

# Innovate Dementia

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fig 1. The entire 'Innovate Dementia' group during final exhibition



## THE PROJECT

### **Innovate dementia**

The innovate dementia gave us the opportunity to develop an intelligent lighting systems to influence the mental health of people. The project focuses on lighting solutions to lower the symptoms of dementia, and to support dementing people and their carers in coping with their disease.

The client we worked with is GGZE, a care institution in Eindhoven. We visited GGZE and had the opportunity to co-reflect on our proposal. Next to that, we will contribute to the set-up of a living lab for dementia in Eindhoven, and the definition of ways of working for designing and testing solutions for dementing people and their carers.

### **Design challenges/Research questions**

The objective of this project is to iteratively design a lighting object or an interaction with a system using light to make patients at the GGzE more relaxed or give a fulfilling experience. You will develop in depth knowledge about the

mental effects of lighting systems which can be applied in various other contexts.

Designing solutions for health care environments also requires an understanding of the business context. Typically in healthcare there are multiple stakeholders and indirect business transactions (e.g. through insurance companies or municipal budgets). Therefore, we had to develop a value model that supports a social business case.



## VISION ON DEMENTIA: AT THE START

### Isabelle

The experience I have got with my grandmother who has been diagnosed with Alzheimer's 10 years ago, helped me a lot to identify myself with the patients and their environment. The changes my grandmother went through helped me to envision the individuality of the disease process. I could clearly see the differences in her character and her abilities, whereas these were totally different to those of the other ladies in the elderly home she is living in.

Furthermore I could rely easier with the children who have to execute the hard task of care taking, since I heard all the stories from my uncles and aunts experiencing this. When thinking of a home environment to create possibilities, the image I had of my grandma's home was a good starting point.

### Glenn

Before I started this project I never had any experiences with dementia, I had only read about it. I have one grandmother who recently turned 80 years old. Despite the fact that she started forgetting small things, it could not be named dementia. So I could not bring any personal experiences to the project. All the knowledge and empathy came from other people's stories.

However, During the start of the project my grandmother was telling that she forgets things more and more. I could also notice this because she, for example, keeps repeating questions. Still, she is not diagnosed with dementia, but I am afraid that these are some of the symptoms of the early phase of dementia.

### Oda

My grandfather already has Alzheimer for a long period of time. He is 92 years old. He was diagnosed with Alzheimer when he was 80 years old. I do not remember my grandfather that well before he was diagnosed with Alzheimer. He is now in one of the last stages of Alzheimer, that's why he is staying in a closed nursing home.

Visiting my grandfather is something I really enjoy. It is inspiring to see how my grandfather is seeing the world differently than I am. The things that fascinate him are moving objects, the outdoor living, animals, words, and women. He is a true womanizer. I enjoy being with him, because I forget the busy world around us. We talk about anything and repeat this ten times.

Unfortunately I have also had some unpleasant experiences with dementia. The hardest thing when visiting my grandfather is leaving him. When you are saying goodbye to him he gets suspicious. One time, he grabbed my hand and looked at me with frightened eyes and said: When do you take me away from this place? Nowadays we put him in his chair, turn on the TV, say we are going to put the wheelchair away and that we will come back in a moment. In reality we are leaving. In the meanwhile my grandfather is already focused on the television and forgets us and our visit. This way we can leave him peacefully. This is a moment when I realize how terrible the disease is.

In my opinion you live for yourself and your dearest. When I look at my grandpa, I often wonder for who my grandfather is living. If you have dementia it seems you are living for no one anymore. This terrible side of dementia comes at a further stage and this is the only stage I am familiar with.

### Jeroen

Before this project, I did not have any experience with dementia. I only knew it was about behavioral changes and memory loss. I chose this project to do actual user tests and have more experience with social differences inside a project. But I did not know this group would be protected so much. My vision on the disease was that it was hard for these people to remember new stuff as well as that they would change in terms of behavior. But since I did not have any experience with dementia, it was hard to actually empathize with the target group.

### Pepijn

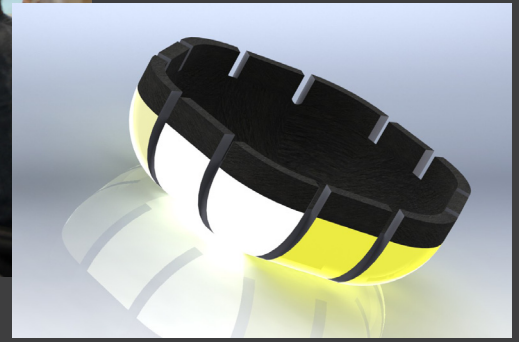
I've worked at an institution for elderly people and in the summer I worked at a company that supplies elderly people with people that clean their homes. During my work I weekly dealt with people who had dementia. So I know a lot about the subject, one thing that I think is very important to know is that there are many different cases of dementia. Something that I found particularly striking was their behavior, on one moment they were very pleased with me while they couldn't stand you a second later. This is due to the fact that they don't have control over their emotions, this is not in every case. It's also pretty difficult to work with people with dementia, you can't really have a conversation with them because they don't know how to answer you. Some people I needed to clean for repeated things they said 100 times for instance without even knowing it.

These experiences really helped me during the project. The experiences make me on one hand motivated because I got the feeling that I could do something to improve their live conditions. while on the other hand I could use my experiences to develop information on the disease and the focus of our project. this made it easier for me to come up with problems.



Fig 2. Pressure Cooker Presentation at GGZE

Fig 3. Result of the pressure cooker: shining fruit bowl



## PRESSURE COOKER

During the first week we needed to go through a pressure cooker with our complete team. At the end of the week we got the task to present our concept to the GGZE.

During this pressure cooker cycle we got stuck in the idea generating cycle. We tried different brainstorm techniques to get inspiration and keep the process interesting, we also used the standard brainstorm techniques which we already knew.

- A method that involves problem solving, we started to think as the user and what their possible problems are in real life. When we had some of these problems we could continue to work on a solution to solve that problem. What we first did with the problems was categorizing them in certain "problem groups". After that we addressed the problem groups this made the process more understandable.
- We used a technique to continue building on a word which displays a normal activity for an elderly person with dementia. With this technique I mean that we started off with one word concerning dementia and continue with that word to create all kinds of weird sentences. The idea behind this process is to trigger people's creative mind and come up with ideas.

After all we got a fairly nice concept: a fruit bowl (fig. 3) that stimulates people with dementia to take certain daily activities. The idea behind the fruit bowl is that it sends out a specific smell, for instance if it's time for the patient to brush his/her teeth it sends out the smell of tooth paste. This smell makes them remind them of this activity and hopefully makes them do the activity. At the side of the fruit bowl we made a light time scale to show them the time of the day and makes them think about the things they planned that day.

Because we wanted to give the GGZE an idea of how our concept should look like Pepijn created a 3d render of the fruit bowl in Solid works. This gave them a better idea of the concept and the story.

During the presentation we got some useful feedback. They told us that sent was one of the first senses that they will get difficulty with. It was rather negative but it's good to know whether your concept works or not. It was a good opportunity to look and listen to the concept of the other group. We also got the opportunity to ask questions to specialist for the first time. We got some useful information and inspiration out of this meeting. They told us about the Alzheimer café which is a meeting for people with dementia, this was a good possibility to come in contact with our target group.

After the presentation at the GGZE we decided that it would be the best to do research on dementia. This research needed to make clear what the problems are that occur with people who suffer from dementia and at what stage of the sickness they happen.

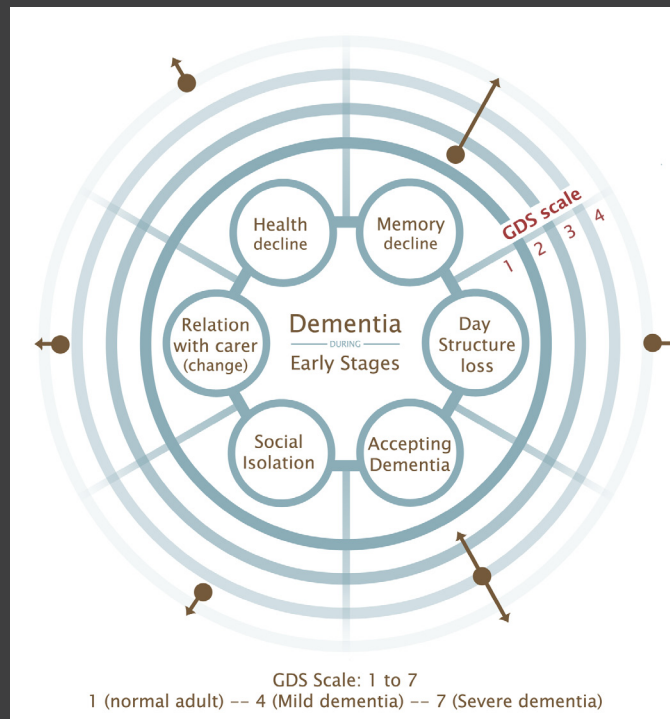


Fig 4. Visual of the symptoms during early stages of dementia

## RESEARCH

### Six themes

In order to find a focus for our project we have done lots of research. Dementia is a disease that is hard to understand. Some of us have some personal experiences with dementia, so they already have a little bit of knowledge of the disease. These experiences are all different because every person with dementia has his own symptoms. That's why it's also hard to design for people with dementia. When you design for someone with dementia you soon exclude certain people that can use your design. Because of the many symptoms a person can have, one product can't be suitable for everyone. We wanted to reach as many persons as possible. More research had to be done on the disease dementia to understand it better in order to make a decision on what kind of focus we were going to choose.

After doing some general research about the disease, we came together and told each other what we found interesting about dementia. We came up with six themes. These themes were topics where we saw design opportunities:

- memory decline,
- day structure,
- accepting disease,
- social isolation,
- relation with care giver,
- health.

### Matrix

We first made a matrix with these themes. This way we were able to see where certain themes overlap. By naming these overlaps, different questions about dementia raised. By this matrix we were capable of doing more profound research. Out of this matrix we got the following topics to do more research on.

- what is meant by the term 'beginning stage'
- light and dementia
- what designs and other resources are there already for people with dementia
- what kind of light therapies are there already
- neurological consequences of dementia

### Beginning stage of dementia

Memory loss is occurring already in the earliest stage of dementia, as only 8% of 388 participants with mild dementia was able to fully succeed memory tests. [1]

The acceptance of the disease is variable. It depends on the other symptoms and the degree of severity. Dementia is an ongoing process, which means the symptoms are getting worse over time. It is hard to cope with ongoing losses instead of just one loss, so it depends on the attitude of the patient.

In early stages of dementia it is not always clear what is going on. The relationship with relatives can be put under stress as well, since there is some insecurity. This can give problems for both sides of the relationship. As the character of the patient might change, this is another event that puts stress on the relationship. This change in character will occur before and during diagnosis, which is mostly at an early stage.

Social isolation happens when there is awareness over the fact that the patient has a serious disease. This happens only if the symptoms cannot be written off as ageing any more. It is still relevant in early stage dementia, but on later terms. [2] [3]

Health decline as well as day structure loss are also relevant, as they depend on the aforementioned symptoms. They both occur in later stages of dementia and are less relevant to our target group.

**Figure 4 displays the symptoms of dementia connected to the stage of dementia.**

By this research, that has been done by Jeroen, we were able to create an image of what the term 'beginning stage' means. We knew now what problems people with dementia in a beginning stage entail. Because our target group will be persons who have dementia in an early stage, who still live at home. Jeroen was the one executing this research.

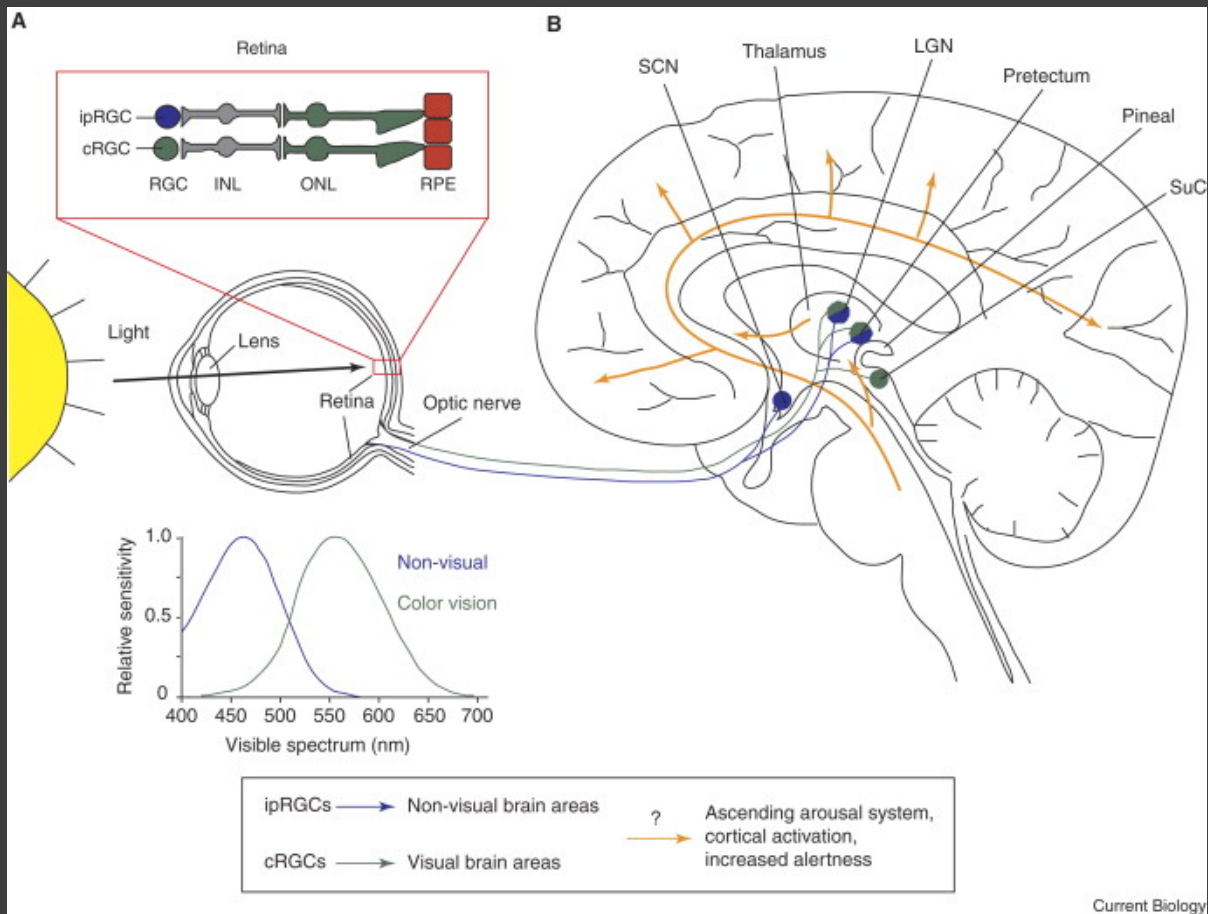


Fig 5. Visual of the effects of light on the brain

#### Light and dementia [4]

A small part of the hypothalamus nucleus suprachiasmaticus (NSC) regulates the circadian rhythm. This rhythm creates the sense of time and links the actions that are attached to this. A dementing person, but also an older person in general, has problems with their circadian rhythm. Certain stages arise earlier, their dinner for example tastes much better in the morning than in the evening. The NSC is responsible for the production of melatonin which is a hormone that creates sleepiness.

The NSC responds to light because the retinal receptors (ipRGC) sends signals to the NSC when they are stimulated by light. The ipRGC are especially sensitive to light with short wavelengths, for us these are observable as green-bluish.

When people get older there is less light transmitted through the eyeball, this ensures that the NSC is less stimulated by an increased light intensity. The degeneration of NSC underlies the disruption of the circadian rhythm. Because indoors the light intensity is lower than outside their rhythm becomes disrupted and they for example go visit the neighbors in the

evening instead of the morning.

Another disturbance of the circadian rhythm is the body temperature that a person has. This body temperature fluctuates throughout the day. Between 4 and 6 hours at night, it is at the lowest temperature and between 12 pm and 6 am the highest. With a disturbance of the NSC, this change is less noticeable and it is therefore difficult to make this distinction between night and day.

After exposure to blue light with a short wavelength the circadian rhythm will be improved, people suffer less of restlessness. Lamps with 1000 lux are better than lamps with 300 lux this ensures a better night's sleep, positive effects on autonomy and degree of depression and disorientation.

The research showed that:

- Reduces the deterioration of the sense of direction by about five percent;
- Takes symptoms of depression by 19 percent;

- 53 percent of the surveyed elderly with dementia were more independently during certain activities;
- Show a positive impact on the day-night rhythm. This can lead to a reduction in the use of medicines.

Through this research we knew more about the effect of light on people with dementia. It has a great impact on them, so we were getting more interested in using this therapy in our design. But we also understood that it would be hard to apply this therapy in our design because all the different requirements need to be applied exactly right to let the therapy be successful. Pepijn was the one who executed this research.

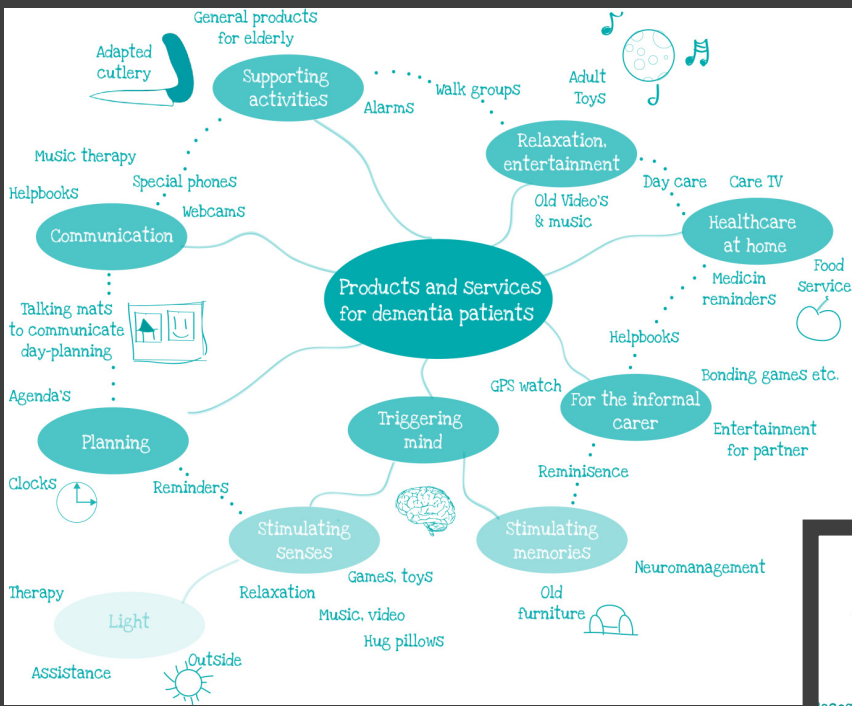


Fig 6. Visualization of the categories of the existing products for dementia

Fig 7. Matrix of the benchmarking

		Health				Recognition	
Health							
Recognition	Reminiscence (e.g. walking in environment) Neuromanagement						
Social Isolation	Communication tools which help socializing. Care at home. (webcam, volunteers)	Calendars & phones with pictures of beloved ones.					
Day Rhythm	Medicin reminders. Light Therapy.	Agenda's, clocks, talking mats.	Day-activities (walking, biking)				
Relationship with Caretaker	Assisting products for the caretaker to prevent fatigue	Communication tools. Reminiscence.	Communication tools. Reminiscence. Shared activities.	Bed sensors. Day rhythm improving products (also assistance for caretaker)			
Acceptation	Information platforms to enable people to be diagnosed in an early stage	Different lifestyle, recognizable homes. (furniture etc.)	Information platforms.	-	Bonding activities, to get used to the new situation.		

**What designs and other resources are there already for people with dementia**

One question we asked ourselves before starting with the research was which products and services already exist for people with Alzheimer. With this information we hoped to get a better insight in which solutions already exist to enable people diagnosed with Alzheimer to live a more durable life. Isabelle was the one executing this research.

Browsing the internet was the first step. Products and services for people with Alzheimer's are displayed on sites with many various purposes, such as providing information, showing innovations, selling a wide range of products for people with Alzheimer only or elderly in general, or showing a possible approach of therapy and the tools they use. (References that have been used for this are: [5], [6], [7], [8], [9] and [10].)

To oversee the wide range of available products we categorized them into seven categories, which are displayed in the mindmap visual in fig 6.

Many of the products and services provided in the categories "supporting activities" and "healthcare at home" are meant for elderly in general, such as dinner services, walking assistance and shower chairs. Whereas the products in the other categories are meant for Alzheimer patients in particular, since they provide assistance and solutions for the main problem areas that are originating from the symptoms of the disease. Such as troubles to communicate, to plan, to remember, to specify emotions and to execute actions.

The categories show a lot of similar characteristics to the six themes we defined as our main interests. That is why we created a matrix in which the products that are especially designed for Alzheimer patients are displayed in relation to the six themes.

We used this knowledge of already existing products and services to gain inspiration, to define possible areas for innovation (by linking the products to problem areas during the brainstorming see the chapter idea generation), and to see what techniques are already being used. This way we knew

for example that daylight therapy is mainly provided by big light installations in nursing homes, rather than at home. The most daylight-lamps that are being sold for individual use are lamps you consciously need to sit in front of. According to us this offers space for innovation. In what kind of elegant way could you integrate the light in the daily environment of people? One of the questions we addressed early during our idea generation phase, and eventually used to create our final concept.



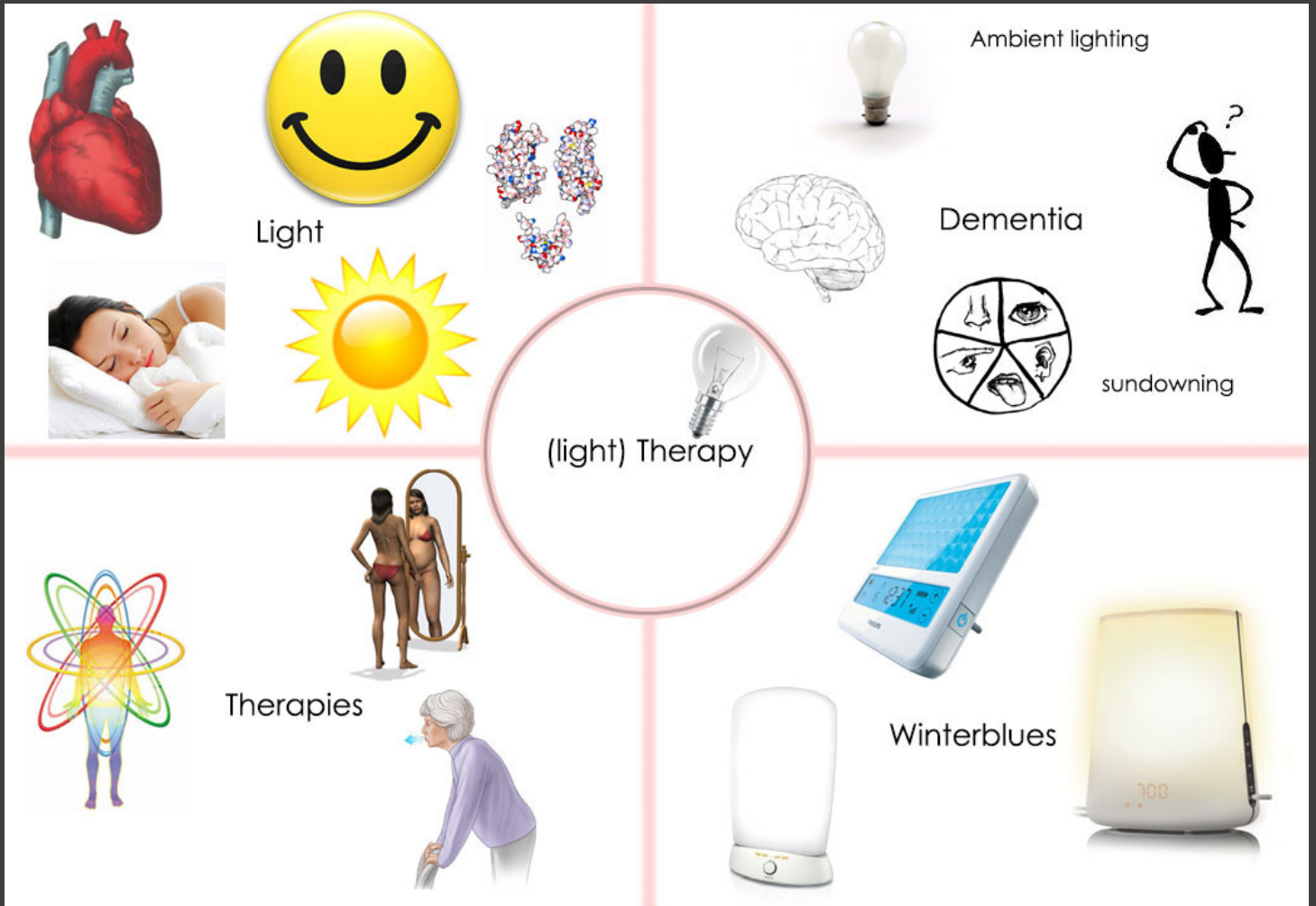


fig 8. Visualization of the different light therapies

**What kind of light therapies are there already**

Research has been done by Glenn, to find information on the different types of (light) therapy. A visualization of this research has been made, to make it more clear the research is divided over 4 different categories; light, dementia, therapies and winter blues.

**Light**

First of all the essence of light therapy has to be clear. Light therapy is used because it has multiple effects:

- A better view
- Better regulation of day and night rhythm
- Better regulating the short and longer term effects, like reducing sleep, reducing depressions, reducing cognitive deterioration.
- Controlling certain body processes like functioning of cardiovascular, hormone secretion, vitamin D production and immune system

- Can influence the breathing of a person (relaxation) but tests aren't certain yet

**Dementia**

Some products have been developed which aim for people with dementia.

These products are based on the fact that a high lighting level (more than 1000 lux) has a positive effect however, this only affects people without visual limitations.

This reduces sun downing, which is a psychological phenomenon associated with increased confusion and restlessness in patients with some form of dementia.

**Therapies**

Light therapy does not only help with dementia.

Despite lack of clinical verification, colored light therapy, or chromatotherapy, has been said to treat various conditions, such as sleep disorders, diabetes, allergies, high blood pressure, and heart and lung problems.

Another unproven therapy can influence the breathing of a person, which can lead to relaxation and it is speculated that light therapy has a positive effect on people with bulimia nervosa.

**Winterblues**

Products like Philips wake-up light and Blue Philips light have a therapeutic value by emitting light. These products are aiming for winter blues specifically.

(References that has been used for this research are [11], [12], [13], [14] and [15] )

This research made clear how the knowledge on light therapy is being applied in products. What is there in the market already and what are their intentions.



Atrophy = dying of ..

Dementia is associated with loss of connections between neurons. They are therefore no longer able to communicate with each other. As the disease progresses, not only do the foothills, but even the entire nerve cell loss. Neurons in our brains, unlike other cells in our body, are no longer able to multiply by division. This has the consequence that once nerve cells that have been lost can not be replaced. The damage caused by the death of nerve cells is irreversible. Patients with severe forms of dementia can lose the volume of their brains of 10 to 15%, this is caused by the loss of connections between neurons and neuronal cell death.

This loss of brain tissue during life can scan techniques are made visible.

The following pictures give you an idea of the extent of atrophy of the brains of dementia:

Grade 1 = normal brains

Grade 2 = moderate dementia

Grade 3 = severe dementia

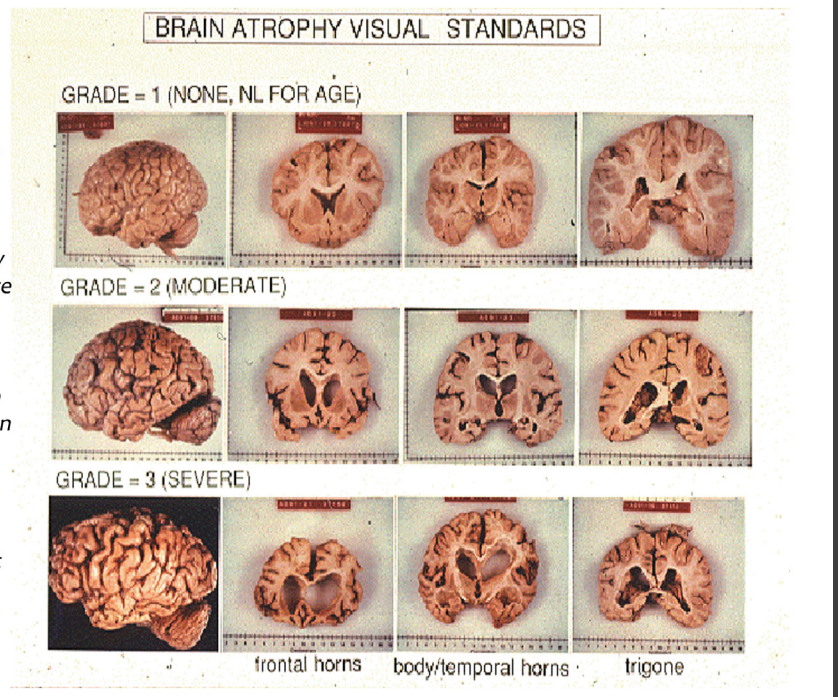


Fig 9. Visualization of the neurological effects of dementia

### Neurological consequences of dementia

Dementia is a disease that is hard to understand. There is still lots of research being done to the source of this disease. When designing for people with dementia, it is off course useful to understand what this disease means, and what it exactly does to the brains. So the task was given to Oda to do more research on this.

In the brains of Alzheimer's patients there are some abnormalities visible: the so-called plaques and tangles. Both of these are proteins. These proteins obstruct the communication between nerve cells, and that affects the mind and memory. It is not said that these plaques and tangles cause Alzheimer, but they do form a risk factor, next to a high blood pressure and high cholesterol.

Dementia is associated with the loss of connections between neurons. They aren't capable anymore to communicate with each other. Therefore the brain activity also reduces. The Alzheimer Centrum in Amsterdam found that several parts

in the brains became slower instead of less activated. They found another remarkable thing, there are areas in the brains which behave contrary regarding the rest. They're very active during rest, and are less active during a task. When the disease progresses several proceedings are harder to execute.

[17] Many persons have this type of dementia, an estimated 200,000 to 300,000 people in the Netherlands with a form of dementia. The causes of dementia often overlap making the total more than 100% is:

- Alzheimer's disease: 70%
- Vascular dementia: 15-20%
- Rare cases of dementia: 15%
  - » Frontotemporal dementia
  - » Dementia in Parkinson
  - » Dementia with Lewy bodies
- Mixed types of dementia (combination of two or more disorders): 15%

- Rest <5%, including:
  - » Creutzfeldt-Jakob
  - » Dementia in Huntington

( Other references that has been used for this research are [16], [18] and [19] )

By researching more on the neurological effects of dementia on the brains, we realized how bad this disease is. You simply lose volume of your brains. The connection between neurons isn't possible anymore and therefore you lose certain proceedings which differ per person. There is still no medicine or other solution against dementia, although it is a disease which affect many person. Only slowing down the disease is possible at the moment.



fig 10. Logo of the Alzheimer Café

### Alzheimer café

Next to doing research on the internet we found it important to get in touch with our target group. During the presentation of our pressure cooker at the GGZE, they told us about the Alzheimer café. This was a meeting opportunity for elderly people who deal with dementia in their environment. The meeting is meant for people to share experiences and ask questions to experts. The people who go to this meeting either have dementia or they're a carer for someone with dementia, but people who are just interested in the subject can take part in the meeting too.

This was a good opportunity to get in contact with people who experience dementia. This could also give us information about people who really experience dementia. There is a lot of information about dementia on the internet but there is nothing more relevant than a conversation with someone who really experiences dementia.

During the two meetings that we attended, we were able to talk with our target group. Here we could confirm the assumptions that we had. We learned about the daily problems they encounter and more about the relationship between care giver and the person with dementia. Some points that were remarkable, the first time we went, were:

- A lot of people were desperately searching for a magical solution, while most of them not even had correct knowledge about the disease and biology in general yet.
- The partners felt very alone, the situation was killing them.
- A lot of Alzheimer patients eat too little and therefore lose a lot of weight. A big problem, because the body is not only getting less healthy, but it is also losing more muscle tissue than fat. Whereas they gain weight again

they gain a lot more fat than muscle tissue.

- Acceptance of the disease is really hard
- The help and information they receive at the moment. Finding the relevant information was hard for the elderly.
- Alzheimer is quite a taboo
- Relation between informal carer and person with dementia is hard, and different than before they are no longer wife and husband for example.
- Non-verbal communication is very important when someone has dementia.
- Regarding the light aspect of our project, there was discussed that light especially helps with behavioral disorders like day-night rhythm.

The second meeting was a special one, because the Alzheimer Café existed for ten years. So it was harder to ask lots of questions to the elderly. We gained new knowledge about their day rhythm and activities they do such as: reading the newspaper or a book, helping around the house, doing groceries, watching TV, having visitors (family, especially grandchildren are beloved, listening to music). We did get a phone number of one couple who we could contact later in our process. This will be further explained in the part User Testing.

## Personas

Still it was hard for us to find a focus in our project. We didn't know who to design for because we wanted to reach as many persons as possible. But how we were going to achieve this was still a question that had to be answered. Therefore we thought of another method: making personas. Everyone made several personas. These personas were totally different. Different age, symptoms, life style, sort of dementia etc. Here you can read one as an illustration of how they looked like:

*For already 39 years Susan and Paul have been living together. They are both now in their early sixties and decided to start somewhat earlier with their retirement after they have been working in the educational sector for a long time. But what they did not expect at first is that something would disturb this period on which they've been looking out for many years. Half a year ago Susan got more and more oblivious. Paul did not know what to think. After a large process of diagnosis Susan has been diagnosed with vascular dementia.*

*Although Paul gets a lot of help from his three sons Jim, Edward and John, he has a hard time taking care for Susan. Not systematically or physically but emotionally. He feels like he lost his beloved wife, when she is actually still there.*

*Both Susan and Paul miss the activities they used to do with their friends. Paul still golfs with a few of them but nice dinners and parties are not possible anymore. Their contact is decreasing, which is also hard to deal with for Paul.*

*Once a week Susan goes to a day care institute so Paul can play golf with his friends. It was a huge step to make but it eventually felt like a relief.*

*With the help of his sons Paul is more than willing to invest in products which will help him and Susan at home. He buys these product on the internet for example: alarms, talking mats, big*

*remotes etc. He also encourages Susan to keep on painting, something she is still able to do in the middle stage of the disease.*

These were the characteristics we chose:

- Teachers in retirement
- Susan: 61 years old, Paul: 64
- Middle stage of vascular dementia
- 3 sons
- Changing relationship
- Investing in products at home
- Hobbies: golf and painting

Unfortunately we weren't able to use these personas like we wanted. The persona's that we made were too detailed and focused on the wrong points of interest. We didn't describe a clinical picture, but our personas contain more ethnographical facts: like the amount of children, hobbies, age etc. They should entail a clear clinical picture so we could form a focus in our project. But with these personas we weren't able to do this. We did use them as examples of the life styles that people with dementia could have and see during which activities they experience problems. We could keep the outcomes of the persona's in mind during the idea generation phase which would be our next phase.



Fig 11. Scrap Prototyping

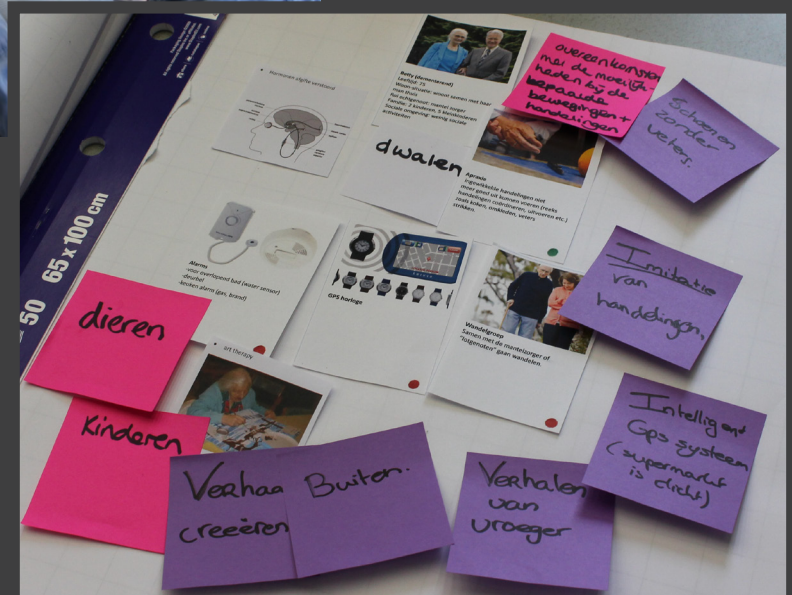


Fig 12. Idea generation using research cards

## IDEA GENERATION

After the research phase we started with the idea generation phase. The start of the process was quite a struggle. We began with individual brainstorms at home in order to be able to discuss our ideas the day after, and to elaborate on them. However this turned out to be harder than we thought it would be. The ideas were all so blank that we could hardly elaborate upon them.

We decided to start scrap prototyping, we collected a big bunch of random objects in order to try to let go and come up with creative ideas. Although we have had a lot fun, this did not result in any ideas either. We could hardly link the objects we created to the subject. The same problem we got when we tried to link characteristics of light with those of dementia in order to create sentences, such as "Shadow enjoys confusion" and many others.

After endless discussions about the reasons of our struggles for coming up with some basic ideas, we decided to choose a

focus. The focus we decided to take was one of the six themes, "health". We hoped that a clear focus would enable us to create more context for ourselves, since we kept on discussing which problem was the most interesting to solve, while we needed to brainstorm and generate ideas.

During the coach meeting on that Friday Cindy discouraged us to do this. According to her we should not immediately choose a focus by heart, but we should try to search for one while brainstorming. We also should incorporate our research in the brainstorms to extent them. The group members we defined as experts in the "Ideas and Concepts" competence should organize these brainstorms the upcoming week. An example could be to make different cards with information gained during the research phase, and to use them during our brainstorms.

### Time pressure

Since the midterm presentation for the coaches and the GGZ was only one week away, we had quite some time pressure to come up with several concepts. That is why we decided

to do four intensive brainstorms the Tuesday after the coach meeting just mentioned. This in order to develop those ideas into concepts, in order for Cindy to see them before the presentation.

The three group members who have had defined "Ideas and Concepts" as their expertise, Glenn, Oda and Isabelle would prepare one brainstorm session each, using a specific technique. Jeroen and Pepijn would make little cards out of the research to be able to create several problem situations that need a solution or support.

### Using the cards

Within this brainstorm we made several combinations of the research cards that have been made about the persona's, the problems the disease causes and the already existing solutions (products and services). The results were person specific solutions. Such as an application that would provide the people information about the symptoms they deal with. Or a device that enables you to imitate several actions, such as brushing your teeth. However this brainstorm also brought





Fig 13. Brainstorm by selecting

many and many other ideas which turned out to be quite useful later on.

#### Benchmarking

For the second brainstorm we categorized all kind of various products on cards into groups to see how they were related, what their characteristics were, and what characteristics could be improved/invented. What intrigued us that a lot of entertainment products were oriented on active relaxation, keeping the mind busy to distract the confused thoughts of the Alzheimer's patient. It was during this brainstorm when we started to see a big opportunity to combine this active relaxation with passive therapy. Next to that we also came up with many other ideas and directions, such as a decision maker, and a machine answering the questions that the patient continues to ask.

#### Brainstorms by selecting

Within five minutes each one of our group should write down or draw the first ideas that pop up in their mind on 5 blank sheets of paper. We needed to put these ideas in the middle, to eventually choose 3 ideas per person we liked the most. Out of those 15 ideas we together selected 5 ideas which were the most appealing to us. One of those was a handle which can be clicked onto various objects in order to help people with aphasia out, this concept we elaborated on later on.

#### Drawing Annie's life

The last brainstorm was one in which we drew the surrounding of a fictive person called Annie, who had been diagnosed with Alzheimer. We drew the city, the street and the house she would live in, and looked at the possible problems she would encounter, geographically, socially, practically etc. We did not gain any more ideas throughout this brainstorm, most probably because there was no clear link with the generation of those, and since it had already been a very long day.

#### Categorize and elaborate

After an intensive day of brainstorming we saw some themes in the ideas we generated. We decided to prepare briefings within these themes for further brainstorms which we could do the next day. The ideas we already created would be a good basis to come up with new ones and to slowly move towards creating concepts. The five themes we decided to make the briefings about were:

- A social community
- Information/help
- Help with a specific action
- Help with daily actions (in general)
- Light therapy

Out of the brainstorms we held around these themes we created and selected 5 ideas, or possible concepts: A moldable lamp, a handle applicable in multiple situations, an information book giving person-specific information about the disease, a cooking club in which 4 Alzheimer's patients eat together each week and a telephone memory which recalls the patient's earlier conversation in order to hold him back in asking the same question over and over again.

#### The next step

During the coach meeting we evaluated the 5 ideas with Cindy. The idea of telephone memory was the one that got the most remarks, concerning the fact we were all afraid the patient would feel fooled and confused hearing his previous conversation. When going through them all we decided it were the cooking club, the moldable lamp and the information book which we found the most potential. This is why we developed those three into concepts to present at the midterm presentation, like will be described in the next chapter.



Fig 14. Moldable lamp in shape of a pillow



Fig 15. The cooking club



Fig 16. Info book

## CONCEPT CREATION AND DEVELOPMENT

The 3 concepts we decided to develop further for the presentation for the GGZE were the cooking club, the moldable lamp and the information book. Pepijn worked out the cooking club, Jeroen and Oda worked on the moldable lamp and Isabelle and Glenn worked on the infobook. We decided to work in small groups/individual to make the concept creation much faster.

The three concepts are as following:

### The cooking club (fig. 15)

The story behind the cooking club is that an informal carer from a dementing patient spends a lot of time to help his dementing partner. This consumes a lot of time and the informal carer doesn't have much time for him/herself. Besides it provokes a lot of stress. We wanted to give the informal carers some time for themselves. On the other hand we want to stimulate dementing people to be active and social.

The cooking club is an organization that organizes a weekly cooking evening for dementing elderly people. Groups will be made with couples consisting out of a dementing patient and an informal carer. Every week one couple organizes the evening and the dementing patients get invited. On this evening the people with dementia cook together with help from the informal carer that organizes the evening. The dishes they make will be original. During this evening the informal carer makes photos of the dishes and the progress of the evening.

The concept allows the informal carer to have one evening quality time every week. The informal carer needs to organize one cooking evening every 5 weeks together with his partner.

After every evening the dementing people need to write a little reflection on what they thought about the food and the evening itself. Because dementing elderly people forget the things they've done or need to do this is a good way to keep the memory of a nice evening.

When every couple organized an evening the group comes together along with all the pictures and short writings. They share experiences on this evening and make a collage from the stories and pictures.

We make use of the audience of the Alzheimer café, they're already in contact with a lot of dementing couples. We as organization put an advertisement on the website of the Alzheimer café. We also want to distribute a folder on the Alzheimer café evenings, in these folders they can read experiences from other people which might make them enthusiastic. We only want to make use of the audience of the Alzheimer café and don't put too much pressure on the organization of this event.

### Info book (fig. 16)

The meaning behind the info book is to replace all the information folders the informal carers get from the care institutions. During the Alzheimer café evening we noticed that the informal carer has difficulty to find specific information about dementia because they got too much folders which creates chaos.

The info book is some kind of e-reader. The informal carer can look for specific information about dementia on a digital book. The information displayed in the info book is based on the profile of the dementing partner from the informal carer. Together with the case manager they make a profile about the dementing patient and only upload the needed information on the info book. This reduces the given information and only shows the beneficial information. Elderly people have

difficulty with operating complex products, The interface of the info book needs to be really easy and clear to understand. This will facilitate the navigation.

### Moldable lamp (fig. 14)

Dementing elderly people lose their ability to sense more and more. This makes them unaware of their surroundings and the world they live in. This is very frustrating for themselves because they don't have any grip on reality. An effect of this is that they try to create stimuli themselves by screaming or by pinching themselves. This causes a lot of stress which we wanted to for come. One inspiring example that we found in the book "Hersenschimmen" from Bernlef is this quote: "Walk, I need to stand up and walk. Then it will go away, the feeling of being absent under full awareness, the feeling of getting lost, I don't know how to call this feeling, which apparently can be provoked by the most simple objects". [34]

Therefore we designed a moldable lamp. This object is a big pillow which can be used to abreact their stress on. This lamp isn't a static object, it does something when people interact with it. The lamp sends out signals which give the dementing a hint to use it and become active. This lamp has a daylight inside which exposes the dementing people to light therapy. By doing an activity they get daylight therapy indirect which also has a positive effect on the ability to sense.



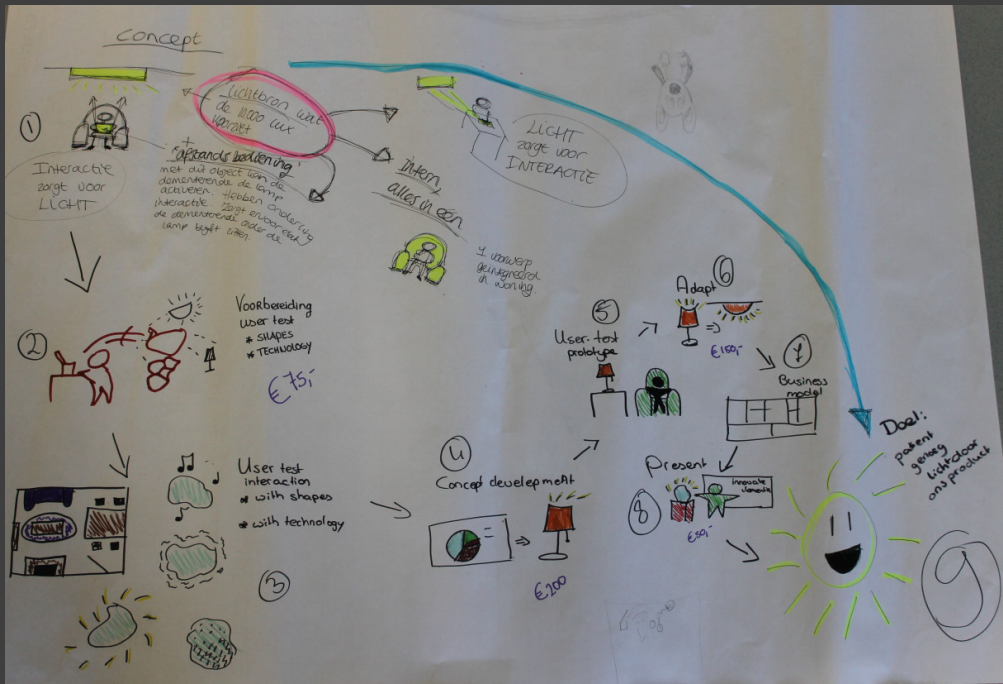


Fig 17. The sheet used to start a discussion about our future process

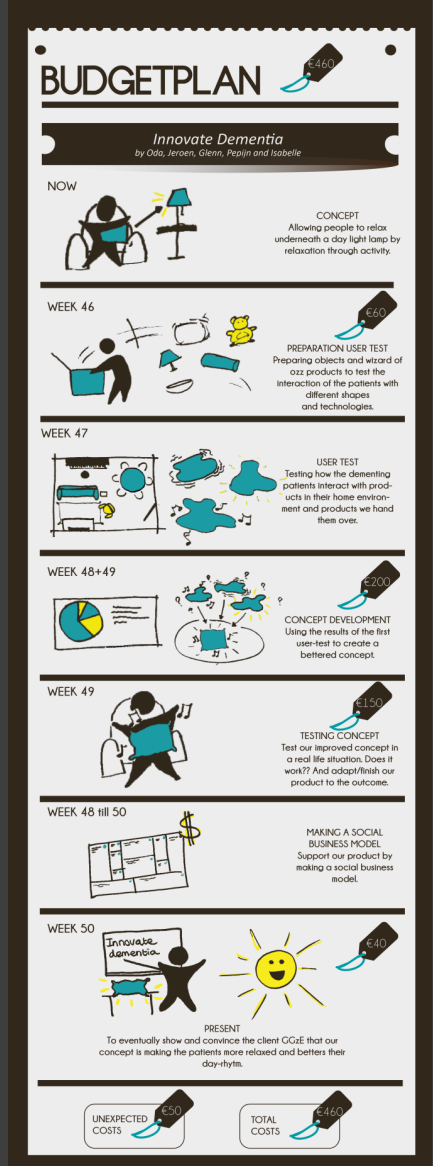


Fig 18. Budgetplan by Pepijn, Oda, Jeroen, Glenn en Isabelle. Drawings: Oda. Graphics: Isabelle.

## BUDGET PLAN

Innovate Dementia is an international research project, of which the research team at the TU/e is an important part. They're currently trying to set up the so called "Living Lab" [20] in which they will be able to test prototypes. Since they would like to see if our concepts and prototypes will be appropriate to test in these Living Lab's, we had the privilege to send in a request for financial support.

Together with Geert Langereis , expert in the competency Descriptive and Mathematical Modelling, we discussed how we could construct a valuable budget plan to send in. He recommended us to make a model, preferably an infographic, in which we would describe our plan.

We decided to make a planning for the rest of the year, so we would be able to assign costs to the different stages. First we discussed the future process that we had in mind. Underneath this paragraph you can see the sheet we used to start the discussion.

We decided we wanted to do two user-tests, an explorative test and one testing the assumptions of our concept by testing the prototype itself. In between these two user tests we planned to develop our concept. This we will examine in the second user test, from which the results will be used to make some final adjustments.

Abpve this page in fig 18. you can see the visualization of our budget plan. Next to this we delivered a document in which we verified the several steps. These are the key points from that document (Appendix 1):

- For the first form study we estimated to spend around 60,-. We will spend this money to buy and construct objects which we will ask the patients to interact with. This will help us get information about the way our target group interacts with certain shapes and technologies.

- For our concept development we estimate to use around 200,-. This is a big expense point because we expect the technologic parts such as the daylight lamps to be rather expensive.
- After testing our concept we might need to improve and adapt our concept for our final exhibition. For these final improvements and adaptations, where the costs are mostly unknown as we need to determine these steps, we would reserve €150.
- For our final exhibition we need around €40. This amount of money is reserved for the required supportive products to deliver a high quality presentation to our client the GGzE.

After a discussion about the budget plans the coaches came to the conclusion that no one was far enough to deliver a concrete plan. However they were content that some people had delivered a description of their process with specific estimated costs. This is why our request has been accepted, with a maximum budget of 500 euro.



Fig 18 Meeting with Harm van Essen



Fig 19. Testing model we used during the talking group session

## USER EXPLORATION

After these presentations, we carried on in the design process. At 27 November, eight people were invited to visit the GGzE for a user exploration with the concepts all the teams were developing. There would be a talking group for dementing people where we could join in. In preparation, a questionnaire has been made, for each of the visitors of the talking group to fill in. This questionnaire would be aimed at finding answers regarding the aspects of our book stand. The questionnaire can be found in the appendix (2).

After arriving at location, the care professional that would lead the talking group was pretty surprised by the amount of students. She thought that eight students was too much for their clients to process and it would be confusing for them. Only two of the eight people were allowed to come. Jeroen was the only one from the project group who was able to join.

Once the talking group started, it soon became clear that the wrong preparations were made. First of all, the concepts

were too vague for the dementing clients to understand.

After having explained the concept repeatedly, most of the people understood the concept, but were not able to answer our questions accurately. Besides, one of the talking group members found it hard to imagine what we wanted after all, and spoke out his objections against this discussion. He thought that the prototypes were not finished enough to show to this group. Since it was a group conversation, many other members agreed in an instant with this prominent speaker.

It is true that because of the wrong preparations we were not able to effectively gather information. The concepts were too vague, as the artifacts that Jeroen was able to bring along were not defining enough for the concept. Besides, there was no actual example of bright light in this case.

After that, there was looked for an alternative to this user exploration. Input from an exploration would define the concept further. For advice there was talked to Harm van Essen. He advised us to not just try to find everything out by research or try to make decisions based on this research. We

are designers after all, and need to take assumptions for which we design. This does not mean there should not be tested at all, but just not for things that can as well be assumed. Harm advised us to test it later on instead of to determine it by testing it. One objection was that the results of the test might be disappointing, which would still bring the project nowhere.

Besides, Wina Smeenk was asked for advice on what to do next concerning empathic designing. We had some questions concerning the concept and the fact that she has more experience with dementing people would maybe help us already. She advised us to take a more specific situation by making a scenario and that it may help to design for perhaps just one person. Because we were focused on light so much, we should first find the qualities that the light has in favor of the concept, as well as what properties the specific situation of the user has that we can mean something for. We had to make assumptions on our own, but that it would be important to test and prove these in context. We should make clear for ourselves what criteria our concept has to fulfill at two levels: at level of the user and of the technology.

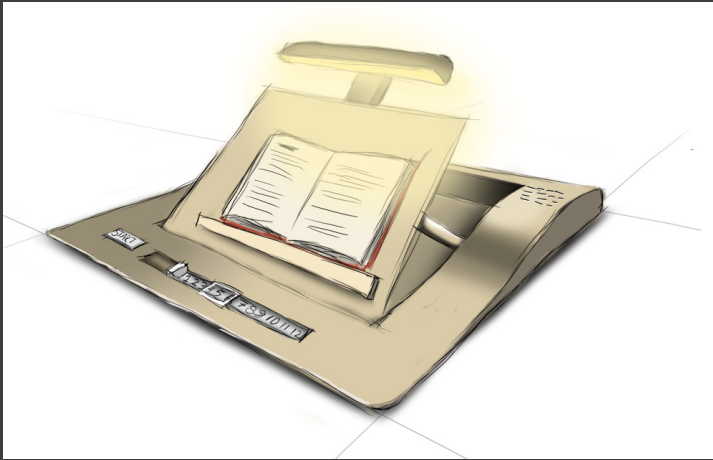


Fig 20. Visualization of the bookstand, an example of the concept

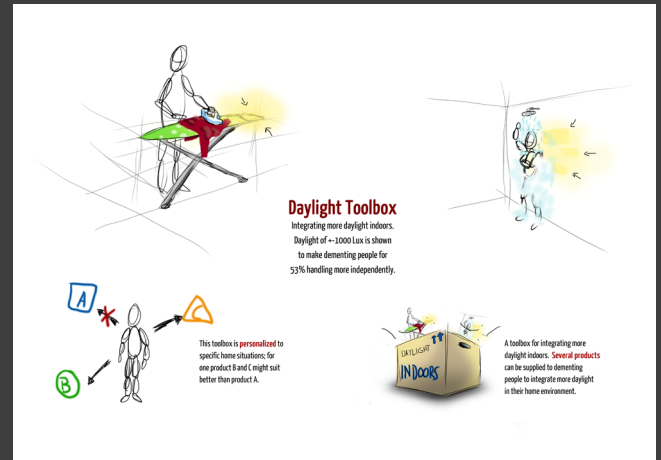


Fig 21. Visualization of the final concept the 'daylight toolbox'

## FINAL CONCEPT AND ITS DEVELOPMENT

The final concept that was chosen, was the moldable lamp. Deciding upon continuing with this concept, we had to change its definition. It would need to have a different shape, and for making this concept more meaningful we decided it had to be in a shape of an object of use. This redefined our concept. Instead of keeping the temper and emotions in a safe state, we now wanted to support the target group with a daily activity. We also wanted to use the benefits of daylight, because this was really the strongest part of the concept.

The diversity of lives is large, and we wanted to choose an object of use that would be the best choice for our concept. An universal daylight kit was another option, which meant being able to "stick" daylight to anything inside the house. After a brainstorm, some ideas were generated. Those were daylight-tiles, daylight-strips that could be attached to a table, an interaction plaid, curtains that would emit the light they took up during the day. We made a list of requirements for our concept, to find out which ideas would suit our requirements the best.

Criteria and purposes:

- The light has to directly come into the eyes.
- An intensity of at least 1000 Lux at eye-level has to be reached for at least 3 hours a day.
- The light needs to be full-spectrum, and come close to daylight.
- Preferably it has to be a big surface, this would decrease the diffusion.
- The concept should assist in daily activities, which would mean that people could longer be independent on various tasks.

- The activities must suit in the daily lives of the target group already, nothing new has to be introduced.

We would choose the idea that would fulfill most of these criteria and purposes. Would people be for instance able to carry on with a task for about 3 hours? Would the light intensity make the size of the object too big or would it fit?

Shortly after, we found it hard to determine some of these criteria, because we knew only little about the context. We made scenarios of what the dementing people would actually do at home, and besides we visited Alzheimer Café for inspiration for the scenario we were making. Over there we were told about personal experiences with the disease, but also about life would be rearranged with the disease. This gave more insight into what would be the best persona for us to make.

Then a persona was made, where we included specific symptoms of dementia for a person, the living situation, hobbies and difficulties in the person's life. This scenario was inspired by the conversations we had at the Alzheimer Café. The persona can be found in the appendix (3). It enabled us to design for a specific situation. Though we thought the situation was a bit shallow, as it was made up by ourselves. Besides, the problem was that all of the objects of use could potentially fit for the persona we made.

Looking back at the daylight kit, the idea of making the daylight therapy universal to a wide range of daily activities was more suitable for us. The therapy is universal in itself, so making a universal concept for the therapy would bring us further than just trying to choose one situation. The concept evolved into a range of objects of use that can be supplied to the target group, where specific products would be applicable for a specific situation. But because of the range, a wider audience would be covered.

Then we had to figure out what we would work out. Making a business model would be the job of just one person, spreading the effort would require picking one specific example to work out. This would also make the concept more concrete and would give us the ability to perform user tests, to iterate and investigate other aspects of the concept that are context-related. From the persona we made, we chose to work out an enjoyable daily activity, which many dementing people seemed to do: reading books.

Up next was defining our concept further, by dividing all the tasks like making the prototype, testing the assumptions this concept was based on and find out how to place the lighting, what is the most comfortable or best position etc.

We divided the tasks as following:

- Jeroen would be responsible for the user testing;
- Pepijn would be responsible for the form of our design;
- Glenn would be responsible for defining the toolbox;
- Isabelle would be responsible for the business model;
- Oda would be responsible for the light aspect in our design.

In the next chapter all the individual parts will be explained and eventually these parts will form our final design that is described in the chapter.



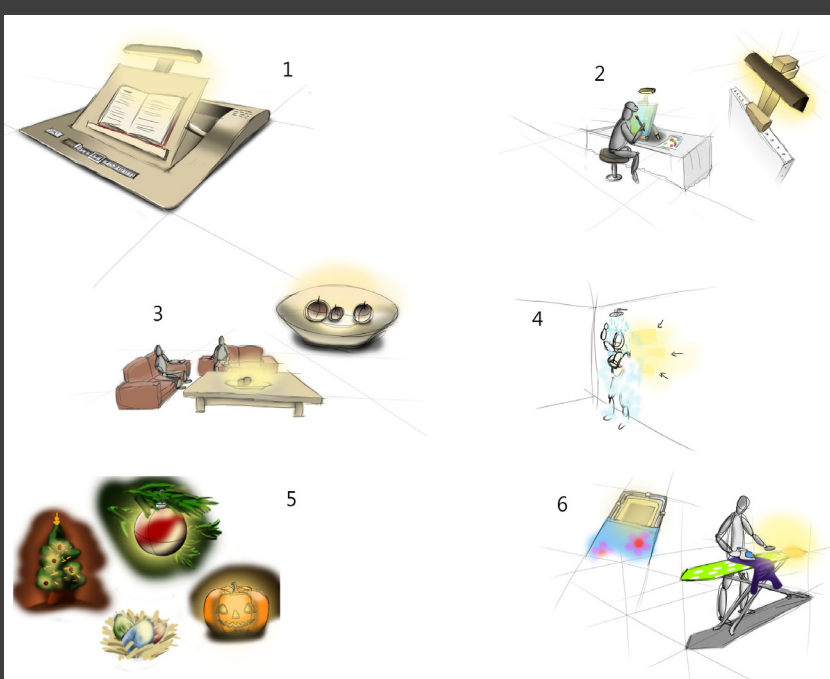


Fig 22. Visualization of utensils in the toolbox

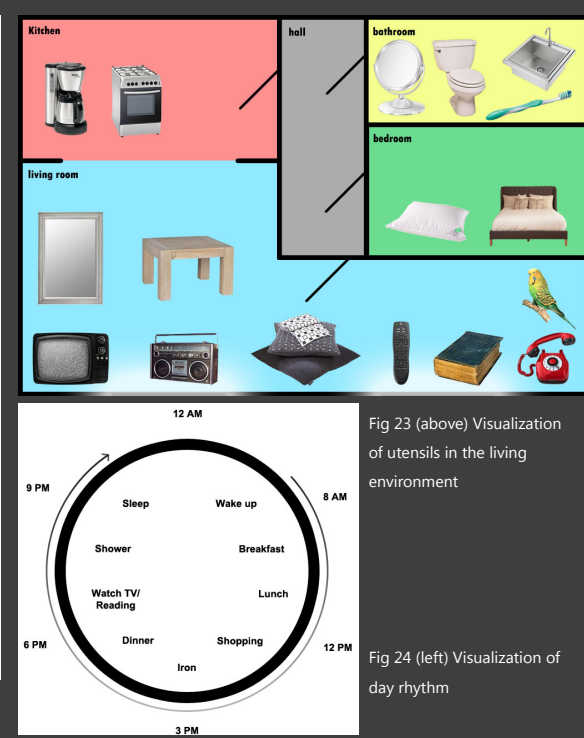


Fig 23 (above) Visualization of utensils in the living environment

Fig 24 (left) Visualization of day rhythm

## INDIVIDUAL PARTS - TOOLBOX CONCEPT

The toolkit contains a series of utensils that can be assembled by the dementing person together with the informal carer and the case manager who assists them. One of the reasons for choosing the daylight toolbox concept is that the user can assemble a personal package of products. Each person has his or her own personality, habits, daily activities etc. These are all influenced differently by the disease.

Therefore, there has been chosen to collect more information about the lifestyle and life environment of elderly.

### Research/Daily activities of elderly

By making the personas we learned that the border between healthy elderly and elderly with dementia is thin. Elderly with dementia (mostly) like the same things as they did when they were healthy.

To learn more about the daily life of elderly the team asked their grandparents and acquaintances what they did during the day. Also, we tried to gain more knowledge about this during the conversations at the Alzheimer café. Based on the results that were given a visualization of an average day has been made.

Next to that a list of objects that are placed in an average home together with a floor plan of an elderly home has been made. This list of objects can be found in appendix (4). By visualizing the list of objects and day schedule some products stood out that are used daily and which fit in our toolbox concept. So the gained knowledge about the target group helped with picking the right products which we want to integrate within the daylight toolbox and also validate these choices.

### Toolbox

New knowledge about the daily activities of elderly was gained and the next step was to pick out the most general ones. These were worked out in the toolbox daylight concept. The utensils have to provide a daily amount of daylight (1000 lux). Next to that, each utensil supports the activity itself (fig 22)

#### 1. Bookstand

The daylight bookstand supports the activity itself, by providing enough light. Next to that it also contributes to the needed daily amount of lux.

#### 2. Painting easel

The painting easel supports the activity itself by providing enough light, but also contributes to the daily needed amount of lux.

#### 3. Decoration plate

The decoration tray supports activities like serving food and drinks or just serves the right amount of light while sitting in the living room. Additionally, it provides the required 1000 Lux.

#### 4. Daylight tile

The daylight tile is a tile which can be placed at any place on the wall at any place in the house, but above all at the kitchen and bathroom. This way the tile supports the activities at these kitchen and at the bathroom like brushing teeth.

#### 5. Seasonal daylight products

We also want to offer seasonal products like Christmas balls, Easter eggs and pumpkins in which daylight is integrated. These products are only applicable for a couple of weeks each year, but might make it easier to talk about dementia.

#### 6. Daylight ironing board

The ironing board contributes to the daily need amount of lux. Also, the light supports the activity itself by improving the sight.

### Impact on society

Research to the underlying principle of our product shows that the functional behavior declines slower by the rate of 53% when exposed to daylight for more than 3 hours a day. Deeper information about this data can be found at the research to light chapter. At the moment health care lets people stay at home as long as possible, because putting all the elderly in an elderly home is too expensive and, next to that, there is only limited space in elderly homes. So we designed a series of products that responds to this by connecting the aforementioned research to the home situation. This product namely makes the people with dementia live independently at home for a longer time. The society stays more in touch with the family of the dementing person.

### Impact on health care, health insurances

Because aging causes dementia in general and in this society people on average get older, the health insurances get more and more dementia patients. This is one of the reasons why we want to make the time at home as enjoyable as possible, and delay the moment they have to go to an elderly home. It is more profitable for either this elderly home and the dementing person. For the health care this concept means less occupation by people with dementia, what makes the health care less burdened. For the dementing person it means less costs, as the care institutions are quite expensive.

### Close environmental impact

Our products have an impact on dementing people and their caregivers for multiple reasons. Firstly, By using our products, people with dementia can live at home for a longer period of time. Secondly, our products help people with independently performing an action. Research shows that many informal caregivers get socially isolated (Schoenmakers e.a., 2002b). By our products the informal caregiver can for example meet with friends or perform a hobby.

Value Proposition		Payment	
The Toolbox, a product	Multiple products at the same time	Finance (by insurance) or cash	Pay each month
Tangible products	Durable	Fixed price	All customers pay for entire offering
Broad range of products	Consumer use	Pay for the value extracted	Toolbox: one time purchase summary: bait&hook
Customised package, different products per person	Focus on value and quality of life	Rent system	Pay tangible

Delivery	
Direct delivery	Pre-mediated purchase
Heavily supported to purchase	At traditional location, home care store
Toolbox purchased once summary frequently	Multiple channels
Always deliverable	Only in Netherlands
Value on long-term and short-term	Niche market, people with dementia

Fig 25. Definition of the value proposition, payment and delivery

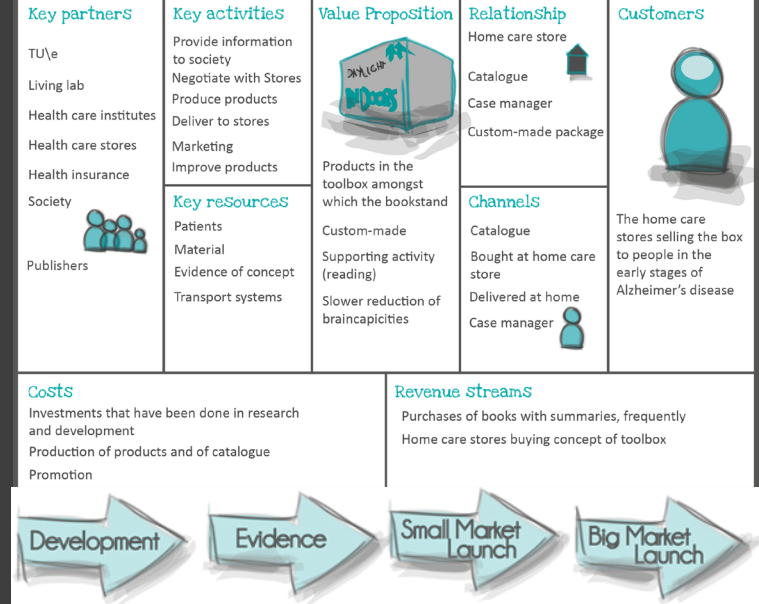


Fig 26. Business model canvas

## SOCIAL BUSINESS MODEL

One of the deliverables of the project was a social business model. This chapter describes what the idea is behind the model Isabelle has made.

### A welfare state

There is a big gap between the innovations that are being made by the market and the innovations healthcare so desperately needs. One of the reasons is the fact that it is very hard to implement new innovations within healthcare. Like Drs. Jan Thie says in a talk about the gap between healthcare and business: "There are scientifically proven innovations which are both effective and efficient, but those cannot be implemented easily in other regions or contexts." (translated from Dutch) [21]

That is why this business model is built around the idea that for the sake of the –fast– implementation it would be the best if you ask other institutions to sell, promote, inform and deliver the innovation throughout their network –which has already been build up for years–, in trade of the honor of the innovation and other advantages such as money.

### Defining the value proposition

In order to start creating the model the concept had to be defined more specifically. By answering the questions in the book "Innovation Design" by Elke den Ouden [32] it became clear in what the offering –value proposition– is for the customer, who is able to pay for the costs of the product and in what way it is being delivered. Within the image with the three rectangles you can see the specific definitions.

### Steps for the future

In order to be able to start selling the toolbox several steps should be taken. First of all the products need to be developed. In order to do this, co-creation with dementia

patients and the other stakeholders of the business model would be required, by integrating knowledge out of multiple fields. [33] The living lab would be a great opportunity to do this. During this development it is also important to collect evidence, that your concept is working out the way it should do.

Like Elke den Ouden states in her book "Innovation Design": "For transformational innovations, the uncertainties are unlikely to be low enough to plan full-scale market introduction(...).In these cases another scenario is a limited market launch." A limited market launch would be a great opportunity to develop the products, and the evidence to such an extent that you could have a big market launch relatively fast. The pace of the implementation of the product within the market is very important with the current speed of innovation in society. These steps should help speeding up the process.

### The Business model

The idea is the following, we sell the concept of the toolbox to home care stores. The Alzheimer's patients can assemble their package over their or online together with their case manager. Since the case managers are the closest to the patients of all stakeholders in healthcare it is critically important that they get information about the toolbox and its advantages so they will feel the need to recommend the product.

The patients can rent the package so it won't cost them a fortune, which is important since most elderly people do not like and are not able to spent much money. Next to that the costs are being suppressed by the money invested by health insurances in the development. Of course this is a hypothetical statement, but the biggest health insurance companies are more than willing to invest in innovations which will eventually suppress the total costs for society. [22] What we need is to persuade them and/or other parties is solid evidence that we will collect during the development of the product, and

especially during the limited marked launch as mentioned before.

What we as initiators need to do is to make sure that both the health insurance companies as the home care stores are persuaded to support our concept. Next to that we need to produce and deliver the toolboxes to the stores. And we should guide the home care stores with setting up the entire plan.

We will earn money by selling the idea to the stores, getting funds from the health insurances and by getting money from the book summaries that keep on being sold. The patients can buy these books via the catalogue that will be delivered once upon a time.

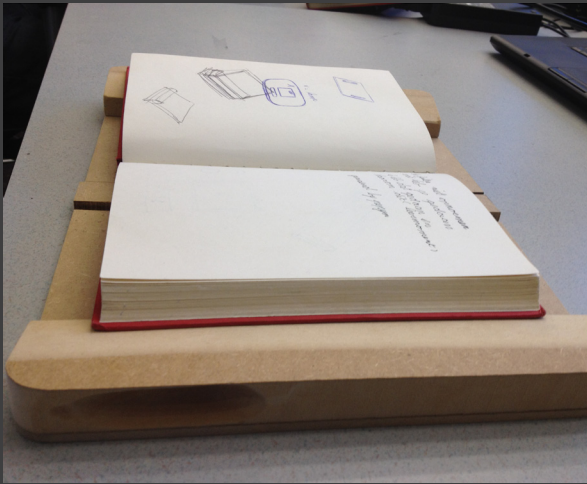


Fig 27. Prototype of first idea

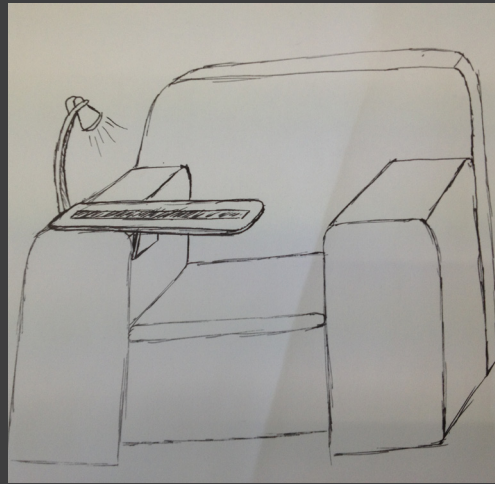


Fig 28. Drawing of second idea



Fig 29. Final prototype

## SHAPE STUDIES

For this project we decided that we wanted to make a product that supports reading by exposing the patients to daylight through a lamp. For the shape of our product Pepijn started by sketching and looking on the internet for possible places where dementing people read their book. Besides he looked how he could make a product that fits in that specific place. The objective was that the shape supports the dementing elderly people with using the book and making the necessary actions while reading a book easier. Regarding those actions one could think of holding the book, folding the paper etc. After the research and exploring by sketching, Pepijn developed some ideas regarding the shape.

The idea behind the first form study iteration was to test the extent of which the product supports reading. By testing multiple options and multiple ideas, there could be tested which one is the best. There were two ideas:

### First idea: hard cover around the cover with extra grips

The first idea was to create a cover that could fit around a regular book. The hard cover makes it able to attach grips to the book which makes it easier to hold. The big advantage of keeping the concept small in size is that it is very portable. The extent in which the grips support handling the book would be tested. The grips were attachable to the cover with Velcro, and variable in position. Thus different positions could be tested.

Integrating daylight into this shape was a challenge. The light had to be close to the book in order to be effective, which could make reading difficult. A possibility is to attach the light to the shape with arms. The arms could be quite heavy and voluminous, which makes it harder to use. As a conclusion, we chose to place the book on a static surface instead.

From his experiences, Pepijn knows that people with dementia

spend their days sitting in a comfortable armchair. Through exploring by sketching, Pepijn found that a product which would allow people to read in their armchair.

### Second idea: chairback support/ lap table

The chair back support was meant to rest on the chair back and used as a table. On that table we placed a regular book stand which could hold the book in place. The advantage of the chair back support over the hard cover was that the user does not need to hold the book and the lighting could be added to the product without making it harder to use.

The chairback support stimulates people to stay in their relax fauteuil, while we want to stimulate them to be more active. So we decided to think in another direction which also made the patients sit in a more active position. This would improve the concentration of the patients and therefore the possibility to read. Pepijn continued sketching and researching for existing reading assistants. He found inspiration in old desks and bankers lamps. These artifacts could make the concept easier to understand, as the dementing people already know this type of products.

### Final concept: book holder placemat

By sketching, Pepijn developed a shape in the form of a placemat with an embedded book holder. This placemat created an opportunity to design a surface like an old desk. The placemat allows the reader to use the platform for multiple activities like spelling games or reading the paper. The first shape iteration of wood was meant for implementation of functions and for the user test. The looks weren't so important as long as it would function. When this iteration was finished Pepijn worked together with Oda to find the optimal position of the daylight, which shouldn't disturb the activity but on the other hand expose the reader to enough light. We came to the conclusion that the light would function the best if it came in from above the book, so that it would fall in the eyes

of the reader but also on the book, when they read the book the focus is primarily on the book and the light wouldn't be a disturbing factor.

During the user test we got the feedback that the light needed to be a little higher. This would light the book more equally which makes the reading easier, and would disturb the reading activity to a lesser extent. Critical thinking about the shape resulted in integrating the bankers lamp in the book holder. An advantage of this was that the old fashioned style of the bankers lamp came out better. The feedback from the coach was that it should be a little bigger so that you could also for instance read a newspaper on it. She also said that the working prototype looked a little bit like a time machine. This was definitely not the intention of the looks of the prototype, as it should look old fashioned and familiar. The feedback from these two moments was included in the creation of the last iteration to give people a real idea of the looks of our concept. In this final concept Pepijn used wood to create a nice wood pattern from an old style desk.





Fig 30. Study various types of lamps



Fig 31. Measuring light intensity

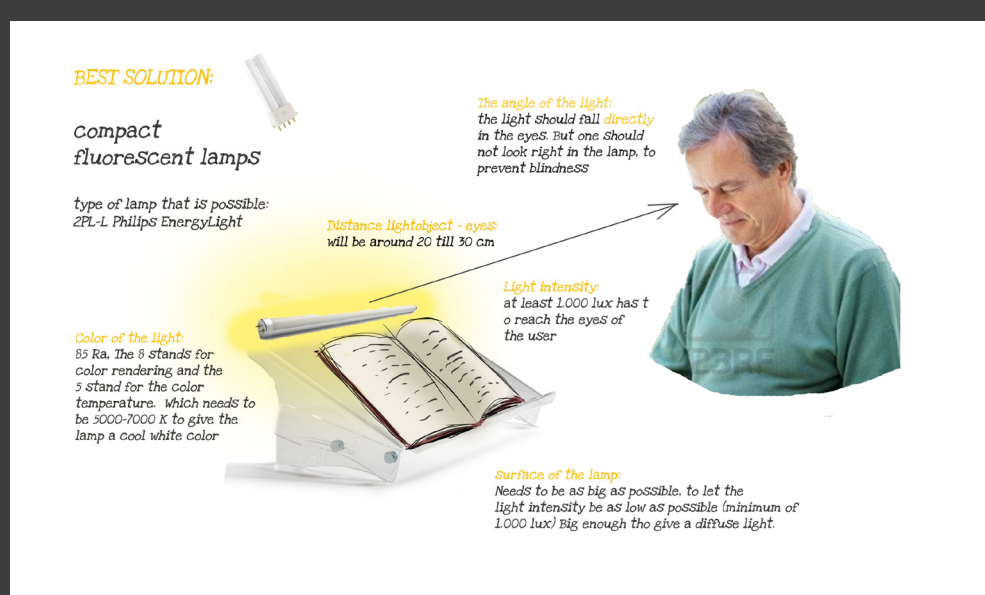


Fig 32. Visualization of the choice of lighting

## IMPLEMENTING DAYLIGHT

### The influence of light

The light was an essential part in the project. Our concept is built on all the investigations that has been done on the therapeutic effects of light on people with dementia. There is still plenty of research that is being done to clarify the duration of therapy, the brightness, the color of the light etc. Oda therefore made a summary of all these different investigation to find a focus for our project to get a certain grip on how we should implement the light therapy in our design. The comparison of the different studies about light therapy is visualized in a schedule, which can be found in the appendix (5) References [23] till [31]

We use light in our product, but what exactly is the effect of this light? First the light has a visual value. People with dementia are often elderly people (65 +), and the eyes of an older person are rapidly deteriorating. There are several features of the eyes that damage, which has the effect that the accommodation power of the lens decreases. There will be a high probability of scattering of light in the eye which eventually reduces the amount of light that reaches the retina. This eventually leads to less sight. By a worse vision, activities such as reading, cooking and writing are getting difficult to execute, and some activities may also lead to dangerous situations like falling and tripping. All this can be prevented by aids such as glasses or contact lenses. A higher brightness indoors is also recommended.

Besides these visual value, light also has a non-visual values. Light helps to control certain body processes, such as hormone levels, body temperature, alertness, day rhythm, mood and performance. How this all works biological is pretty difficult to explain, but it will be shortly described here:

A small core in the brains, the suprachiasmatic nucleus (SCN), forms the biological clock. This biological clock is stimulated by the so-called light-sensitive rod cone cells, and these control the various processes in the body that may have a circadian rhythm. These cells are light-sensitive so the more

light they get the better they can control these various processes.

### Intensity of the light

But what light do we use in our product? Because we have several products involved in the provision of daylight we would like to decrease the brightness of the light therapy lamps that we often see now. These lamps often have a brightness of 1.000 lux. We have chosen to let at least 1.000 lux reach the eyes. This amount of lux comes from the study of Eus van Someren which we took as the main information source. He said: It would be nice if people would receive 1.000 lux at their most common places. But because we have different products, we will also have to change the brightness of the lamp. The amount of lux that reaches the eye, depends on multiple factors. Because all these factors differ per product the brightness of the light needs to adjusted to this. When for example the distance increases, the number of lux quadratic reduces. So you will need a higher brightness to let 1.000 lux reach the eyes.

### Duration of therapy

The duration of therapy across multiple products will be approximately 3 hours spread over the whole day. This is an estimation, made through studying the different articles. This could not be tested as it was not feasible

### Corner of RAID, distance and position of light

It is important that the light enters the eyes directly, but one should not look directly into the light. The position of the lamp is therefore of great importance. During the test we had placed the lamp lower, closer to the book. In this way the top was well exposed to the light but at the bottom side of the book it wasn't that well lit. Next to this people found the light brightness too high, and the light shined too much directly in the eyes. We therefore chose to place the light of the book stand slightly higher, so that the light is distributed over the book, and that the light will shine diagonally from above into the eyes. Different studies said that the lamp would have to be placed above the eyes, or at the side. So the position we eventually used in the product suffice to this.

### The color of the light

The color of the light is also important. In order to simulate daylight we have a high Color Rendering Index, needed. A CRI of at least 85 is required. Incandescent lamps have the highest CRI value of nearly 100.

The spectral composition does not affect the visual performance like reading (Eperjesi 2007). The spectral composition and the color rendering is of influence when it is important to be able to recognize colors. A lamp with good color rendering (Ra least 85) will support in distinguishing colors, which is useful with taking medication but also perform a hobby such as painting.

A lamp that is enriched in the short-wave (blue) portion of the spectrum, will contribute to compensate the yellowing of the lens. A result of yellowing of the lens is that there is less blue light entering the eye, and this causes sleep disturbances. Blue light actually influences the normal sleep cycle because it is involved in the production of melatonin in the brains. The hormone melatonin tells the body when it is sleepy or just be alert.

Older people often have a preference for warm white (2700K) lamps or lighting that covers the full spectrum (Kolanowski, 1990). So that's why we use full spectrum light in our book stand, because they often have a preference for this. But for an other product that is in the toolbox, like the painter's easel, a more bluer light is more appropriate to use, to stimulate distinguishing the colors.

### Lamps used in prototype book stand (fig 32)

The lamps that we have used are compact fluorescent lamps. With the lux meter we measured the amount of lux. And we measured an amount of lux just above 1000 lux that reached the eyes. Once the distance or angle slightly changes, the amount of lux varies enormously. The amount of lux that is already there in the room (because of the sun) plays also a big role in the amount of lux and the contrast. When it is dark the lamp seems much brighter than if you're already sitting in a well lit room. The lamps cover the full spectrum.



Fig 33. Setting up the usertest, Jeroen



Fig 34. Analysing the results, Oda



Fig 35. Setup usertest

## USER TESTING THE CONCEPT

### User Focus

Our target group is dementing people. All in all, it is hard to get and stay in touch with these people. We tried to get in touch with this group by visiting Alzheimer Café as well as contacting care institutions. With varying results.

For example, a caregiving wife of a dementing man we met at Alzheimer Café had to decline last minute for a co-creation session with us, as her husband did not want her to make appointments concerning his disease behind his back. Besides, contacting the care institutions was not always fruitful. Most were reluctant or denying access to their clients. It is understandable, since this target group is fragile and requires a more protective attitude from its caregivers. But this made it harder to design, as the target group was pretty distant during the process. In the end, we still managed to hold a co-reflection session about our prototype.

### User Research Approaches and Findings

As described above, the target group was approached in different ways. For gaining input and insights into the disease, and how it could influence our design, there were multiple meetings with care professionals from the project client. Throughout the design process these inputs and insights were taken into account for more suitable designs. For example, we formed 6 themes that we found interesting or important. These themes were based on shared insights from care professionals. We also based some research on these themes, which makes the project have a certain empathic approach. The diagram for these themes can be found in the appendix. This diagram made us realize what problems are the most important to tackle for our specific target group. The themes can be found in the appendix, and are part of the research that is described earlier in this report.

We also had a co-reflection planned with a talking group for dementing people, but it turned out only two people were allowed to attend. So Jeroen volunteered, and showed some artifacts. This resulted in criticism, as it was not clear what the concept was about. Because for co-reflection it is critical to make the outsiders have a clear vision on the concept, we could not even start reflecting on the concept. The only outcome was when they are reading, the dementing tend to forget what the story is about.

For feedback on the setup of a user test, there has been spoken to Harm van Essen, a coach at TU/e and expert at user centered design, and Rens Brankaert, a master student at TU/e who has done a similar project. They gave feedback for improving the user test. The final setup was a co-reflection, because of the information we wanted to gather. A co-reflection enabled us to gain more qualitative insights and input, whereas an actual user test would be more about quantitative information. The questions we liked to be answered with the test would better be answered with qualitative input. For us it was important to just talk to the target group and see how they perceived the concept and worked with the prototype. That made us choose for a co-reflection.

The goal was to find out if the assumptions we took were correct. Because of a more tangible prototype, we could actually get insights from the target group. They clearly understood what the concept was about, and were able to give insights in some aspects of the concept that helped us pretty much with developing this concept.

A certain setup has been made beforehand, which can be found in the appendix (6). This setup was not entirely followed. We had to alter it after we had a session with the first participant. The setup took too much time, as reading an entire chapter (see the setup in the appendix) would take too long.

The purpose of that was to record how long the participant reads with or without a directly facing daylight. But this setup would not fit in the available time, approximately 20 minutes.

The co-reflection led to some helpful insights:

- The bright light (at eye-level 1000 Lux) is not annoying for this target group, however, it would be more comfortable if placed higher.
- The summary is a great idea. The participants liked this solution, in order to keep hold of the story of the book.
- The interface for this summary was easy enough to handle for the participants on first glance. After explanation they easily understood how the interface worked.
- Something that stood out during the co-reflection, was that the posture of the participants while reading with the bookstand improved greatly over the posture while reading without the bookstand.

The results of the co-reflection have been written down. This can be found in the appendix (7). With these results we improved our concept. The most important outcome for the prototype was the fact that the light had to be adjustable and positioned higher, so reading could be more comfortable.

For the concept it was important that the assumptions were validated. We had to find out whether the summary was a good idea, as well as the book stand itself and the bright light. It all turned out to be okay, which is of course the desired result.

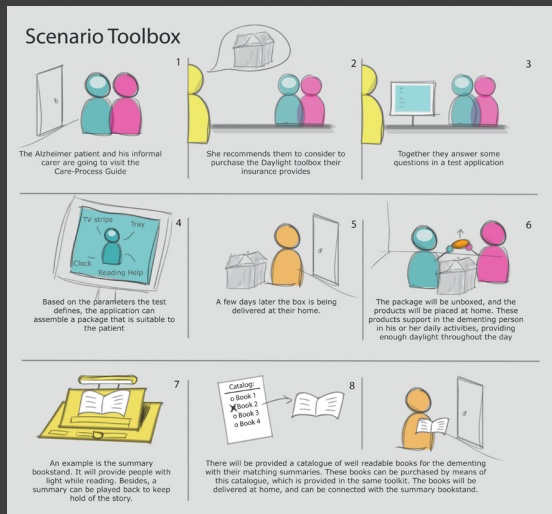


Fig 36. Visualization of the scenario

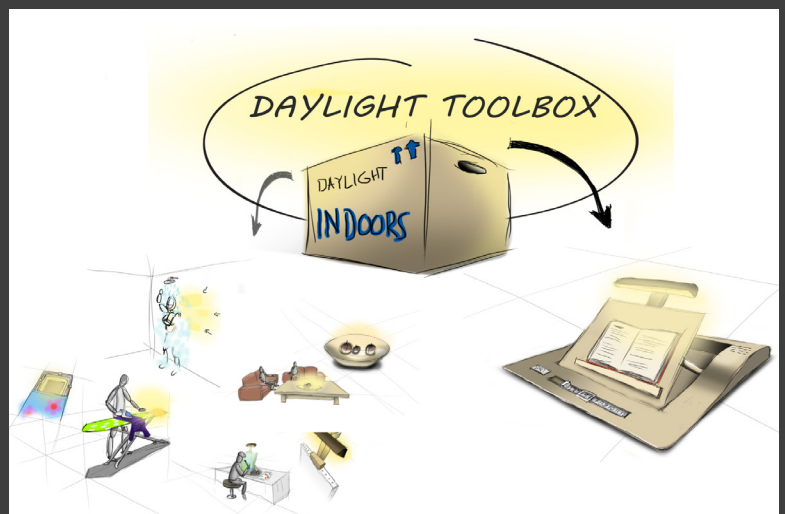


Fig 37. Visualization of the final design the daylight toolbox

## FINAL DESIGN

Our final concept is already introduced in the previous chapters but of our final design will be explained more clear in this chapter to form a total image. Our design is called the 'daylight toolbox'. The idea of the daylight toolbox is that people with dementia can choose different products from the toolbox that provides them of enough 'daylight' during the day. A selection of these products will offer them enough light which contributes to their wellbeing because of its therapeutic operation and it also supports them to perform certain activities they enjoy. The idea behind the toolbox was that we could reach a wider target group. Because the disease dementia is really personal it is hard to design for specific people with dementia. By providing a large amount of products there will always be a product that is suitable for the user. People can select daily activities they enjoy, and choose the right product with this. This has two advantages:

- First of all it gives the product more value. Because people will see it as a personal package. They select the products by themselves. It will feel more like a personal product, although lots of other people would use the same product. But the assembly is personal.
- Secondly, by providing products that support activities they like, they will definitely use the product and hopefully for a longer period of time. This way the therapeutic effects will be greater. The more light they receive the better the effects of the therapeutic operation.

To illustrate what the toolbox could entail we came up with some examples for products like a decoration tray, a painter's easel, an ironing board or a book stand. The last product, a book stand, was elaborated on further to clarify the concept.

The motivation behind the book stand, was that lots of people

enjoy reading. But dementia makes reading more difficult, due to visual impairments as well as disease-related difficulties. By providing them of more light, people with dementia will stay more focused and it is easier for them to see the contrast of the letters. But the main reason why they don't read anymore is because they forget the story. This is an important point of interest to design for, otherwise they won't use the book stand. So to trigger the people to start reading again we thought of giving a short summary about what they have read before. They get a little refresher of what they have read. This helps them to understand the relations and characters in the book again so they can continue reading.

But how are we going to achieve this audio summary?

The idea is that people can select several books they like, from a catalogue that is supplied with the book standard. These books in the catalogue suffice to special requirements, which means that:

- The story must be contemporary and needs to be told in chronological order.
- The story must not contain too many characters (max. 4).
- The language must be simple and there should not be too long sentences.
- The content must be recognizable (no exotic story, just an ordinary story).
- The book should not be too thick, preferable with short chapters.

All these books that suffice to these needs, contain a chip.

The book standard can recognize the chip of the books and connects the right summaries to this. Then it is up to the user to select the summary of the chapter he or she would like to hear.

To make this selection, the control panel on the book standard has to be used. This control panel should be designed as simple as possible. We decided to let this selection consist out of two simple steps.

People first have to choose the right chapter of which summary they would like to hear, and secondly press 'start', to start the summary. We tested this control panel and the people thought that it was understandable. They are able to perform this task without any help of their partner or caretaker.

To clarify the whole picture of this service (toolbox) and the bookstand we made a scenario, shown in fig 36 and also in appendix 8.

### Our product briefly:

We aim for a bigger independence of the person with dementia, so they can perform enjoyable activities more independently and for a longer period of time. The goal eventually will be that the people can stay longer, more independently and more pleasantly at home.

By enlarging the independence of the person with dementia we will also give a little more freedom to the informal carer, who is often the partner. The informal carer doesn't need to guide the person with dementia with the activity, and doesn't need to worry about dangerous situations that could arise or that the house will be a mess.

We support the activity by providing light. This light has a visual value, so the activity is getting easier to execute. Besides, the light also has a non-visual value which will be the therapeutic effects.

By presenting multiple products it will contain something for everyone.

## VISION ON DEMENTIA: AT THE END

During the project we all learned more about dementia, and its impact on society. This was not only because of the research we did, but also because we got in contact with our target group.

We visited the Alzheimer café, which is an monthly event for people with dementia, their informal caregivers and everybody who is interested in dementia. At the Alzheimer café we spoke with people who suffer from dementia, what had a different impact on our vision on dementia.

At "Background with dementia" we explained what our experiences with dementia were before we started this project. This chapter explains how our vision changed during the project.

### Isabelle

Alzheimer can be called a losing-of-self, because of this it is a very person-specific disease. Although there are a lot of general symptoms, not everyone has the same ones. Losses occur in different order and different measure. While one may hear worse from the very beginning, the other might not lose his hearing before he dies. Next to that the patients and their environment all react differently to the scenario. The couple I have met in the Alzheimer café may not have accepted the disease three years after the diagnose while another couple could accept it after a year.

My vision is that acceptance as a care-giver or as a patient in an early phase can only come when you accept the person –yourself- to be as he is in this moment, without comparing to the past or the future. Only in this way you cannot be disappointed by the loss or afraid for a possible one. You will need to live in the present, and need to embrace the feelings you have at that moment. As a designer it has been my goal to relief and entertain the Alzheimer patient within this moment, to make the best out of their lives.

### Glenn

When I started this project I did not know what an impact dementia can have. It does not only involve the dementia patient, but their whole environment. It influences the social lives of all the patient's relatives and friends. As I already mentioned, my grandmother's memory has deteriorated while the project proceeded. I look different to my grandmother now. Even the most normal daily activities will become harder. I realize that this disease can be closer than I thought.

As regards the meetings at the Alzheimer café, it seemed to me that the couple I spoke with are still having a good time

and enjoy the things of life. The man still had a sense of humor and could also make some jokes about his disease. However, everybody will deal with these situations in a different way. As the woman at the Alzheimer café already said: it is hard to be patient. They are confronted with the disease daily, and this is not always easy. Her husband accepts it and tries to live with it, but there will be people who find it harder to accept and try to hide it. Dementia is a slow and hard process that changes people's life forever.

Dementia has a great societal impact. That's why I believe that the life of people who deal with Alzheimer's disease should be made as easy as possible. I believe that when their lives are made easier, they will enjoy the positive things of life more. Helping those people with living independently for a longer period of time is a great drive to design for.

### Oda

You wouldn't say so but there is also a beautiful side on dementia. Like one couple described at the Alzheimer Café that they are enjoying activities like watching a movie much more than they used to. The man used to be a pessimistic, grumpy person but since he has dementia his character changed into a more friendlier person. They are enjoying the little things more at the moment itself and cling to the feeling they got out of this moment. This is also what my vision is about. I would like to support this joyful moments by responding on them immediately, and make it stronger with my designs. Supporting people with dementia in the daily tasks they enjoy, in order to let them enjoy it even more and longer than they normally do.

During the visits at the Alzheimer café and the attempts we did to arrange a user test or co-creation I found out that the people who have dementia are being really protected by their care givers. By care givers I mean their partners, but also the care givers who work in the health care sector. I understand this protection but sometimes I think it also limits the independence of the patient. My opinion is that they are still able to make certain decisions, and that they are still able to perform certain activities. But we have to support them in these moments. And try things out before saying that it isn't possible.

It is a terrible disease but with this project I hope that people start to focus on the positive moments of someone with dementia instead of anticipating on the negative moments.

### Jeroen

Before this project, I did not have any experience with dementia. I only knew it was about behavioral changes and memory loss. I chose this project to do actual user tests and

have more experience with social differences inside a project. But I did not know this group would be protected so much. My vision on the disease was that it was hard for these people to remember new stuff as well as that they would change in terms of behavior.

My vision on the disease of dementia as of now, is that it is a disease very hard to cope with. But since it progresses slowly and one is confronted with losses all the time, it doesn't mean life cannot be enjoyed anymore. I learned a lot about what the disease means to the people involved with it, and what they try to make it as durable and long-lasting as possible. Just because it is progressing so slowly, life during this fatal disease is sometimes enjoyed to the most, as they try to see it from the bright side.

From last time I learned that the changes in the lives of people are very hard, but that's why they try to adapt their lives to it line by line. I saw that this is a disease one starts to live with, just like diabetes, but then possibly more confronting. One has to accept to live with it the rest of their lives, and the sooner one accepts it, the more durable life is even with the disease.

My vision was changed to such an extent that I placed myself into the situation of these people. I learned that it is very hard to live with and very confusing. I learned to look at the target group from a different perspective, and adapted mine to that. The assumed ease of testing was false, and that was hard for me to accept. User focus was my main goal this semester, so I had to and still have to find alternatives.

### Pepijn

During the project I tried to shape dementia in different stages, I noticed that this was very hard because every patient who suffers from dementia has other symptoms. The project was very interesting for me because I dealt with a lot of people with dementia during my work. This project gave me the opportunity to do research on the experiences I had and why and how dementia works. The project also made me aware of different care institutions and certain methods to help the patients.

The organization of the user test showed to me the vulnerability of our user group. They're really suspicious and careful with contacting. They also found it hard to help halfway in the project because they don't understand it when you test a half-finished prototype to them to test with, they didn't for instance understand my book with Velcro. This made the possibility to do a user test very complicated.

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 Published: 1984

## Persons who we consulted

Elke den Ouden, expert in Business Innovation Design

Geert Langereis, expert Descriptive and Mathematical Modeling

Harm van Essen, expert User Focus & Perspective

Jacob Alkema, expert in Light and Material

Rens Brankaert, expert in the project 'Innovate Dementia'

Wina Smeenk, expert of the disease dementia, and User-Centered Design



# 1 THE BUDGETPLAN

## BUDGETPLAN

€460

### Innovate Dementia

by Oda, Jeroen, Glenn, Pepijn and Isabelle

NOW



**CONCEPT**  
Allowing people to relax underneath a day light lamp by relaxation through activity.

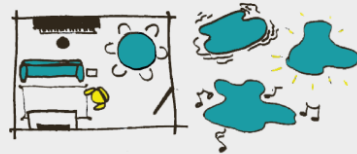
WEEK 46



**PREPARATION USER TEST**  
Preparing objects and wizard of ozz products to test the interaction of the patients with different shapes and technologies.

€60

WEEK 47



**USER TEST**  
Testing how the dementing patients interact with products in their home environment and products we hand them over.

WEEK 48+49



**CONCEPT DEVELOPMENT**  
Using the results of the first user-test to create a bettered concept.

€200

WEEK 49



**TESTING CONCEPT**  
Test our improved concept in a real life situation. Does it work?? And adapt/finish our product to the outcome.

€150

WEEK 48 till 50



**MAKING A SOCIAL BUSINESS MODEL**  
Support our product by making a social business model.

WEEK 50



**PRESENT**

To eventually show and convince the client GGzE that our concept is making the patients more relaxed and betters their day-rhythm.

€40

UNEXPECTED COSTS

€50

TOTAL COSTS

€460



The exploration was to gain insight into how dementing people would look to our concept, as well as how they would experience it. The questionnaire would have been handed out in Dutch, but for documentation purposes, has been made in English.

First introduce. Who are we, who are they?

- Do you read often?
  - » How does reading go for you? Do you experience any problems while reading?
  - » Did you read frequently in the past? (If not anymore) Why don't you read anymore, are there any reasons that made you stop reading?
- What would you think of making reading easier for you?
- How would you feel about a handgrip attached to the book you are reading?
  - » Now test different positions of the handgrip
- What do you think about a daylightlamp that faces you (hold the lamp, facing the person)
  - » Now test different positions of the light: what is the best/most comfortable position?
- What would you think of listening to a narrative soundtrack while reading? Would you like to try it out?
  - » If yes, start playing back the narrative soundtrack, and hand over the matching book (chapter 2)

Our concept is a bookstand that would make it easier to read. Besides that, we would like to integrate daylight in it, which has a therapeutic value.

What do you think of combining all the aforementioned things (the handgrip, the daylight and the narrative soundtrack) into one product, namely our concept?

## 2

### USER EXPLORATION AT DEMENTIA TALKING GROUP



**Bert has Alzheimer's disease**

**Bert.**  
76 years old.

**Work.**  
Retired, used to work as a representative for DAF.

**Characteristics.**  
Puts himself in social isolation,  
Used to have a lot of humor,  
Reticent  
Considerate  
Sweet

**Hobbies.**  
Plays billiards at a café around the corner.  
Likes to watch television.  
Reads the newspaper every day.

**Emmy is caretaker and wife**

**Emmy.**  
72 years old.

**Work.**  
Retired, used to work as a cleaner.

**Hobbies.**  
Swimming (has a knee injury), Play cards with neighbors.

**Characteristics.**  
Stubborn, Always a helping hand, Likes to talk with people.

3  
THE FINAL SPECIFIC PERSONA FOR  
DEFINING A DESIGN PROBLEM

**Living room:**

- Telephone
- Television (with remote)
- Radio (with remote)
- Pillows
- Paintings
- Coffee table
- Blankets (plaid)
- Table
- Chairs
- Bank
- Easy chair
- Ceiling lamp
- Plafond lampen
- Clock
- Dresser
- Carpet
- Stairs
- Plant
- Candles
- Frames
- Vases
- Plates
- Baskets

**Kitchen:**

- Stove
- Coffee machine
- Refrigerator
- Dish washer
- Microwave
- Oven
- Timer
- Cutlery
- China
  - » Glasses
  - » Dishes
  - » Cups
  - » Bowls
  - » Etagère
  - » Tray
  - » Pot
  - » Pan

**Bedroom:**

- Bed
- Pillow
- Nightstand
- Alarm clock
- Wardrobe
- Lights

**Bathroom:**

- Sink
- Mirror
- Tooth brush
- Toilet
- Shower
- Towel
- Dryer

**Study room:**

- Writing desk
- Chair
- Lamp
- Bookcase
- Radio

**Other:**

- Ironing board

**All spaces:**

- Mirrors
- Doors
- Windows
- Ceilings
- Food
- Floor
- Walls

# 4

A LIST OF OBJECT IN THE LIVING ENVIRONMENT OF ELDERLY WHICH COULD BE OF USE FOR THE CONCEPT

# 5

## COMPARISON OF MULTIPLE RESEARCH ARTICLES ON LIGHT

### Comparison of multiple studies on light therapy

<p>TNO: Inventarisatie en vastlegging van de state-of-art kennis over licht en ouderen onderzoek</p>	<p><a href="http://www.limosof-lichttherapie.nl/lichttherapie-1.html">http://www.limosof-lichttherapie.nl/lichttherapie-1.html</a></p>	<p><a href="http://www.lichttherapie-webshop.nl/informatie/vragen_lichttherapie_algemeen/">http://www.lichttherapie-webshop.nl/informatie/vragen_lichttherapie_algemeen/</a></p>	<p><a href="http://www.leenwiki.nl/Wat_is_lichttherapie">http://www.leenwiki.nl/Wat_is_lichttherapie</a></p>	<p><a href="http://www.goodlife.nl/inzicht-en-lichttherapie">http://www.goodlife.nl/inzicht-en-lichttherapie</a></p>	<p>Eva Van Someren <a href="http://lichttherapieblog.nl/professor-eus-van-someren/">http://lichttherapieblog.nl/professor-eus-van-someren/</a></p>	<p><a href="http://www.psycheducation.org/depression/LightTherapy.htm">http://www.psycheducation.org/depression/LightTherapy.htm</a></p>
<p><b>Brightness</b></p> <p>1500 lux till 4000 lux needed for an activity as reading.</p>	<p>Light therapy requires a light intensity of 2500 to 10 000 Lux. Not every lamp that produces bright and intensive light, such as a halogen lamp, is suitable for light therapy.</p>	<p>A light therapy lamp emits between 2,500 and 10,000 lux and helps to increase the light absorption in the darker months</p>	<p>To get a sufficient light therapy session it would take 30 to 60 minutes for a lamp with 10,000 lux</p>	<p>10,000 lux proved most effective to result in a useful life of 20-30 minutes. Insights teach us that a lower light output also can be very effective, provided that light focuses on the most effective wavelength.</p>	<p>It would be nice if you are in the neighborhood of thousand lux comes, at the places where you spend the most time</p>	
<p><b>Duration therapy</b></p> <p>biological light stimulus: bright white light reaches the eye 3000 lux should be for a minimum of 2 hours per day.</p>			<p>30 - 60 minutes</p>	<p>a duration of 20 - 30 minutes</p>	<p>if older people spend all day in a thousand lux, they are better off than others who with two or three hundred lux.</p>	
<p><b>Color light</b></p> <p>Older people often prefer warm white lights. A lamp with good color rendering (Ra least 85) will support in distinguishing colors positive. A lamp that is enriched in the short-wave (blue) portion of the spectrum, will contribute to the yellowing of the lens to compensate.</p>				<p>The most effective wavelength (462 nanometers) in the blue spectrum may become as much as 10 times more effective than other wavelengths of light.</p>	<p>CRI must be as high as possible. Color: There are many indications that the biological clock is stimulated by blue light. But blue is not perceived as a nice light. Blue also has other effects: for example, your pupil squeezes together. Then, less light will reach the eyes. It is considered more pleasant if you have ten units blue light and gives you fill it with the rest of the color spectrum</p>	
<p><b>Distance eye - lamp</b></p>				<p>In many, 10 000-lux light therapy lamps that use fluorescent lamps, the useful life is 40 centimeters distance from the face 60 minutes and at 60 inches even 120 minutes. A good 10,000 lux lamp also at arm's length 10,000 lux making everyday life at this distance just 15-20 minutes.</p>		<p>It turns out you need use a light box positioned above your eyes, so that the light hits the bottom of your retina not very far away though: one foot for the big right, and 6 inches for the little white box</p>



The main purpose of this user test is to find out how people feel like when reading under a daylight lamp. This will be tested by measuring the time a dementing person takes to read a chapter under the lamp compared to how long the person reads a chapter without this lamp. Besides, we want to test whether the summary works out the way it is supposed to work out.

The user test will be executed in the following order, following the steps as described below:

- Two people will lead this session:
  - » Person #1 will lead the conversation, will ask the questions for the co-creation
  - » Person #2 will write down quantitative facts, the timespan of the reading sessions, the profile of the participant, summaries of answers to the co-reflection questions
- First a consent form will be presented. In it will stand what the test is about, what our concept is and what we would like to test. Besides, we will say what we will use the data for.
- Then there is asked permission to record the test with sound. Besides, there is asked for taking anonymous pictures where the face is not visible. There should also be given the chance to opt out of recording the sound once they approved on this.
- Then the test commences, and the recording starts. First the participant is asked to read the first chapter of the book, without the light and the bookstand. The timespan will be for comparison whether reading with the light has a positive or negative effect on reading.
- After reading this first chapter, the prototype will be presented, and the summary-functionality will be explained. Per functionality will be asked what the participant thinks of it. Some questions (the original questions were asked in Dutch):
  - » Do you face any problems while reading?
  - » What do you think of the book stand?
  - » How do you feel about the light that is facing you while reading? Do you think it's too bright?
  - » Do you think the summary would help when you're reading?
- After that, the summary will be "programmed and played", Wizard-of-Oz style. And there will be asked some questions about the way the summary is "programmed" (the original questions were asked in Dutch).
  - » What do you think about the way you have to program the summary? Do you think you can remember the procedure?

## 6

### USER TEST SETUP

Then, the lamp will be turned on, and the book will be read from chapter 1 on for the same amount of pages. Once again, the time will be measured, and the behavior will be monitored. This will be material for comparison. After this reading session, some more questions will be asked.

- What do you think of reading under this lamp? Did it distract you, or didn't it have any side-effect on you while reading?
  - » Would you find it more comfortable when there would be a lamp that is less bright?
  - » How would you feel about a brighter lamp?
- The result of this user test will be input on the concept, as well as quantitative information about reading under the lamp.

MR. SELDER	BEGIN STAGE
<p><b>Without lamp</b></p> <ul style="list-style-type: none"> <li>• Book in hands, leaning on the table;</li> <li>• Somewhat normal distance from eyes to book;</li> <li>• Did not like the contrast of the letters, the page was too dark (not really well-lit);</li> <li>• Reads at home with a lamp, mostly newspapers;</li> </ul>	<p><b>With lamp:</b></p> <ul style="list-style-type: none"> <li>• The upper half of the page was much better lit than the lower half;</li> <li>• Takes a little getting used to, but works fine;</li> <li>• Letters have a much better contrast;</li> <li>• The light on the paper was fine, but the direct light was a bit too bright. Putting the lamp higher might be better;</li> </ul>
MR. VAN DE LEIJ	MODERATELY ADVANCED STAGE
<p><b>Without lamp:</b></p> <ul style="list-style-type: none"> <li>• Book laid on the table (hands under the table);</li> <li>• Somewhat bent over while reading;</li> <li>• Contents of the text were hard to understand, but pretty readable;</li> </ul>	<p><b>With lamp:</b></p> <ul style="list-style-type: none"> <li>• Maintained a more active posture, sat more upright;</li> <li>• Better readable than without light, but the light was not equally divided over the page;</li> <li>• Direct light was not annoying at all;</li> <li>• Reads more magazines than books;</li> <li>• Summary would be good for keeping overview of the story. Relations between people or keywords mostly did the trick (experience).</li> <li>• Programming the summary looked simple;</li> </ul>
MR. GELUK	BEGIN STAGE
<p><b>Without lamp:</b></p> <ul style="list-style-type: none"> <li>• Reads a lot, but as long as there is light (introduction);</li> <li>• Why in the corridors of day care? Because there is much light and are many people coming by;</li> <li>• Liked it when light comes from behind or from the sides;</li> <li>• Posture: sitting upright with the book in his hand, leaning on the table edge.</li> <li>• Contrast for reading was considered good;</li> </ul>	<p><b>With lamp:</b></p> <ul style="list-style-type: none"> <li>• At first sceptical, but later on more positive;</li> <li>• Wanted to extensively compare reading with and without the light. In the end, reading with the light was considered better;</li> <li>• The bookstand was not necessary according to him, besides he thought the position of the bookstand would not matter for him either;</li> <li>• He liked it that his hands were free (not holding the book);</li> <li>• He did not like the audio summary, as he did not need it.</li> </ul>

# 7

## USER TEST RESULTS

MR. HUIZINGA	MODERATELY ADVANCED STAGE
<p><b>Without lamp:</b></p> <ul style="list-style-type: none"> <li>• Book in hands, sitting upright;</li> <li>• Everything was well visible, letters were well readable;</li> <li>• Overall remark: sometimes it's hard to remember the story;</li> </ul>	<p><b>With lamp:</b></p> <ul style="list-style-type: none"> <li>• Ease of reading was the same as without light, took some getting used to, but in the end okay;</li> <li>• The light from the lamp was shining a little too bright in the eyes;</li> <li>• When the light would be placed higher the light would be more equally divided over the page;</li> </ul>
MR. VOS	MODERATELY ADVANCED STAGE
<p><b>Without lamp:</b></p> <ul style="list-style-type: none"> <li>• Arms leaning on the table, somewhat bent over the table;</li> <li>• Reading without the light went okay;</li> </ul>	<p><b>With lamp:</b></p> <ul style="list-style-type: none"> <li>• Did not know where to place the hands;</li> <li>• Eventually placed the hands next to the book;</li> <li>• Liked reading with the light;</li> <li>• Did not have any difficulties while reading under the lamp;</li> <li>• The audio summary would be a nice addition in his opinion;</li> <li>• Remarked by himself that his posture improved, liked the bookstand;</li> </ul>
MR. NIJSSE	BEGIN STAGE
<p><b>Without lamp:</b></p> <ul style="list-style-type: none"> <li>• Hands on the table, book laying down on the table. Bent over with his head;</li> <li>• Thought most rooms were too dark to read, was always looking for light places;</li> </ul>	<p><b>With lamp:</b></p> <ul style="list-style-type: none"> <li>• More relaxed posture than without the stand;</li> <li>• Light was not disturbing the reading, the brightness was okay, not annoying;</li> <li>• The little stands for the book to lean on were not handy made. He thought flipping pages might tear the page with these stands;</li> <li>• The summary programming was considered quite easy, after some explanation;</li> <li>• The summary would help with picking up the story after a break in reading;</li> </ul>



## Scenario Toolbox

