanding of the context, later to evaluate the designs (IDEO.org, 2015; Sanders & Stappers, 2012). This project was divided into an analysis and design phase. Figure 2 shows an overview of the different stages, including their corresponding research questions.

1.3.1 Analysis phase

To understand what disconnectedness in dementia is, two studies were setup to generate knowledge. On the one hand, I created a theory that presents a framework about connectedness, through literature research (Hanington & Martin, 2012). On the other hand, the context of people living with moderate to severe dementia, residing in nursing homes was explored in two ways. First, literature was used to understand what happens when a person develops dementia. After this, I immersed myself in the context through exploratory field research techniques, like interviews and observations, to gain a deep understanding of the user and context (Hanington & Martin, 2012; IDEO.org, 2015). Combining both the knowledge about connectedness and dementia, I formed an understanding of what disconnectedness means in the context of people in the later stages of dementia living in a nursing home.

Dementia affects a person’s cognitive, behavioral and emotional functioning, which influences product experience and interaction (Anderiesen Le Riche, 2017). Therefore, a separate study was performed in the analysis phase of this project to gain knowledge about design principles that can be used in designing for people in the mid to late stages of dementia.

The analysis phase of this project is concluded with a design brief, in which all insights were combined into a coherent design goal and interaction vision (Pasman, Boess, & Desmet, 2011). This design brief forms the basis for the design phase of the project.
1.3.2 Design phase
In the design phase of this project, idea generation was performed, based on the formulated design brief. This resulted in several idea directions. One of these directions was chosen to further develop in the iteration phase. In this phase, design and evaluation stages alternate to develop the concept. A user-centered evaluation process was used, where prototypes were tested with the user group (Andriesen Le Riche, 2017; Hanington & Martin, 2012; IDEO.org, 2015). This resulted in the final concept: Twinkle.
1.4 Structure of this report

The structure of this report is based on the project approach, which is grounded by two analysis studies. The analysis of connectedness in dementia is presented in chapter 2. Chapter 3 presents the analysis of design principles in dementia. These two chapters form the basis for the design brief, which is described in chapter 4. The design process, including the description of the final concept, is described in chapter 5. In chapter 6, the final concept is evaluated, based on the design brief of chapter 4. This chapter also discusses recommendation for the further development of the concept.
2.1 Connectedness

‘Connectedness’ is a term which can be used in diverse contexts and can have different meanings. But what does it mean in this project? This subchapter presents a universal theory about how ‘connectedness’ can contribute to our overall happiness and emotional well-being. This theory can be used in every context, regardless of culture, lifestyle and age.

2.1.1 Process of theory creation

The theory about connectedness was created through several steps and iterations. To guide this process, the following research questions were created:

- How could connectedness be defined?
- What is the spectrum of connectedness? With who/what can a person feel connected?
- How does a feeling of connectedness relate to human needs?

Connectedness can be described as: the state of being connected and having a close relationship with other things or people (Cambridge Dictionary, n.d.-b). With this as a starting point, the top of mind knowledge about connectedness was investigated through the creation of a mindmap, inventorying the concept (Hanington & Martin, 2012; Tassoul, 2009a). This mindmap was focused on to what or whom people can feel connected and in what way. To elaborate more on this top of mind knowledge, this mindmap was discussed with fellow students as well as with two of the coaches of this project to add things which were still missing.

Analysis of connectedness in dementia

This chapter presents the analyses of the need for connectedness in dementia. First, a theory on different types of connectedness is presented. After this, information is given about what dementia is and what life is like for people in the later stages of dementia living in a nursing home. The third part of this chapter is focused on combining the knowledge about connectedness with that on the daily life of someone with dementia living in a nursing home, to find insights on disconnectedness in dementia. The chapter is concluded with an overview of the most important insights and vision on how we could contribute to a feeling of connectedness for people with moderate to severe dementia and what the focus of this project is.

Figure 4: Mindmap about ‘connectedness’
Maslow’s theory on human needs was used, because it describes fundamental human needs that are universal for everyone, regardless of culture, lifestyle and age (Maslow, 1943; McLeod, 2018). It is a psychological theory about human needs, put together in an eight-tier model shaped like a pyramid (See Figure 5) (Maslow, 1943; McLeod, 2018). The pyramid indicates that there is a certain hierarchy in fulfilling our needs, where for example survival takes precedence over others. In this research, the model is used because it shows clear categories. The order of these categories is less important in this project. Also, the order of needs is not rigid. It can be flexible based on personal differences and external circumstances (Maslow, 1943; McLeod, 2018). Attempts were made to combine the aspects of connectedness found in the mindmap, with the different categories of Maslow’s human needs, but these did not convey a coherent theory. The attempts can be found in Appendix B.

Because the previous approach did not lead to a coherent framework, it was chosen to turn the process around and have human needs as a starting point and relate this back to a concept of connectedness. To broaden the scope on human needs and find qualities to form a concept of connectedness, an extra theory on human needs was used; the theory of Desmet and Fokkinga. Their theory on human needs and find qualities to form a concept of connectedness, an extra theory on human needs was used; the theory of Desmet and Fokkinga. Their theory on human needs, but these did not convey a coherent theory. The attempts can be found in Appendix B.

With the elements of human needs of these two theories as a basis, clustering was done according to the way Marc Tassoul described it in Creative Facilitation (Tassoul, 2009b). The aim of this was to form clusters of needs that are closely related. This resulted in three clusters; one related to social interactions, one to the psychological self and one to the physical self (see Figure 7). These three clusters formed to bases for a theory which defines three types of connectedness: social, personal and physical. This final theory is explained in the next paragraph.

Figure 5: Maslow’s hierarchy of human needs

Figure 6: Desmet and Fokkinga’s thirteen fundamental needs

Figure 7: Result of clustering the human need categories of Maslow and Desmet & Fokkinga
2.1.2 Framework about connectedness

Through the analysis of human needs in relation to connectedness, I created a framework that divides the concept ‘connectedness’ into three different types: social, personal and physical connectedness. In the following section, each one of these types will be explained. While in this framework the three types are described separately, it is possible to experience more than one type of connectedness at once, as they are all interconnected.

Social connectedness is directly related to some of our human needs. We feel the need for love and belonging, want to feel related to others and feel the need to get esteem from and be acknowledged by other people (Desmet & Fokkinga, 2018; Maslow, 1943; McLeod, 2018). Figure 10 shows an overview of which fundamental human needs are related to social connectedness, including their underlying sub-needs. Fulfilment of one or multiple of these needs leads to a greater feeling of social connectedness. For example, when you become member of a sports association and are accepted by this group, your needs for belonging are a bit more fulfilled and therefore you will experience more social connectedness.

When talking about our social life, we tend to think about the interactions we have with close friends and family, but social connectedness is much broader than that. Not only your strong relationships, but also relationships involving less frequent contact, low emotional intensity, and limited intimacy belong to social connectedness. For example, a passer-by on the street. You will feel more socially connected when a passer-by makes eye contact with you instead of neglecting you by looking past you (Sandstrom & Dunn, 2014b). These type of interactions with weak relationships become especially more important and of greater impact when we have had less interaction with our strong relationships for some time (Sandstrom & Dunn, 2014a, 2014b).
Personal connectedness is based on our basic needs for self-esteem, self-actualization, cognition, aesthetics, transcendence, purpose, competence, impact, morality, autonomy and ease (see Figure 12) (Desmet & Fokkinga, 2018; Maslow, 1943; McLeod, 2018).

All the needs related to personal connectedness are related to who we are and what we believe we should do, be or become. Based on this we can say that fulfilling one or more of these needs results in a greater overall feeling of personal connectedness. For example, when someone can act upon his personal beliefs and values and is able to see them reflected in the world, we could say that the need for morality of this person is fulfilled (Desmet & Fokkinga, 2018) and therefore this person feels more connected to his personal self.

Another example is about searching for meaning in life. We want to have a purpose and be valuable to our sense of what makes life meaningful (Desmet & Fokkinga, 2018; McLeod, 2018). We set goals for ourselves about who we are or want to be to make life meaningful (Desmet & Fokkinga, 2018). When someone is able to live in such a way that one can get closer or even reach these goals, it touches upon almost all the needs related to personal connectedness. It is about being able to direct your own life, act autonomously, grow and achieve something as a person.

Our senses (vision, hearing, smell, taste and touch) play a central role in experiencing physical connectedness. Our sensors receive input throughout each day, but sometimes, this sensory input is intensified for a moment, which makes us experience a peak of sensory stimulation. This can for example happen when cycling through the rain. You can feel the water and wind touching your skin and can hear the rain falling on the sidewalks and the wind blowing. It is a more intense sensory experience than sitting at a desk inside an office. One could therefore say that cycling through the rain results in a peak experience of sensory stimulation. Therefore, the need for bodily sensation and stimulation is fulfilled. This leads to a greater feeling of physical connectedness and makes us feel alive.

An increase in physical connectedness can also be experienced when the sun suddenly appears in between the clouds and it shines upon your face. You can feel the warmth of the sunlight and your eyes need to adapt to the sudden increase brightness of the light. This causes a peak of sensory input and therefore makes you feel your body in the present moment, which increases a feeling of physical connectedness.

Not only things that you can feel from outside in are able to increase our sense of physical connectedness, but also things we can feel happening inside our bodies contribute to this. For example, when doing a cardio training. You can feel your heartbeat raising, your body temperature rising and your blood streaming to every part of your body. This all raises your awareness of your physical body and therefore increases a sense of feeling alive in the present moment and feeling physical connected.

Figure 11: Personal connectedness

Personal connectedness is about everything that has to do with who you are as a person. It is about feeling connected to your psychological self, your background and your beliefs. Every person has his own personal story about how he became who he is today and everything we experience builds up to that story. It is about our life history and memories that create our identity in the present and a sense of who we want to become.

Our senses (vision, hearing, smell, taste and touch) play a central role in experiencing physical connectedness. Our sensors receive input throughout each day, but sometimes, this sensory input is intensified for a moment, which makes us experience a peak of sensory stimulation. This can for example happen when cycling through the rain. You can feel the water and wind touching your skin and can hear the rain falling on the sidewalks and the wind blowing. It is a more intense sensory experience than sitting at a desk inside an office. One could therefore say that cycling through the rain results in a peak experience of sensory stimulation. Therefore, the need for bodily sensation and stimulation is fulfilled. This leads to a greater feeling of physical connectedness and makes us feel alive.

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Figure 13: Physical connectedness

Figure 14: Human needs related to physical connectedness
2.2 What is dementia?

Before explaining the concept of ‘connectedness’ in the context of dementia, a better understanding of this condition and the effects on daily life need to be understood. This subchapter presents a brief explanation of what dementia is.

Dementia is a collective term for a syndrome covering different types of diseases with similar symptoms caused by damage of the brain (Perrin, May, & Anderson, 2008b). When someone develops dementia there is deterioration in memory, thinking, behaviour and the ability to perform everyday activities. It has a progressive nature and currently there is no cure for it (World Health Organization, 2017b). The older someone gets, the more likely it is that they will develop a form of dementia. Although age is the biggest risk factor, dementia is not a normal part of aging (Alzheimer’s Research UK, 2018; World Health Organization, 2017a).

2.2.1 What happens in the brain?

To be able to understand the changes in health and behaviour that are caused by dementia, it is important to have a basic understanding of the functioning of our brain. In the following paragraphs, the structure and functions of the brain is explained, where after is described what happens when parts of the brain are damaged by dementia.

Structure and functions of the brain

Our brain is one of the most complex parts of our body. It can be divided into different structures with their own specialized functions (see Figure 15). In a healthy brain, all these different structures cooperate within the brain to regulate the body and behaviour of the person (Perrin et al., 2008b).

Summary of main insights on connectedness

‘Connectedness’ is a term which can be used in diverse contexts and can have different meanings. To communicate the interpretation and meaning of connectedness in this project, a theory about how connectedness can contribute to our overall happiness and emotional well-being is created. This theory presents a framework that identifies three types of connectedness based on clusters of human needs: social, personal and physical connectedness.

- **Social connectedness** is about our interpersonal contacts and relationships, through which we feel connected to others. It relates to our needs for love and belonging, feeling related to, getting esteem from and being acknowledged by others.

- **Personal connectedness** is about feeling connected to your psychological self. It is about who you are as a person, about your beliefs and background. It is based on our basic needs for self-esteem, self-actualization, cognition, aesthetics, transcendence, purpose, competence, impact, morality, autonomy and ease.

- **Physical connectedness** is about feeling alive in the present moment. The human needs related to physical connectedness are all focused on bodily experiences: the need for physiological safety and survival, health, fitness, order and sensory stimulation. Therefore, physical connectedness focuses on what we experience through our senses and feel happening in our body that makes us feel alive.

Fulfilling one or more of the human needs related to a type of connectedness, leads to an increased feeling of being socially, personally or physically connected. It is possible to experience more than one type of connectedness at once, as they are all interconnected.

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**Figure 15: Parts of the brain and their functions**

Alzheimer’s Society, 2014; Perrin et al., 2008b
An important part to understand is the cerebral cortex, as it is responsible for supporting the more complex cognitive abilities such as consciousness, memory, reasoning, language and social skills and is particularly likely to be damaged by dementia (Perrin et al., 2008b). The parts that lie beneath the cerebral cortex are less likely to be badly affected by causes of dementia, especially in the mild to moderate phases of the disease (Perrin et al., 2008b).

The cerebral cortex is divided into two hemispheres. The left hemisphere is important for language functions and the right one for spatial understanding and emotional processing (Perrin et al., 2008b). Each hemisphere can again be divided into four separate lobes, with each lobe having its own specific abilities (see Figure 16) (Alzheimer’s Society, 2014; Perrin et al., 2008b).

![Diagram of the cerebral hemispheres and their functions](image)

**Figure 16 Lobes of the cerebral hemispheres and their functions**

(Alzheimer’s Society, 2014; Perrin et al., 2008b)

### 2.2.2 What are the effects when parts of the brain get damaged by dementia?

When sections of the brain get damaged by a form of dementia (e.g. Alzheimer’s disease), they will not be able to fully interact with each other and cognitive symptoms of dementia will become noticeable (Alzheimer’s Society, 2017a). The specific symptoms that someone will experience depend on the exact parts of the brain that are damaged. This can be different per person, disease and stage of the disease (Alzheimer’s Society, 2017). According to Perrin et al. (Perrin et al., 2008b), people suffering from dementia often experience some or all of the following symptoms:

- Memory loss
- Language difficulties
- Difficulties with spatial awareness and skilled movement
- A loss of knowledge and understanding of the world
- Problems with reasoning, planning and judgement
- Changes in personality, behavior and emotional control

In appendix C, each symptom is explained in more detail.

### 2.2.3 The course of the disease

Dementia is a progressive disease, which means that symptoms will increase and become worse over time (World Health Organization, 2017b). In the early stages of dementia, symptoms depend on the type of disease and which parts of the brain are typically affected by this disease. As the dementia develops further, damages spread to more areas of the brain and symptoms across different types of dementia tend to become more similar (Alzheimer’s Society, 2014).

The progress of dementia can be divided into three stages (World Health Organization, 2017b). The World Health Organization created the following overview of signs and signals per stage.

**“Early stage:”**
- forgetfulness
- losing track of the time
- becoming lost in familiar places.

**Middle stage:**
- becoming forgetful of recent events and people’s names
- becoming lost at home
- having increasing difficulty with communication
- needing help with personal care
- experiencing behavior changes, including wandering and repeated questioning.

**Late stage:**
- becoming unaware of the time and place
- having difficulty recognizing relatives and friends
- having an increasing need for assisted self-care
- having difficulty walking
- experiencing behavior changes that may escalate and include aggression.”

(World Health Organization, 2017b)
2.2.4 What stays intact?

Besides only focusing on the disabilities caused by dementia, it is important to pay attention to what people with dementia are still capable of. They may lose their memory, but there are still things that stay intact.

The areas of the cortex that support the abilities of conscious awareness and feeling emotion are usually not damaged by dementia (Perrin et al., 2008b). Therefore, a person with dementia is still capable of feeling negative emotions, like fear and pain, and positive emotions, like interest and happiness (Perrin et al., 2008b; Plaats & Kits, 2016). Also, the capacity for sensation and action is not lost. It is just the understanding part in between that is damaged (Perrin et al., 2008b).

It is important to note that, people with dementia are still conscious human beings with a soul, needs, beliefs and feelings. They are still capable of knowing if they are treated as a ‘PERSON with dementia’ or a ‘person with DEMENTIA’ (Perrin et al., 2008b). Therefore, they deserve to be treated with care and dignity.

2.3 Quality of life and well-being in the later stages of dementia

The aim of this project is to improve the quality of life (QoL) of people with moderate to severe dementia, through creating a feeling of connectedness. To be able to achieve this, some knowledge about QoL and well-being in dementia is needed. In this chapter, the concepts of quality of life and well-being are explained in general and in the context of late stage dementia.

2.3.1 Definition of Quality of Life and well-being

While analyzing literature on this topic, it was noticed that the distinction between the terms well-being and QoL is not always clear. Research shows that there is a lot of subjectivity in the use and definition of the terms (Pinto et al., 2017). Also, the meanings of the terms are very similar, as they are both related to health and satisfaction in life.

“Well-being: the state of feeling healthy and happy” (Cambridge Dictionary, n.d.-f)

“Quality of life: the level of satisfaction and comfort that a person or group enjoys” (Cambridge Dictionary, n.d.-e)

To make sure the terms are interpreted in the right way, I want to clarify how the terms are used in this project. The explanation of the terms is based on the research of Pinto et al. (Pinto et al., 2017), who reviewed a total of 18 studies in order to identify the differences between the terms (Pinto et al., 2017). The concept of QoL is seen as a broad multidimensional concept closely related to the overall definition and dimensions of health. Well-being can be divided into physical and emotional well-being. Physical well-being is about being safe and healthy and emotional well-being is the dimension of health, related to mental health. Thus, physical and emotional well-being are concepts that contribute to the overall concept of QoL.

There are two types of QoL: subjective and objective. In assessing our subjective QoL, our own opinion about our lives and life conditions are important, while in objective QoL general objective criteria are used (T. Ettema et al., 2005; Gerritsen et al., 2010).

Summary of main insights on the effects of dementia

Dementia is a collective term for a syndrome covering different types of diseases with similar symptoms caused by damage of the brain (Perrin, May, & Anderson, 2008b). It has a progressive nature, which means that symptoms will increase and become worse over time. In the later stages of dementia, damages have spread across the areas of the brain, which means that symptoms across different types of dementia tend to become more similar in the later stages.

As people living with dementia suffer from multiple disabilities caused by dementia, it is also important to focus on what stays intact. People living with dementia stay capable of feeling negative and positive emotions, as well as feeling sensation and action. They are still capable of knowing if they are treated as a ‘PERSON with dementia’ or a ‘person with DEMENTIA’. Therefore, they should be treated with care and dignity.
2.3.2 Quality of Life in dementia

When assessing the QoL of people affected by dementia, the question arises to what extend they are capable of subjectively assessing their own QoL, as their cognitive abilities are increasingly limited (as explained in chapter 2.2). Literature emphasizes that only people with minimal levels of impairment are still able to do so (T. Ettema et al., 2005; T. P. Ettema et al., 2005; Perrin, 1997). This means that when assessing the QoL of people in the later stages of dementia, we are dependent on objective tools, which include observation and documentation of behavior (T. Ettema et al., 2005; Perrin, 1997).

The concept of QoL in dementia consists of a multidimensional model. In literature, models differ but mostly include the same type of domains. The relevancy of these domains can differ per stage of the disease (T. P. Ettema et al., 2005), therefore we need to identify which domains are relevant in the later stages.

I compared the theories on QoL of the World Health Organization, Gerritsen et al., Droës and Ettema et al. and chose to focus on the adaptation-coping model of Droës and the QUALIDEM model of Ettema et al., because they define the QoL domains for people with dementia as an adaptive process, which differs per stage of dementia (Dichter et al., 2016; T. Ettema et al., 2005; Gerritsen et al., 2010; World Health Organization, n.d.).

The adaptation-coping model of Droës consists of the following adaptive tasks: “developing an adequate care relationship with the staff, preserving an emotional balance, preserving a positive self-image, preparing for an uncertain future, developing and maintaining social relationships and dealing with the nursing home environment.” (T. P. Ettema et al., 2005) The QUALIDEM model of Ettema et al. is based on Droës’ model of adaptive tasks for coping with dementia and provides a clear overview of what still can be assessed for people with severe dementia to measure their QoL (see Figure 17) (Dichter et al., 2016; T. P. Ettema et al., 2005).

The information provided by these two models indicates what elements contribute to the QoL for people in the mid to late stages of dementia. These elements are described in the next paragraphs.

<table>
<thead>
<tr>
<th>Mild to severe dementia</th>
<th>Severe dementia</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Positive affect</strong></td>
<td><strong>Positive affect</strong></td>
</tr>
<tr>
<td>Is cheerful</td>
<td>Radiates satisfaction</td>
</tr>
<tr>
<td>Is capable of enjoying things in daily life</td>
<td>Is capable of enjoying things in daily life</td>
</tr>
<tr>
<td>Is in a good mood</td>
<td>Has a smile around the mouth</td>
</tr>
<tr>
<td>Has a smile around the mouth</td>
<td>Mood can be influenced in positive sense</td>
</tr>
<tr>
<td>Mood can be influenced in positive sense</td>
<td></td>
</tr>
<tr>
<td><strong>Negative affect</strong></td>
<td><strong>Negative affect</strong></td>
</tr>
<tr>
<td>Makes an anxious impression</td>
<td>Makes an anxious impression</td>
</tr>
<tr>
<td>Is sad</td>
<td>Cries</td>
</tr>
<tr>
<td>Cries</td>
<td></td>
</tr>
<tr>
<td><strong>Restless tense behavior</strong></td>
<td><strong>Restless tense behavior</strong></td>
</tr>
<tr>
<td>Makes restless movements</td>
<td>Makes restless movements</td>
</tr>
<tr>
<td>Is restless</td>
<td>Is restless</td>
</tr>
<tr>
<td>Has tense body language</td>
<td>Has tense body language</td>
</tr>
<tr>
<td><strong>Social relations</strong></td>
<td><strong>Social relations</strong></td>
</tr>
<tr>
<td>Has contact with other residents responds positively when approached</td>
<td>Has contact with other residents responds positively when approached</td>
</tr>
<tr>
<td>Takes care of other residents</td>
<td>Cuts himself/herself off from the environment</td>
</tr>
<tr>
<td>Cuts himself/herself off from the environment</td>
<td></td>
</tr>
<tr>
<td>Is on friendly terms with one or more residents</td>
<td>Feels at ease in the company of others</td>
</tr>
<tr>
<td>Feels at ease in the company of others</td>
<td></td>
</tr>
<tr>
<td><strong>Social isolation</strong></td>
<td><strong>Social isolation</strong></td>
</tr>
<tr>
<td>Is rejected by other residents</td>
<td>Is rejected by other residents</td>
</tr>
<tr>
<td>Opens rejects contact with others</td>
<td>Opens rejects contact with others</td>
</tr>
<tr>
<td>Calls out</td>
<td>Calls out</td>
</tr>
<tr>
<td><strong>Care relationship</strong></td>
<td><strong>Care relationship</strong></td>
</tr>
<tr>
<td>Rejects help from nursing assistants</td>
<td>Is angry</td>
</tr>
<tr>
<td>Is angry</td>
<td>Has conflicts with nursing assistants</td>
</tr>
<tr>
<td>Has conflicts with nursing assistants</td>
<td>Accuses others</td>
</tr>
<tr>
<td>Accuses others</td>
<td>Appreciates help that he or she receives</td>
</tr>
<tr>
<td>Appreciates help that he or she receives</td>
<td>Accepts help</td>
</tr>
<tr>
<td>Accepts help</td>
<td>Criticizes the daily routine</td>
</tr>
<tr>
<td>Criticizes the daily routine</td>
<td></td>
</tr>
<tr>
<td><strong>Having something to do</strong></td>
<td><strong>Having something to do</strong></td>
</tr>
<tr>
<td>Finds things to do without help from others</td>
<td>Finds things to do without help from others</td>
</tr>
<tr>
<td>Enjoys helping with chores on the ward</td>
<td>Enjoys helping with chores on the ward</td>
</tr>
<tr>
<td><strong>Positive self-image</strong></td>
<td><strong>Positive self-image</strong></td>
</tr>
<tr>
<td>Indicates he or she would like more help</td>
<td>Indicates not being able to do anything</td>
</tr>
<tr>
<td>Indicates not being able to do anything</td>
<td>Indicates feeling worthless</td>
</tr>
<tr>
<td><strong>Feeling at home</strong></td>
<td><strong>Feeling at home</strong></td>
</tr>
<tr>
<td>Indicates that he or she is bored</td>
<td>Indicates feeling locked up</td>
</tr>
<tr>
<td>Indicates feeling locked up</td>
<td>Feels at home on the ward</td>
</tr>
<tr>
<td>Feels at home on the ward</td>
<td>Wants to get off the ward</td>
</tr>
</tbody>
</table>

Figure 17: Domains with subdomains of the QUALIDEM model (Dichter et al., 2016)
The nursing home environment
When a person living with dementia moves to a care home, it is important for them to be able to deal with the nursing home environment, as this contributes to the QoL of this person (Dichter et al., 2016; T. Ettema et al., 2005; T. P. Ettema et al., 2005). Dealing with the nursing home environment includes being able to feel at home and having something to do. Unfortunately, these two elements cannot be assessed for people with severe dementia (Dichter et al., 2016; T. Ettema et al., 2005). As seen in Figure 17, to make the residents of a nursing home feel at home, it is important that they do not feel locked up or bored.

2.3.3 Focus on emotional well-being
This project is about enhancing feelings of connectedness in people living with moderate to severe dementia to improve their QoL. As the word ‘feelings’ already indicates that it is about what a person experiences emotionally, the focus of this project within the topic QoL is on the psychological part of it, which is called emotional well-being.

In this chapter it is confirmed that preserving an emotional balance is important for people living with dementia, even in the latest stages of dementia (Dichter et al., 2016; T. Ettema et al., 2005). Therefore, it is important to analyze what contributes to a person’s positive and negative affect. This way, elements that causes negative affect can be eliminated and the elements contributing to positive affect can be enhanced. Therefore, in the further course of this report, I will focus on how feelings of connectedness can support emotional well-being.
2.4 Life in a nursing home for people with dementia

This chapter will explain more about the exact context of this project, namely people with moderate to severe dementia living in a nursing home. First, the research methods are explained, where after an explanation of the nursing home environment is given. The chapter ends with an insight in the daily life of a person in the mid to late stages of dementia.

Due to the progressive nature of dementia, symptoms will worsen to the point that someone is not able to take care of himself anymore and full-time care is needed (Alzheimer’s Association, n.d.-b; Alzheimer’s Research UK, n.d.; Alzheimer’s Society, 2017b). This can lead to the institutionalization of the person with dementia, which mostly occurs in the later stages of the disease (Alzheimer’s Association, n.d.-a; Alzheimer’s Society, 2017b).

In the Netherlands, 82,000 people over 65 years old had an indication for inpatient psychogeriatric care in 2013 (Volksgezondheidenzorg.info, 2019). This is about 32% of people diagnosed with dementia. In the UK, 311,730 people with dementia (39%) are living in a care home (Alzheimer’s Research UK, n.d.). Moving to a nursing home has a big impact on the life of the person with dementia, as well as on their relatives and informal caregivers (Alzheimer’s Association, n.d.-b; Alzheimer’s Society, 2017b; Omroep Human, 2018). Therefore, people with dementia tend to stay at home as long as possible to retain as much of their independence as possible (Alzheimer’s Research UK, n.d.; Omroep Human, 2018).

2.4.1 Setup of the context study

To gain knowledge about the life in a nursing home, both desk and field research was performed. The research questions for guiding this process were as follows:

- What do nursing homes for people with dementia look like?
  - What is the thought behind this?

- What does daily life in a nursing home look like?
  - What is the general daily routine?
  - What effect does this routine have on the residents?

Desk research

The performed desk research includes literature, as well as documentaries and inspiring stories. The main goal of this exploratory desk research was preparing for the field research. Important elements to pay attention to were identified to guide the field research.

Summary of main insights on QoL and well-being in the later stages of dementia

The following elements that contribute to the QoL of people living with moderate to severe dementia are identified:

- Preserving an emotional balance
- Preserving an adequate care relationship with the nursing home staff
- Developing and maintaining social relationships
- Preserving a positive self-image (cannot be assessed for severe dementia)
- Dealing with the nursing home environment (cannot be assessed for severe dementia)

The aim of this project is to improve the quality of life (QoL) of people with moderate to severe dementia, through creating a feeling of connectedness. This means that this project is focused on the psychological aspect of QoL, which is called emotional well-being.

Therefore, the goal of this project is further specified: enhancing feelings of connectedness of people living with moderate to severe dementia, to support emotional well-being.
The work of Anderiesen Le Riche, Campo and Chaudhury and True doors were used to gain an understanding on the influences of the physical and social environment on the behavior, feelings and activities of daily life (Anderiesen Le Riche, 2017; Campo & Chaudhury, 2012; True doors, 2017). This includes interior design, as well as social interactions between residents and between residents and care givers. The documentary series ‘in de Leeuwenhoek’ and the book ‘De dag door de deur met demen tie’ by Plaats and Kits were used to empathize with the user group and gain contextual knowledge to be able to form an understanding of what daily life in and the physical environment of a nursing home looks like.

A total of four nursing homes and one geriatrics department of a hospital were visited. All located in the Netherlands: in Heythuysen, Breda, Delft and Amersfoort. Three conferences were attended, which were used to empathize with the broader context of dementia. These conferences especially helped to feel the impact of dementia on someone’s relatives. It taught me about the emotional aspects as well as worries and capabilities of care givers and relatives. Appendix D provides an overview of all field research moments.

To quickly gain hands on experience with the user group and observe the general context of a nursing home, two short exploratory visits to nursing homes were done in the beginning of the project. These visits were focused on the Tovertafel, as I joined a Tovertafel demo and a game evaluation. During these visits, I was able to observe the physical environment of these nursing homes and the social environment when interacting with Tovertafel. This immersion in the context helped me to empathize with the user group and understand better what living with dementia is like.

For the more thorough context research, a total of three nursing homes were repeatedly visited during different times of the day, altogether covering a hole day from morning till evening. The nursing homes included in this research are: Thebe Lucia in Breda, Nijestede in Amerfoort and Die Buitenweye in Delft. Insights were gathered through exploratory research methods, including semi-structured fly-on-the-wall and participant observation as well as unstructured interviews (Hanington & Martin, 2012; IDEO.org, 2015). The research was purposefully setup to be flexible to enable collection of information from spontaneous interactions and observations.

During the field studies, I started out with fly-on-the-wall observation (Hanington & Martin, 2012; IDEO.org, 2015). During these observations, residents and care givers in the nursing homes were observed without interfering in their daily routines. The aim of these observations was to gather insights with a minimal potential bias caused by interaction with the stakeholders. It was noticed that only fly-on-the-wall observations did only provide superficial insights. Therefore, this observation method was alternately used with participant observation. In participant observations, a design researcher actively participates in a community (Hanington & Martin, 2012; McLoad, 2015). This type of observation was used to gain deeper connections and empathy with the people with dementia and get a deeper understanding of things that are important to them in daily life.

To support the observations, short unstructured interviews with care givers were conducted in the nursing homes. Questions were asked to clarify and interpret certain behaviors and/or activities of the residents. As these unstructured interviews were often very short and conducted in the hallways in between the caring duties of the care givers, these interviews were not recorded and therefore could not be transcribed. Just like with the observations, written notes were made.

The results from the field research is gathered in appendix F. In the following chapters, the insights of both the desk and field research are combined, resulting in a description of the nursing home environment and the daily life of residents.

2.4.2 The nursing home environment

A nursing home for people with dementia provides round-the-clock specialized care for people living with dementia. Professional care givers are always around to help people with their personal care, like washing, dressing and eating, as well as supporting them in their daily activities and guiding them through the day.

In the Netherlands, each resident has his own bedroom, which they can decorate with their personal belongings, like pictures of relatives and furniture from their previous home. The bedrooms open onto a main hallway, to which the living/dining room(s) are also connected. Mostly, people get assigned to a specific living room, with a total of about 5 to 8 residents. In the shared areas, nursing homes pay attention to creating a home-like atmosphere, instead of a very clinical one. Therefore, these areas are filled with furniture and objects with aesthetics dating from the residents’ youth (see Figure 18-21). This fits the perception of the residents, as their world perception is focused on the past, and will make them feel at home (Plaats & Kits, 2016; True doors, 2017). Some of the staff members, like the occupational therapists, wear normal clothes, instead of uniforms, to enhance the home-like atmosphere.
Overall, residents spend most of their time during the day in the living room. This is where they eat altogether and where daily activities take place, such as watching television, singing, playing games or reading the newspaper. Because people spend most time in the living room, this setting became the focus of this project.

![Figure 18: Open kitchen in the living room](image1)
![Figure 19: Sitting area of the living room](image2)
![Figure 20: Dining area of the living room](image3)
![Figure 21: Hallway decorated with objects that fit the resident's world perspective](image4)

**2.4.3 Daily life of a resident**

As a result of the observations and interviews of the field research, a journey was created which gives insight in the daily life in a nursing home (see Figure 22). This journey is an example of what a day could look like. Some activities, like breakfast, lunch and dinner happen every day at approximately the same time. Others differ per day. Some days there are extra activities for residents like appointments with medical specialists or family visits. This journey does not include these extra activities, as they do not happen on a regular basis and differ per resident.

Besides this general overview of activities (see Figure 22), a more detailed journey was created (see pages 44-46). This detailed journey provides a general explanation of daily activities, as well as an example of a day in the life of two fictional residents. Following the analyses technique 'personas', as described by Hanington & Martin, the profiles of these fictional residents were put together from information collected from real residents of the different nursing homes (Hanington & Martin, 2012). A selection of residents in comparable situations and with comparable behaviors was used to create them.

![Figure 22: Overview of activities that take place on a daily basis](image)
Truus (see Figure 23) is an optimistic 85-year-old lady, who is living with mid to late staged dementia. She is still able to walk independently and has a curious character. Truus is a social person who enjoys chatting with her fellow residents and the care givers. She is still well capable of having and understanding conversations. Because of her apathy level, it is hard for her to initiate activities by herself. Truus needs quite a bit of stimulation. When this is not provided, this can result in either apathetic or restless behavior, depending on the time of the day and environmental factors like her social surroundings. She doesn’t like to be left alone in a room. When this happens, she feels lost and often starts wandering around, looking for social acknowledgement and stimuli.

Kees (see Figure 24) is a 90-year-old man, who is living with late staged dementia. Because of his physical condition, he is wheelchair dependent. Kees sleeps a lot and suffers from apathy. This causes him to rarely initiate contact with his surroundings. He doesn’t show curiosity. Kees does react to contact initiated by others, but his responses are slow. Because of his aphasia, Kees is not able to make sentences anymore and hardly understands conversations. Kees needs stimulation, but easily feels overwhelmed. When Kees is overstimulated he can become agitated, but most of the times he becomes apathetic or goes to sleep. He likes to explore technical objects and puzzles. He is passionate about nature and enjoys going outside. Dutch music is something Kees enjoys less, as well as playing bingo.

The entire journey, including those of Truus and Kees can be found on the next three pages.
Daily life in a nursing home for people living with dementia

People often have their personal spot in the living room. Care givers are busy bringing people to bed or getting them out of bed again and have to time to provide stimulation. Sometimes a radio provides some (very quiet) background music.

### General explanation of daily activities

#### Morning 8:00 - 10:00

- **Breakfast**
- **Personal Care**

#### Morning 10:00 - 12:00

- **Coffee/Tea**
- **Activation**

#### Afternoon 12:00 - 14:00

- **Coffee/Tea**
- **Rest**
- **Coffee/Tea**

#### Afternoon 14:00 - 17:00

- **Coffee/Tea**
- **Activation**

### Important remarks

People often have their personal spot in the living room. Care givers are busy bringing people to bed or getting them out of bed again and have to time to provide stimulation. Sometimes a radio provides some (very quiet) background music.

### Personal Care

- **Getting dressed**
- **Breakfast**

### Activation

- **Without distractions, Truus is still able to eat without a lot of help. This gives her a feeling of independence.**
- **She cannot decide to leave the breakfast table and go somewhere else, because he is in a wheelchair and not able to move it by himself.**
- **His hand is shaking and it seems to enjoy the interaction and attention.**
- **Easy activity, it is a state of being autonomous.**

### Activation

- **Care givers need to wake up Kees, otherwise he would stay in a deep sleep and as a result become more restless at night.**
- **Care givers are more awake and active when there is an activity going on. The active, positive atmosphere seems to stimulate him in a positive way.**

### Coffee/Tea

- **Without distractions, Truus is still able to eat without a lot of help. This gives her a feeling of independence.**
- **She cannot decide to leave the breakfast table and go somewhere else, because he is in a wheelchair and not able to move it by himself.**
- **Care givers need to wake up Kees, otherwise he would stay in a deep sleep and as a result become more restless at night.**
- **The activating atmosphere of an activity initiated by the care givers, has no long term effect on Kees. Already during or right after the activity, Kees becomes quiet, inattentive and apathetic. The state environment doesn’t trigger or stimulate him.**

### Key Facts

- **Truus is well capable of making her own breakfast and grooming the things on the table that she needs for this. She is proactive in the activity of making and eating breakfast.**
- **Truus sits at the table and fidgets with her watch and purse. She goes through her purse and looks at the things that are inside it. She does this over and over again. You can see that she really enjoys the attention in the coffee break. She looks up and is fully engaged in the coziness of the coffee moment. This also happens when playing with the Tourettes. Truus really enjoys the social part of it.**
- **Care givers are busy with their household tasks. They try to entertain the residents when they can, but they have a lot of tasks to fulfill. When there is no initiative from the care givers, the ambient becomes quiet and flattened out.**
- **After breakfast, Truus sits in his wheelchair at the table. His hands folded up on his lap, head hanging down. He seems to be awake. When it is time for coffee a care giver touches his arm and asks what he wants to drink. Truus and sound of the care giver wakes him up. He enjoys the social activity. During the Tourettes activity he becomes more physically active for about 25 minutes. After this he goes back into his apathetic, seemingly asleep state.**
- **Kees is wake up at 8:30. He needs a lot of help with dressing and personal care. He is put in his wheelchair and brought to the living room. He is not capable of making his own breakfast, but with some guidance he is still capable of bringing the food to his mouth. When he is done eating he seems to fall asleep.**
- **Kees is still able to eat without a lot of help. This gives him a feeling of independence.**
- **When his surroundings take the initiative, Kees is still able to react and seems to enjoy the interaction and attention.**
- **Easy activity, it is a state of being autonomous.**
- **Care givers make sure that all residents are in the right position for lunch. Some residents are able to make their own sandwiches, others need help or need to be fed. When people are done eating, they mostly just sit and gaze around.**
- **Gazes around and waits. She seems to understand where the game has ended and the care givers got busy with other tasks, Truus is still engaged.**
- **The atmosphere becomes quiet. For the people that do not rest, the atmosphere is turned on to provide some entertainment.**
- **The date and time on the clock provide a bit of stimuli. When she reads it out loud, she seems to understand what everybody went.**
- **Care givers make sure that all residents are in the right position for lunch. Some residents are able to make their own sandwiches, others need help or need to be fed. When people are done eating, they mostly just sit and gaze around.**
- **When care givers start to put more and more people to bed, Truus starts to feel restless. She doesn’t know what to do with herself when she is left alone.**
- **Truus is often engaged in the cozyness of the coffee moment, which includes getting out of bed, providing personal care and dressing. After this they are moved from their own room to the shared living room, where they have breakfast with the other residents. The table is set in a breakfast setting. Care givers provide the help that a person needs. Some need to help, some only need help with making their sandwich, others need to be fed.**
- **The activating atmosphere of an activity initiated by the care givers, has no long term effect on Kees. Already during or right after the activity, Kees becomes quiet, inattentive and apathetic. The state environment doesn’t trigger or stimulate him.**
- **Kees wakes up at 9:00. He enjoys the social activity. During dinner, Truus is focused on her food and the task of eating. She quietly makes and eats her sandwiches. When she is done she gazes around and waits for the other residents to finish. She does not need a rest after the lunch. She does not go to her room, but stays in the living room.**
- **Kees is not able to feed himself anymore during dinner, but it is still visible that he is still able to feed himself.**
- **The atmosphere an apathetic. The activating atmosphere of an activity initiated by the care givers, has no long term effect on Kees. Already during or right after the activity, Kees becomes quiet, inattentive and apathetic. The state environment doesn’t trigger or stimulate him.**
General planning of the day

Daily life in a nursing home for people living with dementia

Important remarks

- social towards others
- able to walk

This gives him a break to make and eat breakfast. He is not capable of making his own breakfast. He cannot decide to leave the living room. He is physically active the care giver wakes him up when almost all other residents to finish. She sometimes initiate a cognitive game, like ‘Vragenderwijs’, which is an activating memory game (activities vary each afternoon), like gym, listening to music or a walk outside. If not, care givers provide some stimulation for the residents.

During dinner, Truus is fully focused on her dinner. She appreciates the fact that the care givers cook and serve her food and thanks them for it. She seems to enjoy the taste of the food. When she is done eating, she just sits and gazes around, but doesn’t start a new activity. She fidgets a bit with the blouse. When the care givers last to her she responds immediately, but doesn’t continue with a conversation. When the TV is turned on, Truus sometimes gazes at it, but does not actively watch the program. When care givers start to put more and more people to bed, Truus starts to feel restless. She is sometimes left alone in the living room, which causes her to start wandering in a search for stimuli and people. He about 21:30, Truus wants to go to bed and gets some help with undressing and her personal evening care.

Truus enjoys the attention in the coffee break. She "I don’t know what to do with myself... It’s only 8:30, I’m not going to sleep yet, I’m not a child."

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When the living room becomes more static and empty, Truus starts to feel restless. She doesn’t know what to do with herself when she is left alone. Truus is not capable of entertaining herself with her surroundings. The TV is not captivating enough and care givers are busy. Truus is well aware of the time and doesn’t want to go to sleep yet.

"I don’t know what to do with myself... It’s only 8:30, I’m not going to sleep yet, I’m not a child."

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"I don’t know what to do with myself... It’s only 8:30, I’m not going to sleep yet, I’m not a child."

Dinner

Stimulation

Coffee/Tea

Undress

Personal Care

Sleep

Summary of main insights on life in a nursing home for people with dementia

Due to the progressive nature of dementia, symptoms will worsen to the point that someone is not able to take care of himself anymore and full-time care is needed. This can lead to the institutionalization of the person living with dementia, which mostly occurs in the later stages of the disease.

A nursing home for people with dementia provides round-the-clock specialized care for people living with dementia. In the Netherlands, each resident has his own bedroom, which opens onto a main hallway, to which the living/dining room(s) are connected. Overall, residents spend most of their time during the day in the shared living rooms, which is why this area became the focus of this project.

The daily life of a resident living in a nursing home is roughly structured in the same way every day.

08:00 – 10:00 personal care, getting dressed, breakfast
10:00 – 12:00 coffee/tea moment, activity for physical or cognitive activation
12:00 – 14:00 lunch, rest
14:00 – 17:00 coffee/tea moment, activity for physical or cognitive activation
17:00 – 22:00 dinner, stimulation, coffee/tea moment, going to/being brought to bed
2.5 Disconnectedness in dementia

This chapter is focused on the role of connectedness in dementia. The theory on connectedness, as discussed in chapter 2.1, described that connectedness can be divided into three types: social, personal and physical connectedness. In this chapter, this theory is used to analyze the field research results and gain insights on disconnectedness in the context of people living with dementia in a nursing home. The research questions that guided these insights were as follows:

- What influence does moving to a care home have on the feeling of connectedness for a person living with dementia?
- When, where and why do people with moderate to severe dementia feel disconnected on a daily basis?

2.5.1 Moving to a care home

One of the things that has a huge impact on the feeling of connectedness for people with dementia, is moving to a care facility. The consequences of moving to a care home mainly relate to whether people feel at home in the care home. When people do not feel at home, it can cause them to feel locked up or want to get off the ward (Dichter et al., 2016; T. Ettema et al., 2005).

Risk for social isolation

When someone moves to a care home, the risk for isolation increases. They are no longer surrounded by their familiar environment, are not familiar with the new one and have no connections with the people around them. Because of their cognitive decline, it is hard to impossible for people with dementia to build new relationships (Perrin et al., 2008b; Plaats & Kits, 2016; World Health Organization, 2017b). Only superficial interactions remain, while the more intimate ones disappear. This can result in feelings of loneliness (Perrin et al., 2008b; True doors, 2017) and negatively affects their need for relatedness, belonging and love and therefore the feeling of social connectedness.

Loss of identity and ownership

Your home shows your identity and is your legacy. You furnished it yourself, according to your sense of aesthetic pleasure and your rules apply. This all disappears when you are moved to an unfamiliar institutional environment that you don’t own. This decreases the possibility for self-expression and therefore negatively impacts a feeling of personal connectedness.

Loss of outdoor sensory stimulation

When living at home, people with dementia can decide for themselves when they want to go outside, depending on the situation. This changes when they move to a closed unit of a nursing home. Here, people with dementia are not allowed to go outside on their own, for their own protection. This can cause a loss of multisensory and peak experiences that being outside and experiencing the weather, temperature and smells can provoke (Whear et al., 2014). Because these peak experiences are endangered, there’s a risk for a decreased feeling of physical connectedness.

2.5.2 Static environments

As shown in the daily life journey (chapter 2.4), people in the moderate to severe stages of dementia spend a lot of their spare time in unstimulating, static environments. They are surrounded by static objects and non-responsive, apathetic fellow residents.

These static environments emerge in the moments between activities initiated by the care givers. Moments like this result in several possible behaviors, which strongly relate to under stimulation of senses and cognition. The behaviors that result from this and their impact on connectedness are discussed in the next paragraphs.

Apathy: withdrawn from the world

What is very apparent in the daily journey of people living with dementia is the inability to initiate action (see Figure 26). 90% of people with dementia, living in a nursing home, suffer from apathy (Kolanowski et al., 2005). This means that they are uncappable to take action, show no energy and have a lack of feelings, emotions, interest or concern (Andriesen, 2017). When a person doesn’t take action they often are left doing nothing (see Figure 25). They get isolated from their feelings and life and are in a numb state. This state of no emotion negatively impacts the emotional balance of people, which results in a decreased level of emotional well-being (Dichter et al., 2016; T. P. Ettema et al., 2005).

Figure 25: A person is sitting on a chair with no stimuli in her surroundings. Without external triggers the person will just continue to sit here in a state without emotion and connection with her surroundings.
In the daily life journey, both Truus and Kees have apathetic moments (see Figure 26). During an activity, Truus is still able to finish what she was doing (e.g. eating her dinner), but when she has finished an activity, she struggles to initiate a new one, which often results in apathy. Where it is relatively easy to get Truus out of her apathetic state, it is harder to get Kees out of this state. The touch of a care giver or the stimuli from the Tovertafel make him more active, but the effect of these moments of activation rapidly decreases and end in apathy.

**Decreased level of self-expression**

As described above, apathy causes a lack of feelings, emotions, interest or concern. This forms a risk for a feeling of personal connectedness, as apathetic people are not able to initiate actions for self-expression. When we perform actions that are meaningful to us or stimulate our cognition, we are able to connect more to our psychological selves (see chapter 2.1). When a person is not able to initiate this kind of actions, this leads to a decreased level of self-expression. As a result, the level of personal connectedness is endangered.

**Low amount of sensory stimulation**

When a person living with dementia is in an apathetic state inside a static room in an institution, the amount of sensory stimulation is decreased to a minimal level. In order to experience physical connectedness, arousal in sensory stimulation is needed (see chapter 2.1). In this case, nothing in the room nor in the person causes sensory arousal. All physical things are static, both the person living with dementia and the environment. Therefore, an apathetic person in a static environment experiences a minimal amount of sensory stimulation, which decreases his awareness of his physical body and negatively affects a feeling of physical connectedness. This all decreases a sense of feeling alive.

**Restlessness: searching for connection**

Static, unstimulating environments can also trigger agitated, restless behavior (Alzheimer’s Society, n.d.-a; Unforgettable, n.d.). In the daily life journey, this happens to Truus after lunch and in the evening. Care givers are busy with bringing people to their beds, which leaves Truus being alone in an empty living room. Nothing in her surroundings is stimulating and/or captivating enough for her to be able to entertain herself. This causes her to start wandering around the hallways and repeatedly makes her end up in the same empty living room. She even indicates that she is restless: “I don’t know what to do with myself.”

**Increased risk for social isolation**

When a person is apathetic, initiation of social contact turns into one-way traffic. The apathetic person is not able initiate contact, but, depending on the level of apathy, apathetic people are still capable to react to contact initiated by others. This increases the risk for social isolation, as an apathetic person with
This behavior is clearly related to a decreased quality of life, since restless tense behavior is a domain that stays relevant, even in the latest stages of dementia (Dichter et al., 2016). Also, the quality of life domains ‘having something to do’ and ‘feeling at home’ are related to this lack of stimuli in someone’s environment, as people can feel bored and/or can’t find anything to do without the help from others (Dichter et al., 2016; T. Ettema et al., 2005). This generates negative emotions, which negatively impacts the emotional balance of people and therefore decreases emotional well-being (Dichter et al., 2016; T. P. Ettema et al., 2005).

Search for meaning

In a static environment, not only a person’s sensors are under stimulated, but also his cognition. A static room lacks novelty for people with moderate to severe dementia who are still capable of symbolic thinking (Perrin et al., 2008b). These people are still able to creatively relate stories from their past to objects or events in the present. When nothing happens in their surroundings, there is nothing to explore or find meaning in. Also, static objects are harder to interpreted for people living with dementia. Therefore, it is harder for them to recognize and relate to object in a static environment (Plaats & Kits, 2016). A person can feel bored in such a moment or start to develop a negative self-image, because he is not able to do anything (Dichter et al., 2016; T. Ettema et al., 2005). This search for novelty, purpose and meaning relates to feeling connected with yourself, being able to express who you are and find meaning in your life (see chapter 2.1).

Wanting to feel alive

Restless people are aware of their surroundings, but these surroundings do not give the supplies for fulfilling their needs. There are little to no sensory stimuli, which can cause people to start searching for them (Alzheimer’s Society, n.d.-a; Perrin et al., 2008b; Unforgettable, n.d.). They can for example start to fidget with objects or hit the table to fill this gap of under stimulation (Perrin et al., 2008b). This stimuli-seeking behavior can also be an attempt to feel alive; “I am alive. I must be alive, because I can hear myself making this noise” (Perrin et al., 2008b). This basic feeling of being alive is strongly related to the feeling of physical connectedness (see chapter 2.1).

Search for social connection

Being left alone in an empty environment can cause feelings of social disconnectedness. Having no opportunities for social interaction, creates a lack in the fulfillment of our needs to belong, be acknowledged and receive esteem from others (Desmet & Fokkinga, 2018; Maslow, 1943). This can make a person feel socially isolated and not worthy of attention (see chapter 2.1). This can also happen when someone tries to make contact with a nurse or fellow resident, but instead of acknowledged, gets ignored.
Summary of main insights on disconnectedness in dementia

When applying the theory of connectedness to the context of people with moderate to severe dementia, two impactful elements were identified.

Moving to a care home has a huge impact on the feeling of connectedness.
- Social: risk for social isolation, resulting in feelings of loneliness.
- Personal: loss of identity and ownership reflected by your surroundings.
- Physical: loss of outdoor sensory stimulation, resulting in decreased multisensory and peak experiences.

Residents of nursing homes for dementia often spend time in unstimulating, static environments. This can cause both apathetic and restless behavior. These types of behavior impact the feeling of connectedness and decrease emotional well-being.

Apathy: withdrawn from the world, in a state without emotion
- Social: not being able to initiate contact creates an increased risk for social isolation.
- Personal: not being able to initiate meaningful or cognitively stimulating actions decreases the level of self-expression.
- Physical: as both the environment and the apathetic person are static, sensory stimulation is decreased to a minimal level.

Restlessness: searching for connection, leading to negative emotions
- Social: in a static environment, people have no opportunities for social interaction or get ignored, which can cause people to start searching for social connection.
- Personal: static environments can create a lack of cognitive stimulation, which can cause people to start searching for meaning.
- Physical: static environments provide little to no sensory stimuli, which can cause people to start searching for them, out of an urge to feel alive.

2.6 Conclusion

To conclude the analysis on connectedness in dementia, this chapter presents my vision on the project that serves as a basis for the design phase.

In this project, I focus on increasing the feeling of connectedness of people living with moderate to severe dementia in static care environments. In the analysis presented in this chapter, I found that people with moderate to severe dementia spend time in static environments every day. This means that they are surrounded by static objects and non-responsive, apathetic fellow residents (see chapter 2.5).

Due to cognitive impairments, it is difficult for people living with moderate to severe dementia to initiate action and make sense of the world around them (see chapter 2.2). Therefore, static environments cause people to become apathetic or restless. These types of behavior cause the level of feelings of connectedness to decrease, which negatively impact people’s emotional well-being as apathy and restlessness involve states of no or negative emotions (see chapter 2.3 and 2.5).

As the moments where people spend time in static environments happen when caregivers are busy with their caring duties, I envision to offer something for these moments that can be used by a resident without the help of caregivers and can be used individually, without the need for fellow residents. Therefore, the design phase of this project focuses on the individual side of connectedness. This includes personal connectedness, where people feel connected to their psychological self, and physical connectedness, where people feel connected to their physical self (see chapter 2.1).

It is important to offer people with moderate to severe dementia the opportunity to engage with something when wanted. As they also like to rest and/or do nothing sometimes, they should be in charge of the interaction. The authors of the book ‘Wellbeing in dementia’ share this opinion and have described it as followed:

“We believe that it is a good practice for something to be offered. It might be rejected or ignored; that is not important – what is important is that we provide an opportunity for attaching to something that will assist, comfort and ease the journey towards absolute dependence.” (Perrin et al., 2008b)

To provide something that increases the feelings of personal and physical connectedness in static environments, something should be offered that provides both sensory and cognitive stimulation. Therefore, a product should provide dynamic sensory stimulations that can be explored and trigger the curiosity in people. This way, physical connectedness is enhanced through the experience of sensory stimulations and the feeling of personal connectedness is enlarged through cognitive stimulation.
3.1 Interaction principles and play experiences of the Tovertafel

In this chapter, the results of an analysis of the interaction principles and play experiences used in the development of the Tovertafel are described.

3.1.1 Interaction principles

During the iterative development process of the Tovertafel, multiple interaction principles were found which can stimulate and elicit a reaction from people with moderate to severe dementia. These interaction principles are used by Active Cues in designing new Tovertafel games (Active Cues, n.d.-c; Anderiesen Le Riche, 2017). In this research, these principles were analyzed to see which ones are applicable in the broader sense of designing for people with moderate to severe dementia. Principles that are very specific for the Tovertafel and less applicable to other design situations were excluded. This resulted in the following list of principles:

- A product should initiate the interaction
- Sensory triggers can stimulate people to interact
- A product can support people to lengthen their engagement time with an activity by frequently providing triggers. Especially at moments that the attention of the person drifts away.
- A product should provide participation at every level. A so called ‘layered’ design can ensure that most people living with dementia can participate and find joy at their own level.
- The product should provide sufficient time for people to react.
- A product should only provide positive feedback. This emphasizes people’s abilities and creates a safe environment for people to interact freely with the product.
- The product should react to minimal and/or slow movements.

(Active Cues, n.d.-c; Anderiesen Le Riche, 2017)

3.1.2 Play experiences

The results of a literature review on play experiences for people with Alzheimer’s disease were also used in the developmental process of the Tovertafel (Anderiesen et al., 2015; Anderiesen Le Riche, 2017). This literature review identifies play experiences that are still suitable for people in the different stages of Alzheimer’s disease (see Figure 29).
As shown in Figure 29, regardless of the severity of dementia, the play experiences relaxation, reminiscence and sensation are suitable. As this project focuses on designing for people living with moderate to severe dementia, one or more of these play experiences should be used.

### 3.2 Field study with probes

This chapter describes insights from the field study in which probes with varying qualities were presented to the target group. The goal of this study is to investigate what type of product elements trigger and/or captivate people living with moderate to severe dementia. Besides design and play principles, this study also generated insights on practical concerns when designing for people living with moderate to severe dementia.

#### 3.2.1 Research method

The goal of this research was to identify product elements that trigger and/or captivate people living with moderate to severe dementia. In order to achieve this, a set of probes was selected varying in textures, forms, colors and materials. This selection was based on the aim to offer elements that could stimulate different senses. The selection of probes not only differs in terms of sensory stimulation, but also in terms of potential for open-ended play, so attention was paid to freedom of interpretation and ambiguity of the objects (Bekker, de Valk, & Eggen, 2014; de Valk et al., 2015). Also objects that were present in the nursing homes, and were relevant for this study, were included. Figure 30 shows an overview of the probes included in this study.

![Figure 30: Probes involved in the research](image)

As shown in Figure 29, regardless of the severity of dementia, the play experiences relaxation, reminiscence and sensation are suitable. As this project focuses on designing for people living with moderate to severe dementia, one or more of these play experiences should be used.

#### Figure 29: Play experiences for people with Alzheimer's Disease (AD)
(Hester Anderiesen et al., 2015; Anderiesen Le Riche, 2017)

Advanced AD
- challenge
- eroticism
- expression
- fellowship
- humour
- nurture
- relaxation
- reminiscence
- sensation
- simulation
- subversion
- sympathy

Mild to moderate AD
- challenge
- eroticism
- expression
- fellowship
- humour
- nurture
- relaxation
- reminiscence
- sensation
- simulation
- subversion
- sympathy

Earliest AD
- challenge
- eroticism
- expression
- fellowship
- humour
- nurture
- relaxation
- reminiscence
- sensation
- simulation
- subversion
- sympathy

Not for AD
- exploration

No studies found
- captivation
- competition
- completion
- control
- discovery
- fantasy
- sadism
- suffering
- thrill

Figure 30: Probes involved in the research

- Monkey
- RGB ball
- RGB ball in pillow case
- Plush dog
- Plush broccoli
- Plush mouse
- Peu app
- Meditation ball
- Magic plasma ball
- Smiley ball
- Fiberglow spaghetti
- House with doors and locks
- Interactive cat
- Reflective spiral
- Balloon letter
Insights were gathered in three sessions divided over three nursing homes: Thebe Lucia in Breda, Nijenstede in Amersfoort and Die Buytenweye in Delft. Insights were gathered through exploratory research methods, including semi-structured fly-on-the-wall observations and participant observation as well as unstructured interviews (Hanington & Martin, 2012; IDEO.org, 2015).

Probes were placed within the reach of one or multiple residents. For the fly-on-the-wall observations, no introduction of the product was given to research what intrinsically triggers the residents. Participant observations were used to deepen the insights. In these observations, conversations were conducted with the residents, making them explain and elaborate on the objects. To support the resident observations, short unstructured interviews with care givers were conducted to clarify and interpret the certain behaviors and/or activities of the residents. The research was purposefully setup to be flexible to enable collection of information from spontaneous interactions and observations.

The gathered data was analyzed according to the method described by Sanders and Stappers in the book ‘Convivial toolbox’ (Sanders & Stappers, 2012). Data was interpreted and turned into an informational overview (see Appendix H), the interpretation of this information resulted in statements of knowledge. The goal of the analysis was to find similarities in triggers and captivation across the different nursing homes and probes. The results of the probes study can be found in appendices G & H.

3.2.2 Design principles for triggering and captivating

The probes research resulted in a series of statements with insights for design principles for triggering and captivating people with moderate to severe dementia and practical concerns. First the insights for design principles are explained, followed by the practical concerns.

People tend to fidget with what is in their surroundings

Fidgeting can be described as making continuous small movements because you are uncomfortable or bored (Cambridge Dictionary, n.d.-d). For example, a resident in Amersfoort, who was given the RGB ball inside a pillowcase liked to fidget with the pillowcase. She held it between thumb and index finger and made continuous small circles with these two fingers, rubbing the pillowcase across them. This movement was seen more often. Blankets and clothes are also used by residents for this type of fidgeting. Another type of fidgeting was found when a resident was wrapping the fiberglow spaghetti around her fingers like a ball of wool. The RGB ball was also used for fidgeting by a man who continuously rotated the ball in his hands, while exploring the texture.

People are attracted by elements of objects that deviate and/or stand out

Besides fidgeting, people were also attracted by the elements of an object that deviate and/or stand out. This results in touching the edges and corners of objects, as well as on/off switches. For example, a woman started to touch the edges of the black pedestal of the magic plasma ball. This also happened with the balloon letter; a woman stroked with her fingers over the edge of the letter as well as the edge between the head and torso of the monkey. Also, the attention of a man was caught by the on/off switch of the RGB ball.

Products that emit light draw people’s attention, especially when the lights change color

Some of the objects included (color changing) lights. This caught the attention of people, even in the latest stage of dementia. One of the caregivers explained that objects that include lights are also easier to see for people with poor vision. The lights in the fiberglow spaghetti and RGB ball, both changed color in the same way; fading form one color to the next in a preset loop. People found it pleasant to watch this happen and were captivated and sometimes enchanted by it. Sometimes this color changing light effect became a topic for conversations initiated by the residents. They would name the colors and point at the object.

Products that allow for exploration can stimulate and captivate people

People tend to explore objects to figure out what it is and/or what you can do with it or just for the sake of the exploration experience itself. Especially male residents tend to try to figure out the technical details of objects. This, for example, happened with the wooden house with doors and locks. A man was trying to open one of the doors to find out what is behind it. Also, the reflective spiral triggered exploration. A man inspected it and found the elastic band at the end of it. This triggered him to hold it by the elastic band to see what would happen. Afterwards, he held the spiral next to the fiberglow and told me that it takes over the lights. This all indicated that he was exploring the possibilities of the reflective spiral. Some female residents carry around their purse. This is also an object which triggers exploration. Several women explored the contents of their purse. They would find something in it, observe the object and explore what else is inside the purse.

Sound originating from an object triggers people to interact

When a product makes a sound that matches the appearance of the product, it triggers people to interact with it. Also, when there is a more abstract sound, of which people don’t know what it is, it triggers people’s curiosity. The interactive cat makes meow and spinning noises. Each time the cat meowed, a woman started to pet the cat and talk to it. This meow was a trigger for her to start or continue interaction. The monkey starts to blow when the button in front of it is pressed. This made a sound that was unrecognizable for people. This caused people to interact with the product to figure out what this sound is and where it originates from.
3.3 Exploration as a play experience

Most findings of the two studies confirm and/or supplement each other. However, the play experience ‘exploration’ shows contradictory results when comparing the probes study with the literature findings of the Tovertafel. This contradiction is analyzed and explained in this chapter.

Exploration can be described as the experience of exploring or investigating a world, affordance, puzzle or situation (Anderiesen Le Riche, 2017; Bekker et al., 2014). According to Andriesen et al., exploration as a play experience is not suitable for people with Alzheimer’s disease (Hester Anderiesen et al., 2015). However, in my field study with probes it was found that products that allow for exploration can stimulate and captivate people living with dementia. People actively tried to make sense of the products through exploring the possible interactions with it. This raises the question whether or not ‘exploration’ is suitable for people living with moderate to severe dementia.

Exploration is a crucial element in playful interactions. As described by Bekker et al. and de Valk et al., the interaction with a playful design has three stages: invitation, exploration and immersion (Bekker et al., 2014; de Valk et al., 2015). These stages are explained as follows:

- “Invitation: potential players have to be seduced in order to start interacting with the design.”
- Exploration: players need to get to know and try to understand what the possibilities of the design are.
- Immersion: players should be supported in creating rules and games resulting in fun and pleasurable experiences that make players forget about the world around them.”

(De Valk et al., 2015)
As shown in Figure 31, potential players should first of all be invited by the product, where after a stage of exploration starts. The stage of immersion can only be reached through exploration. When this is translated to the context of playful interactions for people living with moderate to severe dementia, it would mean that immersion in these interactions is not possible, as exploration was found to be not suitable for people living with Alzheimer’s disease. But how is it then possible that people do get immersed in the interaction with the Tovertafel?

The recommendation of Anderiesen et al. is stated as follows: “Clinical studies show that the ability to take initiative is reduced in persons with Alzheimer’s Disease, which is reflected in higher levels of apathy. We therefore recommend that game designers should not include exploratory elements appealing solely to a player’s own initiative in games for all persons with Alzheimer’s Disease.” (Hester Anderiesen et al., 2015; Anderiesen Le Riche, 2017) This indicates that exploration is a suitable play experience to apply when exploratory elements are designed in such a way that the play experience does not only rely on the player’s initiative. Therefore, I conclude that exploration is a play experience that can be suitable for people with moderate to severe dementia, as long as there is an external proactive trigger to invite the player to start and/or continue the exploration. This trigger could originate from the product itself and/or be initiated by a third party, like a care giver. This corresponds with the interaction principles of the Tovertafel that indicating that a product should initiate the interaction.

3.4 Conclusion

This conclusion combines all insights into a shortlist of answers per research question.

What interaction principles are applicable when designing for people living with moderate to severe dementia?
- A product should initiate the interaction
- Sensory triggers can stimulate people to interact
- A product can support people to lengthen their engagement time with an activity by frequently providing triggers. Especially at moments that the attention of the person drifts away.
- A product should provide participation at every level.
- A product should only provide positive feedback.
- The product should react to minimal and/or slow movements.

Which types of play experiences are still possible to elicit for people living with moderate to severe dementia?
- Exploration
- Relaxation
- Reminiscence
- Sensation

What type of product elements trigger and/or captivate people living with moderate to severe dementia?
- Color changing lights
- Sudden movement of or within an object
- Sound originating from an object
- Objects with flexible elements that allow for fidgeting
- Elements of an object that deviate and/or stand out
- Creature-like objects with faces

What practical requirements should be taken into consideration when designing a product for people living with moderate to severe dementia?
A product should:
- be easy to clean
- be usable with gross motor skills
- include no small loose elements
- include visuals with high contrast
- intuitive and easy for caregivers to setup
4.1 Design goal

Based on my vision on the project, which is described in chapter 2.6.2, the goal for the design phase of this project is formulated as follows:

“Designing a playful object that enables moments of physical and personal connectedness for people in the mid to late stages of dementia, to support emotional well-being in static nursing home environments.”

It is important to note that the object should be usable for people living with moderate to severe dementia without the help of care givers, as static environments are caused by the fact that care givers are busy with their caring duties. In Figure 32, the design goal is visualized in a storyboard.
4.2 Interaction vision

Since this project is about designing an experience, an interaction vision was created (Pasman et al., 2011). This interaction vision uses a metaphor to represent the qualities of the interaction that should be transferred to the design. The interaction vision and qualities are based on insights from both the analysis of connectedness in dementia (chapter 2) and the analysis of design principles for dementia (chapter 3).

To provide something that increases the feelings of personal and physical connectedness in static environments, something should be offered that provides both sensory and cognitive stimulation (see chapter 2.1). Therefore, a product should provide dynamic sensory stimulations that can be explored and trigger the curiosity in people. This way, physical connectedness is enhanced through the experience of sensory stimulations and the feeling of personal connectedness is enlarged through cognitive stimulation.

Based on this, I formulated the following interaction vision:

“The interaction between user and product should feel like playing with a ladybug.”

This metaphor was chosen because there are several qualities about this interaction that are interesting to translate to the context of this project.

4.2.1 Interaction qualities

Proactive
The ladybug takes the initiative by appearing in your eyesight or on your body. You decide whether to neglect or interact. In the context of this project, this is an important quality, as a product should initiate interaction with sensory triggers, to stimulate people to interact (see chapter 3) (H. Anderiesen, 2017).

Lively
Once you decide to interact with a ladybug, it will anticipate on what you do. You can see that it reacts on your actions, but also that it is not completely predictable. This makes it a lively interaction. Introducing a lively interaction like this into a static environment, increases the level of sensory stimulation which makes the setting more dynamic.

Explorative
When a ladybug approaches you, people can explore the possibilities. You can just look at it or decide to touch it. You can try to let it walk from one finger to the other or make it walk onto a leaf. This exploring of objects was found to stimulate and captivate people with moderate to severe dementia, as explained in chapter 3. Including factors in the object that can be explored and which react on the user’s actions can have a positive effect on people with moderate to severe dementia, as they derive pleasure from being the cause of something (Perrin, May, & Anderson, 2008c) and fulfilling the need for exploration enhances feelings of personal connectedness, as it provides cognitive stimulation (see chapter 2.1).

Enchanting
Enchantment can be described as attracting or pleasing someone very much; a magical effect (Cambridge Dictionary, n.d.-c). A ladybug can suddenly appear in your eyesight, or open its wings, pretending to prepare for takeoff. This can be an unexpected trigger. In the context of this project it was found that in order to lengthen someone’s engagement with a product, it should provide frequent triggers (see chapter 3). Moments with unexpected events can provide these triggers, as people with moderate to severe dementia enjoy the surprise of unexpected events (Anderiesen Le Riche, 2017). Moreover, enchantment also fits the positive design vision of Active Cues: to go beyond the functional solutions and evoke happiness and enchantment.
**Subtle**
Playing with a ladybug does not involve overwhelming, extreme interactions. It is present enough to notice and trigger, but is not too intrusive, so it can still be neglected. When you don’t want to interact with the ladybug anymore, you can decide to blow to make it fly away or to start ignoring it. You have the control over it. This subtleness is an important quality in the context of dementia. When something is too intrusive it can become overwhelming and lead to overstimulation (Alzheimer’s Society, n.d.-b, n.d.-a).

**Open-ended**
In open-ended play, players themselves can attach meaning to the design properties and the interactions while playing. It is play without predefined rules, which triggers the player’s creativity by leaving room for interpretation (de Valk et al., 2013; de Valk et al., 2015). This open-endedness can enhance feelings of personal connectedness, as it is related to cognitive stimulation (see chapter 2.1). Playing with a ladybug is open-ended, as the person playing with it can create his own story and meaning through play. This open-endedness makes it possible to interact with the ladybug on different cognitive levels. This is important in the context of dementia, to make sure that people in different stages of dementia can participate and find joy at their own level (see chapter 3).
5

Design process

This chapter describes the design phase of this project. Based on the formulated design brief and interaction vision, idea generation was done, which resulted in three idea directions. One of these directions was chosen in which three prototype iterations were made to optimize the concept. This resulted in a final concept, which this chapter is concluded with.

5.1 Ideation

I started the idea generation phase with a brainstorm session based on the design brief. Several idea directions were explored through the creation of quick idea sketches. The ideas were focused on providing cognitive and sensory stimulation while taking the design principles for dementia into account, which are described in chapter 3. After the visual brainstorm session, the ideas were analyzed, which resulted in three idea directions.

Idea direction 1
Objects that provide sensory stimulation using different materials and textures and trigger people to interact through including flexible elements that allow for fidgeting.

Idea direction 2
Creature-like objects that provide sensory stimulation using different textures and cognitively trigger people to interact through creating a character with a face.

Idea direction 3
Abstract objects that provide triggers and sensory stimulation through color changing and/or moving lights that can be explored.
All ideas directions were assessed, using the interaction qualities of the design brief (see chapter 4.2). This made clear that idea direction one and two include too many different elements to trigger the users, which makes the object complex and takes away from the overall subtleness and enchantment of the experience. Also, the liveliness is not present in idea direction one. In idea direction two, this liveliness is interpreted as creature-like, which turned the ideas into realistic creatures. This leaves less room for the users to make their own interpretation, which makes the interaction less open-ended (Bekker et al., 2014; de Valk et al., 2013).

Idea direction three shows the most promising results, when comparing it to the interaction qualities of the design brief. While ideas in the other two directions include too many aspects, the ideas in this direction include more subtle triggers. Their abstract appearances make the ideas open-ended, as this makes them open for the interpretation of the user (Bekker et al., 2014; de Valk et al., 2013). One concept within idea direction three was chosen to develop further.

5.1.1 Final concept direction: firefly
The final concept direction is inspired by a firefly. A light, acting like a firefly, is present inside a three-dimensional object (see Figure 38). The light lights up and moves through the object, trying to catch the players attention. When the player reacts to the fly by touching or picking up the product, the light will react to this movement. When rotating the object, the light will always ‘fly’ to the top, like a reversed hourglass.

Figure 38: Sketch explaining the interaction of the ‘firefly’ idea

This concept direction shows to be promising to all interaction qualities:

Proactive
A light moves within the object and sometimes turns off and on again, to trigger the user to interact. Both light and movement showed to be suitable design principles for triggering interaction (see chapter 3).

Lively
The light moves as if it is a firefly. This means that there is be a bit of randomness to it. It doesn’t move with a fixed speed and is never stationary, which makes it dynamic.

Explorative
Once the proactive moving light has invited the player to interact, the interaction with the light can be explored. The user notices that the light reacts on his action of moving the object and can explore what he can do with it.

Enchanting
To enhance the enchantment of the product, the interaction can sometimes change when it has been the same for some amount of time. When this happens, the light goes to the bottom of the object and back up again. This unexpected change of events is implemented to make sure that the product provides frequent triggers to lengthen the interaction. Also, this unexpected change of events could enhance the enchantment of the interaction.

Subtle
There’s only one firefly inside the object to make the interaction active, but not too intrusive. When the object detects there has been no interaction for a while, it turns off the light to provide a bit of rest. After a while it lights up for a short amount of time to subtly trigger the user to (re)start the interaction.

Open-ended
The form of the object is purposely ambiguous, to leave room for interpretation. Besides this, also the light itself is free to interpret. It was inspired on a firefly, but it can be explained as and related to more things, which can cognitively stimulate the user to use his interpretation and creativity.
5.2 Concept development

The concept direction of the firefly was further developed in three iterations. I created three prototypes consecutively and tested these with the user group to evaluate the concept. The first prototype focused on testing the basics of the envisioned interactions. The second and third prototype elaborated on these interactions as well as the embodiment of the product.

5.2.1 First iteration

The first iteration is focused on prototyping and testing the basic interaction with the light. The technical details of this prototype can be found in appendix I. Therefore, the embodiment of this prototype is only in service of realizing the interactions of the light.

The iterations included in this prototype are the following:
- When the object is held vertically, the light moves up through the tube.
- When the light reaches the top of the tube, it keeps alternating between the last and the second-last LED.
- When the tube is turned upside down, the light moves to the top again.
- When the tube is held horizontally, the light moves from left to right in the middle part of the tube.
- When the product is not touched and has not been in motion for one minute, the light would be turned off.
- When the light is turned off and there is no motion for more than one minute, the light turns on again for one minute and perform the movement belonging to the current orientation of the tube.

This prototype was tested in two nursing homes with a total of 12 participants. The test setup and results can be found in appendix J. Based on the test results, I made a list of positive insights as well as insights on improvements, which is shown in Figure 40.
5.2.2 Second iteration

The second prototype is shown in Figure 41. The technical details of this prototype can be found in appendix I.

![Figure 41: Second prototype](image)

The following elements were altered in comparison with the first prototype:
- As the shape of the first prototype negatively affected the interaction with the object, I chose to change the shape of the product to a sphere to make the product more approachable and indicate it as being an interactive object.
- Another argument for the sphere is to avoid flat surfaces, as the flat surfaces in the first prototype, caused people to put down the product.
- The electronics within this prototype were concealed to avoid people from getting distracted by them.
- The movement of the light is amplified to make it more visible and less subtle. The amount of LED’s was increased, so that the light always followed a path of at least 5 LED’s in every position.
- The no-motion trigger was amplified to make it more triggering and less subtle. When the product would be motionless for more than one minute, the light would make a full round through the object with a higher speed than when the product is in motion.

This prototype was tested in one nursing home. The test setup and results can be found in appendix J. The test resulted in a list of positive insights as well as insights on improvements, which is shown in Figure 42.

### Positive insights
- None of the people hesitated to touch the object.
- The trigger when there has been no motion for a while was less subtle and seems promising, as it had a positive effect on at least one participant (participant 2). Further testing is needed though.
- The liveliness of the interaction seems promising, as a lady interpreted the light as the sun that dynamically appears and disappears.
- “And this is the sun (pointing at the lights), but it goes away again and shows up somewhere else later (laughing)” - participant 4
- There was an indication that the product caused participant 2 to feel enchanted by it. This was made up of here continuous positive comments.
- “How nice! Oh dear! That’s something for me — really! I really enjoy it.” - participant 2
- The diameter of the sphere was easy to grab and hold for most people.
- The battery within the sphere was a bit out of balance, sometimes resulted in an unexpected positive insight. The unbalance caused the sphere to move a bit when people tried to put it down. This unexpected movement, caused some people to grab the object again, lengthening the interaction with it.

### Room for improvement
- The cotton that was used to cover the electronics was recognized as cotton by some residents. This took away from the experience with the light.
- The cotton did diffuse the light, but also made it less bright. Care takers questioned if all residents were still able to see the lights because of this.
- The surface of the sphere was shiny, which made it reflective. These reflections were distracting people from the envisioned interaction with the light. This may have caused that people did not seem to notice that the light sometimes turns off.
- The surface of the sphere was a bit slippery. This made it harder to grab the object for people, especially with small hands. Therefore, the material should provide a better grip and the diameter should be a bit smaller.
- Due to technical difficulties, the envisioned effect of the light following your movement and flying to the top of the object was not prototyped as envisioned. It caused the effect to be less noticeable.

![Figure 42: Insights gained from the user test with prototype 2](image)
5.2.3 Third iteration

The third prototype is shown in Figure 43. The technical details of this prototype can be found in appendix I.

![Figure 43: Third prototype](image)

The following elements were altered in comparison with the first prototype:
- The surface of the sphere was sandblasted to make it matt. This also replaced the light to diffuse the light.

This prototype was tested in one nursing home. The test setup and results can be found in appendix J. The test resulted in a list of positive insights as well as insights on improvements, which is shown in Figure 44.

### Positive insights

- For most participants, the proactive light did capture their attention. Especially the moment when it goes into its sleeping state. This triggered participant 2, 3 and 7 to initiate action and give the object a nudge to explore where the light went.

- The interaction was focused on the light and movement of the ball, without distraction caused by electronics, cotton or reflections.

- The product did cause some people to be enchanted by it.

  "It’s a ball of wonder" - participant 3
  (Dutch: “Het is een wonderbolleke!”)

- People did explore the product. Some only by watching the light go on and off again, some further explored the object by picking it up.

- Not only the lights were explored, also the movement of the ball itself. Because the battery is not centered within the sphere, it moves in unexpected ways, when putting it down. This triggered two participants to lengthen their interaction with the object (participants 2 and 9).

- There were some indications that people did interpret it as a lively object. Participant 3 called it a stubborn thing, indicating that it is something with a will of its own. Participant 2 talked to the object saying that it should continue what it was doing, when it went into the sleeping state. This indicates that he appreciated the dynamic stimuli.

- The project does provide freedom of interpretation and interaction. Participants did interact with the object in different ways. Participant 9 interacted with it in a playful way, while participant 3 was more thoughtful about his actions as he tried to figure out the object. This open-endedness was also confirmed to be a positive thing by the comments of a care giver.

  "I think that the fact that it’s something unfamiliar attracts people. It’s a positive thing that it’s unfamiliar. It is pleasurable for people to explore it. To think of what it is and what you could do with it.”
  - Care giver

- Participants were very careful with the object. This carefulness fits the interaction vision, as playing with a ladybug also is playful, but very careful, as a ladybug is a fragile thing. Therefore, the carefulness is part of the interaction.

- Rotating the ball did happen a lot. Also, people seemed to enjoy rubbing the sphere in the palm of their hand. Participant 2, 8 and 9 all initiated this interaction.

### Room for improvement

- Due to technical difficulties, the envisioned effect of the light following your movement and flying to the top of the object was not prototyped as envisioned. It caused the effect to be less noticeable. Further testing with an improved prototype is needed for this.

- Putting down the object sometimes caused problems due to the center of gravity. Since the battery within the sphere is the center of gravity, it not being in the center of the sphere makes the object unbalanced. This causes the ball to roll over when somebody puts it down. This did trigger interaction sometimes, but also caused the ball to fall, like in the test with participant 2. Therefore, this center of gravity should be oriented closer to the actual center of the ball. It can be slightly out of center to keep the surprising effect but make it subtler.

- The diameter of this prototype was 18 cm. Participants were able to pick up the object with one hand, but it was not effortless, because the surface of the sphere was a bit slippery. By making the ball a bit smaller and pick a material that is less slippery, the interaction could be made easier.
5.3 The final concept: Twinkle

All prototype iterations helped to develop the concept. This chapter describes the final concept of this project: Twinkle. First, the overall concept is described, after which the interactions and hardware development are discussed.

‘Twinkle’ provides sensory stimulation to people living with moderate to severe dementia in static care environments, to enhance physical and personal connectedness and hereby support emotional well-being and bring back the twinkles in people’s eyes.

The product is designed to be used by people living with moderate to severe dementia, without the help of caregivers. Therefore, the product should be present in the living room of a nursing home and within the reach of the resident. This way, it can enable moments of physical and personal connectedness when the environment becomes static.

Twinkle consists of a sphere, with an interactive dynamic light inside of it. This light can move across the surface of the sphere to proactively try to attract the attention of residents and trigger the curiosity in them to initiate interaction. When an interaction is started, the behavior of the light will change depending on the actions of the user. This way, it allows the user to explore the possibilities of the object. Meanwhile, the product provides sensory stimulations to the user. Their vision is stimulated through the sight of the object and the light and their touch is stimulated through the physical aspects of the product.

5.3.1 Interactions

Twinkle has several interactions, depending on the circumstances. Each interaction is explained below.

**Sleep**
When the object has been stationary for more than one minute, only the white shell is visible. All lights are turned off and there is no visible action within the product. The product seems to ‘sleep’ (see Figure 45).

**Trigger**
When the object has been asleep for more than one minute, a light will fly in circles around the sphere, from the bottom to the top and back down (see Figure 46). After this, it goes back to sleep again.

**Interaction when in motion**
When the product is picked up, a light turns on and flies to the top of the object. When it has reached the top, it does not become stationary. It starts to flutter in an infinite loop shaped like an 8, until the object is turned into another orientation. In this case the light will again fly to the top in a straight line and start circling around again (see Figure 47).

**Trigger when in motion for a while**
When the product has been in motion for a while, the product provides an extra trigger to increase the interest in the product. This extra trigger happens after two minutes of constant motion. The light will suddenly disappear from top and appear at the bottom of the sphere. The light will fly in circles around the sphere, from the bottom to the top and back down again (see Figure 48). After this, the light will return to the top in a straight line and flutter in an eight-shaped loop (see Figure 47).

**Action when motion ends**
When the product is put down again, which stops the motion, the light will continue to flutter in an eight-shaped loop for a minute (see Figure 49). After one minute, the light turns off and the product will go into its sleeping state (see Figure 45).
One part of the sphere is flattened. This is introduced to prevent the object from falling. The center of gravity of the sphere should therefore be a little bit out of center, towards the flat surface. This way, the sphere will always roll towards the flat surface when released by a user. This stabilizes the object and prevents it from falling.

General elements of the interaction:
- The color of the light changes slightly as it flies across the surface. The color changes gradually from yellow to green and back.
- The speed of the light is not fixed. It sometimes slows down or speeds up a bit to make it more dynamic.
- It takes the light approximately two seconds to fly from the bottom to the top in a straight line across the surface.
- The speed of the light in the trigger state is two times faster than the speed of the light of the in the 8-shaped loop, because it needs to travel across the whole surface of the sphere and should not be out of sight for too long.
- When the sphere is put to motion in the ‘sleep’ or ‘trigger’ state, the interaction will immediately switch to the ‘interaction when in motion’ state, to provide the user with instant feedback.
- When the sphere is rotated during the ‘trigger when in motion for a while’ state, the light will first finish its interaction, before switching back to the ‘interaction when in motion’ state.
- During the ‘trigger when in motion for a while’ state, the orientation of the bottom and top will be fixed. Rotating the object after this state has started, will have no effect on the light.

5.3.2 Product hardware
The product hardware is visualized in Figure 50. The product consists of a white sphere with a small flat surface, forming the outer shell of the object. This sphere has a diameter of 15 centimeters, to easily fit in the hands of the user. The outer shell contains a slightly smaller sphere of lights. The electronics that control the lights are in the core of this sphere. A charger outlet is located on the flat side of the object.

The outer shell serves as a layer to protect and cover up the electronics. It diffuses the lights to enhance a seemingly smooth motion when the light moves across the surface.

The object is spherically shaped to enable the interaction to create an endless surface, which is not interrupted by corners and edges. This way the interaction of the light flying to the top of the sphere can continue endlessly. Because of the spherical shape, the user also doesn’t necessarily need to pick up the product to rotate it. It can be rolled over and rotated on a table as well.
6 Evaluation of the final concept

This subchapter evaluates the final concept, as presented in chapter 5.3, using the design brief of chapter 4. First, the concept is analyzed based on each individual interaction quality of the interaction vision. After this, an evaluation is presented, discussing whether the design goal is fulfilled by the envisioned product.

6.1 Does the final concept fit the interaction vision?

The interaction vision for the design phase of this project, as described in chapter 4.2, is the following:

“The interaction between user and product should feel like playing with a ladybug: proactive, lively, explorative, enchanting, subtle and open-ended.”

To answer the question whether the final concept fits the interaction vision, each interaction quality is separately evaluated in the next paragraphs. These evaluations are strengthened based on the insights gained in the user tests of the multiple prototypes.

Proactive

The ladybug takes the initiative by appearing in your eyesight or on your body. You decide whether to neglect or interact. In the context of this project, this is an important quality, as a product should initiate interaction with sensory triggers, to stimulate people to interact (see chapter 3) (H. Andersen, 2017).

A light moves within the object and sometimes turns off and on again, to trigger the user to interact. Both the light itself and the movement of the light serve as a proactive trigger to make the possible user initiate interaction. Light and movement showed to be suitable design principles for stimulating people with moderate to severe dementia to interact (see chapter 3).

In the prototype tests, it was shown that this light indeed catches the user’s attention and initiates them to interact (see chapter 5.2 and appendix J). For most participants, the proactive light did capture their attention. The trigger when the product is motionless for a while was observed by people. But mostly the fact that the product went into its sleeping state, turning off the light, worked as a trigger for interaction. People wanted to get the light back on again, which caused people to nudge or grab the object.
**Enchanting**

Enchantment can be described as attracting or pleasing someone very much; a magical effect (Cambridge Dictionary, n.d.-c). A ladybug can suddenly appear in your eyesight, or open its wings, pretending to prepare for takeoff. This can be an unexpected trigger. In the context of this project it was found that in order to lengthen someone's engagement with a product, it should provide frequent triggers (see chapter 3). Moments with unexpected events can provide these triggers, as people with moderate to severe dementia enjoy the surprise of unexpected events (Anderiesen Le Riche, 2017). Moreover, enchantment also fits the positive design vision of Active Cues: to go beyond the functional solutions and evoke happiness and enchantment.

The fact that there are lights within a ball that react to your actions is enchanting in itself. The insights gained with prototype 2 and 3 confirm that the product had an enchanting effect on multiple participants.

"How nice! Oh dear! That's something for me…really! I really enjoy it." – Participant 2, user test prototype 2

In the user test of prototype three, a care giver explained that the resident was enchanted by the object, because the ball shape is something he recognizes, but the lights within the shape is something he has never seen before. He tried to figure out the object, which pleased him and therefore had an enchanting effect on him.

To enhance the enchantment of the product, in the final concept an additional interaction was implemented: the ‘trigger when in motion for a while’ state (see chapter 5.3.1). This state implements that the interaction can sometimes change when the product has been in motion for two minutes. This unexpected change of events is implemented to make sure that the product provides frequent triggers to lengthen the interaction and provide people with a surprise which they possibly can derive pleasure from. Further testing is needed to confirm this last part.

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**Lively**

Once you decide to interact with a ladybug, it will anticipate on what you do. You can see that it reacts on your actions, but also that it is not completely predictable. This makes it a lively interaction. Introducing a lively interaction like this into a static environment, increases the level of sensory stimulation which makes the setting more dynamic.

The light does not move with a fixed speed and color and is never stationary. This makes the interaction more dynamic and therefore livelier. This was confirmed by some comments of the residents who participated in the user test (see chapter 5.2 and appendix J).

"And this is the sun (pointing at the light), but it goes away again and shows up later again (laughing)" – Participant 4, user test prototype 2

In the user test of prototype 3, participant 3 called it a stubborn thing, indicating that it is something with a will of its own. Participant 2 talked to the object, saying that it should continue what it was doing, when it went into the sleeping state. This indicates that he appreciated the dynamic stimuli.

**Explorative**

When a ladybug approaches you, people can explore the possibilities. You can just look at it or decide to touch it. You can try to let it walk from one finger to the other or make it walk onto a leaf. This exploring of objects was found to stimulate and captivate people with moderate to severe dementia, as explained in chapter 3. Including factors in the object that can be explored and which react on the user’s actions can have a positive effect on people with moderate to severe dementia, as they derive pleasure from being the cause of something (Perrin et al., 2008c) and fulfilling the need for exploration enhances feelings of personal connectedness, as it provides cognitive stimulation (see chapter 2.1).

The user can already explore the product just by observing it. He can observe the light turning off and on, as the object alters between the sleep and trigger state. Once the user has been triggered to interact with the product, the behavior of the light can be further explored, through rotating the object.

This behavior was apparent in user test of prototype 3 (see chapter 5.2 and appendix J). Most participants in this user test clearly explored the object and its possibilities. For example, participant 3 extensively explored the object, trying to figure out what it was and what he could do with it. Participant 9 did also explore the object in extensively but interacted in a more playful way with it. He altered between several interactions, from rotating it on the table, to observing the movement of the light, to rubbing the ball in between his hands.

"And this is the sun (pointing at the light), but it goes away again and shows up later again (laughing)" – Participant 4, user test prototype 2

In the user test of prototype three, participant 3 called it a stubborn thing, indicating that it is something with a will of its own. Participant 2 talked to the object, saying that it should continue what it was doing, when it went into the sleeping state. This indicates that he appreciated the dynamic stimuli.

"And this is the sun (pointing at the light), but it goes away again and shows up later again (laughing)" – Participant 4, user test prototype 2
The product does provide freedom of interpretation as it provides a balance between recognizable and unfamiliar aspects. To provide a bit of structure, the product has a recognizable shape; a sphere. The light is the thing that makes the product interesting and unfamiliar. This balance was confirmed to be a positive aspect by the care giver in the user test of prototype 3. She explained that it also enhances the explorative and enchanting qualities of the interaction.

“I think it's a certain type of wonder. It's recognizable, but not really, because it has lights in it. I think that the fact that it's something unfamiliar attracts people. It's a positive thing that its unfamiliar. It is pleasurable for people to explore it. To think of what it is and what you could do with it.” – Care giver, user test prototype 3.

The freedom of interpretation and interaction was confirmed in the user test of prototype 3 (see chapter 5.2 and appendix J). Participants did interact with the object in different ways. Participant 9 interacted with it in a playful way, while participant 3 was more thoughtful about his actions as he tried to figure out the object. The freedom of interpretation was confirmed by several comments of participants.

“There it is again, the snow ball” - Participant 2, user test prototype 3

“It's a ball of wonder”- Participant 3, user test prototype 3

“And this is the sun (pointing at the light), but it goes away again and shows up later again (laughing)” - Participant 4, user test prototype 2

Conclusion

Does the final concept fit the interaction vision?

Yes, it does. The evaluation of the interaction qualities confirms that each one of them is strongly represented in the final concept. Therefore, it can be concluded that the envisioned product does fulfill all interaction qualities and thus fits the interaction vision.
6.1.2 Does the final concept fulfill the design goal?

In chapter 4.1, the design goal of this project is formulated as follows:

“Designing a playful object that enables moments of physical and personal connectedness for people in the mid to late stages of dementia, to support emotional well-being in static nursing home environments.”

Enabling physical and personal connectedness

To make sure that the designed product enables moments of physical and personal connectedness, the interaction vision was chosen based on the fact that the design should provide both cognitive and sensory stimulation. This way, physical connectedness could be enhanced through the experience of sensory stimulations and the feeling of personal connectedness is enlarged through cognitive stimulation.

In the previous part of this chapter (6.1.1), I concluded that the final concept does include all the envisioned interaction qualities, that were needed to provide both cognitive and sensory stimulation. Therefore, I can conclude that the product does enable moments of physical and personal connectedness for people in the mid to late stages of dementia.

Usable without the help of care givers

In the envisioned situation of use, as formulated in chapter 4, the product should be usable for people living with moderate to severe dementia without the help of a care giver. This envisioned situation is shown in the storyboard that is presented in Figure 51.

In this envisioned situation, a nursing home resident is sitting on a chair with the product on the table in front of her on the table. The product gives a trigger at some point, which catches the person’s attention. The person approaches the product, which responds to this. The person explores the interaction with the product for a while. After some time, the person decides to put down the product. A while later, the product will again give a trigger, which at some point will catch the resident’s attention and will restart the interaction. This envisioned situation was clearly shown in the results of the user test with prototype 3 (see chapter 5.2 and Appendix J). In this test, this was also confirmed by the comment of a care giver:

“I think people will mostly hold it for a moment. Look at it. Put it back again and after a while it captures their attention again and they will start to think about what it is. This can cause them to pick it up again. And so on. I think it will work in this way.” – care giver (test with prototype 3)

Supporting emotional well-being

In general, observations made in the user tests indicate that the product did evoke positive emotions in people. However, the prototype evaluations were mainly focused on the interaction qualities. Therefore, no reliable conclusion can be formed about whether the product supports emotional well-being.

In theory, the product does contribute to the emotional well-being of people with moderate to severe dementia, as it is aimed to prevent apathy and restless behavior and thereby prevent states of no or negative emotions, but further research should be performed to confirm this.

Conclusion

Does the final concept fulfill the design goal?

The product clearly shows it potential of fulfilling the design goal, but it should be further developed and more thoroughly tested to be able to fully confirm this.

The evaluation of the design goal confirms that the product does enable moments of physical and personal connectedness, as it provides sensory and cognitive stimulation and that it is usable for people living with moderate to severe dementia without the help of a care giver. User tests with prototype 3 indicate that the product does evoke positive emotions, however no reliable conclusion can be formed based on this test. Further research is needed to confirm this aspect of the design goal.

This care giver did also express that the product should be introduced to a resident and tried out with the help of a care giver, to evaluate if it has a positive effect on the resident and make sure that it doesn’t cause negative emotions. She emphasizes that you can only know if something has a positive effect, through trying it out for each resident, as you can never certainly predict, how somebody will react. After this, the product can be used by a resident, individually.
6.2 Recommendations for further development

This chapter presents some of my recommendations for the further development of the product.

6.2.1 Embodiment design
The embodiment design of the product should be further researched, with the main focus on how the material used for the outer shell of the object influences the experience and interactions of the end user.

As explained in the evaluation of the interaction quality ‘subtle’, carefulness is a part of the interaction (see chapter 6.1). The care giver in the user test of prototype 3 explained that the fragileness could possibly have a negative effect on the interaction as well.

“It can also be negative. They may put it away sooner. That they think: I am not allowed to touch it... I have to be careful ... I should not do too much with it ...” – Care giver, user test prototype 3

This carefulness can be enhanced by finding the right balance between firm and fragile. The material used for the outer shell of the product should prevent the product from breaking and should have the right balance between firm and fragile. The ball should not be soft and squeezable, as this probably decreases the carefulness and thereby the subtleness of the interaction. To find the right balance of fragileness and firmness, the use of materials should be explored further in the future development of the product.

The requirements for the material of the outer shell are the following:
- It should provide an experience that has the right balance of fragileness and firmness.
- It should prevent the product from breaking when it falls.
- It should cover up the electronics.
- It should be transparent enough to let the light shine through.
- It should slightly diffuse the light to create the illusion of a smooth motion.

To be able to meet these requirements, further research should be performed on the embodiment of the product.

6.2.2 Improved prototype
Due to technical difficulties, which were caused by reaching the limits of my electronic prototyping skills, the envisioned behavior of the light, as described in the final concept, was not prototyped. Insights gained in the test of prototype 1, where the basics of the behavior were tested, did indicate that it has the potential to be captivating and explorative for the users. To be able to evaluate the effect of the envisioned behavior, an improved and more realistic prototype should be created, including all of the envisioned interactions as describe in chapter 5.3.

6.2.3 Visual and haptic senses
In this project, I purposely chose to focus on optimizing the visual feedback and interactions of the concept. I can imagine that adding elements like sound or vibration could enrich the interaction with the product. Therefore, I recommend researching the possibilities of adding elements that trigger senses other than the visual, to enrich the sensory and cognitive stimulation that the product provides.
There are a few people who I would like to thank. I could not have completed this project without their help.

I want to thank my supervisory team, Marieke Sonneveld, Gubing Wang and Hester van Zuthem, for their investment in this project. You all were there for me when I needed you for feedback, advice or mental support. It was a pleasure working with you all.

I want to thank Active Cues, and all its employees, for giving me the opportunity to work on this graduation assignment and providing me with a pleasurable work environment. You welcomed me with open arms, which made me feel right at home. It was inspiring to experience your huge motivation and positive company spirit. I wish you all the best for the future!

I want to thank all the nursing homes that welcomed me during this project. In particular, ‘Thebe Lucia’ in Breda, ‘Nijenstede’ in Amersfoort and ‘Die Buytenweye’ in Delft. Without the help of the employees and residents of these nursing homes, I would not have been able to complete this project. I particularly want to thank Tanja Bon, Ineke Biemans and Joyce Foesenek for arranging the nursing home visits, thinking along with my process and providing me with feedback.

Last but not least, I want to thank all people that helped me in some way during this project. My fellow graduate students for the enjoyable lunches and tea breaks and my family and boyfriend, for their mental support and in particular my mom for sharing her professional knowledge as a nursing home care giver.
When putting together what I was looking for in a graduation project, I defined for myself that I wanted something social with a specific, complex user group/context and a bit of playfulness. When reading Active Cues’ assignment, I immediately got excited. It felt like a perfect fit.

This project has been a good challenge for me. I had experience with user centered design, gained through my previous projects and internships, but this project forced me to bring it to a new level. Where I would normally go into the field to interview my target group to discover design opportunities, this was not possible in this project. Not being able to ask your target group what their needs are was a new, yet refreshing, challenge for me.

I discovered that the key to success, when designing for people with dementia is time investment. By taking the time to immerse myself in the lives of these people, through observing and participating in their daily activities, I was able to empathize with the user group and gain insights for possible design opportunities.

At the beginning of this project, I set a goal for myself that I wanted to improve my skills of structuring my research to be able to create a coherent report in the end. I struggled with this throughout the project. In the first few weeks of the project, I was so focused on structuring everything that I sometimes lost contact with the way I naturally gather insights. I consciously reflected on my process along the way. Because of this, I was able to adapt it when needed.

The creation of this report has been an iterative design process in itself. Because of the complex context and user group, that involve lots of dimensions that need to be explained, it was a struggle to create a coherent story. If I would have to start over, I would advice myself to think of the structure of the report a bit earlier on in the process, as I experienced that this helped me to structure my insights and forced me to focus on the core of the project. Still, I was able to discover the core of my project and translate this into a coherent story within this report.

I had my ups and downs along the way, but overall it was a pleasure to work on this project!
Appendices

The appendices of this report can be found in a separate document.

The appendices include the following information:

A. Project brief
B. Attempts of creating a theory about connectedness
C. Explanation of most common symptoms of dementia
D. Field research overview
E. Results of field research
F. Consent forms
G. Results probes study
H. Summarized interpretation of data from the probes study
I. Technical details of all prototypes
J. Test setup and results of each iteration