



SUPPORTIVE ENVIRONMENTS

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INTRODUCTION

CONTEXT

Dementia is not a natural part of aging but a serious degenerative neurological condition that affects cognition and memory abilities.[1] Alzheimer's disease is the leading cause of dementia; 70% of Dutch people living with dementia have Alzheimer's.[2] Depression and anxiety often accompany Alzheimer's disease. Some experts contribute these symptoms to changes in the brain, and decreased social interaction. Currently, there are 260.000 people living with dementia in the Netherlands, of whom 70.000 live in care homes.[3] As our population ages, the number of people with dementia will increase by 70% between 2011 and 2030.[4] The majority of people suffering from dementia caused by Alzheimer's disease, or other degenerative diseases, live in care homes because independent living becomes impossible, and the family members are unable to provide the necessary care. This means an increasing number of seniors living in care home facilities. This increase, creates an opportunity to develop the supportive environment for this population, with a wide spread positive impact. The level of care provided in these homes can make a huge difference in these people's quality of life.[5]

DESIGN CHALLENGE

How can we design for a pleasant experience for the increasing population of seniors suffering from dementia living in a care home? The increased population logically results in a larger diversity among the senior population. We can also infer that this increase in resident population will maintain the pressure, if not intensify, the pressure on the care providers of these individuals. By drawing on the experience of reputable therapies, we can design for a simple pleasant experience which requires little or no facilitation from the care providers and speaks to a wide range of personal backgrounds. Due to the degenerative quality of this disease we do not have to expect a design for this user group to reverse or improve the resident's symptoms. A successful design for a supportive environment will draw a reaction from the resident living with dementia and redirect attention to positive interactions.



INTRODUCTION

USER

Degenerative diseases like Alzheimer's disease cause dementia. Every person's journey with dementia is unique because it effects a highly specialized and highly complex organ in the body; the brain. On a biological level, Alzheimer's disease cause protein, referred to as "plaque", growth on the brain inhibiting the natural electric signals that allow neurons in the brain to communicate and allow for a person's higher function.[6] This irreversible plaque growth is blamed for the symptoms of dementia. Symptoms of dementia can include trouble retaining new information, memory loss, trouble with verbal communication, confusion, paranoia, trouble swallowing and walking.[7]

Though the presents of these symptoms might differ, typically a person with Alzheimer's will become more and more withdrawn as their cognitive capabilities diminish and their verbal communication weaken. The highly personal effect of this disease too means that it can be difficult to categories distinct stages to allude to the progression of the disease. The care of people with any

form of dementia often leads to their institutionalization because the care these individuals needs puts considerable strain on family members. In these institutions therapies are utilized to attempt to stagnate the decline of the individual's cognitive and physical ability.

Still, many people with dementia experience depression as a side effect of the physical changes in their brain. This depression can also be a result of frustrations about the increased challenge it is to communicate, making people feel isolated. A lack of direction or accomplishment can also trigger frustration. Opportunities for redirecting activities that feel contributive and positive are important to provide a supportive environment.[8]

While an individual's explicit memory, of names and dates, will disintegrate due to this disease, the individual's implicit memory, or procedural memory, is often maintained for some time.[9] The retained implicit memory triggered by sensory input, allows people with dementia the opportunity for engaging experiences even when their diminished explicit memories don't allow them to communicate productively any more.



OBJECTIVE

Elderly people with dementia often suffer from negative feelings such as loneliness and anxiousness due to increased social isolation, and confusion. Design affords us the opportunity to create supportive environments that engage the elderly with dementia in such a way that they are stimulated in a positive way. From my investigations, it is clear that nature and animals have a positive effect on the emotions of residents living in care homes. However, it is impossible for care providers to facilitate interactions with animals or nature.

To answer this need I wanted to design an immersive experience that suggest a connection to nature for those in the care home that do not have the ability to be in nature due to limited supervision from care takers, limited outside space in urban located homes or mobility challenges.



BACKGROUND

DEMENTIA

Though dementia is degenerative, there do exist a number of methods care providers utilize to attempt to slow or stagnate the decrease in cognitive function. Some of these methods include pharmaceuticals, arts/creativity tactile experiences, and brain training, exercises to keep the mind active.[10] In addition, there are some therapies that seem to treat some of the negative emotional side effects of dementia such as anxiety or aggression, by improving the mood of people suffering from dementia. Some of these therapies include; nostalgia therapy, snoezeling rooms, doll therapy, music therapy and animal therapy.



BACKGROUND

RELEVANT THERAPIES

Many care homes work to maintain a positive and inviting atmosphere for their residents. The care homes do this by implementing various therapies and by building a living environment that exudes comfort and qualities of homeliness.[11] Nostalgia therapy is often recognized as a way not only to recall memories through engaging with objects from the past, but also a way to encourage the resident with dementia to communicate verbally with the care professional.[12] This therapy can be perceived controversial however, because it might be difficult for the care provider to predict whether these memories are painful or not for the person receiving the therapy. Doll therapy is also controversial due to the way this therapy is perceived by the family of the person living with dementia. Though people are sometimes uncomfortable seeing their elderly parents play with dolls, it seems to be positively stimulating for many people with dementia.[13] We can speculate this is because caring for something can feel purposeful in some way, which might relieve the sense of helplessness. Some care homes have taken to encouraging the residents to help with simple

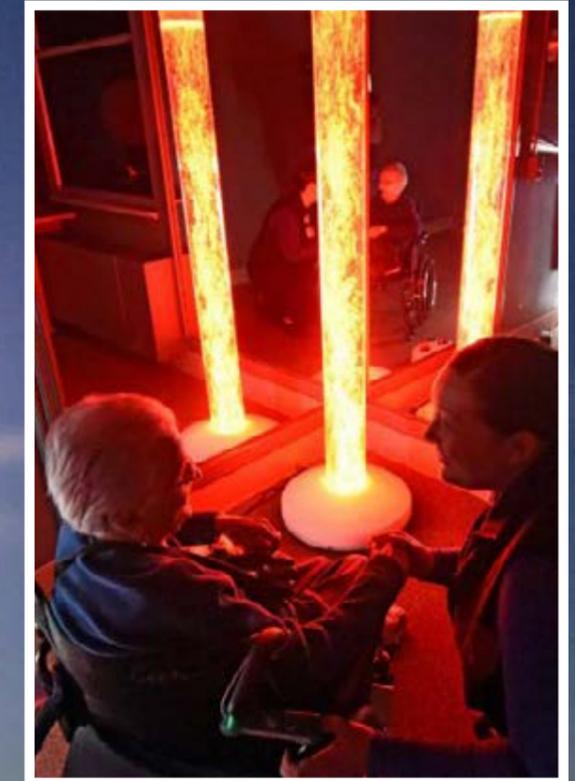
BACKGROUND

chores, which also seems to support a resident's sense of self, as a contributing member of the group.[14] Unfortunately, this asks a lot of time of already busy care providers.

The snoezeling rooms, provide stimulating and soothing environments in a separate room in the care home. These rooms work to relax residents and seem to have a positive effect on the mood of many residents of the care home by stimulating their senses.[15] As explicit memory deteriorates, implicit memory remains, so tactile interaction becomes increasingly important to stimulate people living with dementia. Sensory stimulation can encourage an individual with Alzheimer's disease to communicate and stimulate the recall of memories.[16]

Animal therapy too provides a joyful experience for those elderly who live in the care homes because they usually respond positively to animals and petting also allows for sensory stimulation.[17] Though some residential care facilities now allow their residents to keep pets, people in dementia care facilities lose the ability to care for their animals as their dementia progresses. In addition, allowing

animals in the care home might compromise the sanitation conditions or might burden care providers with the care of these animals. To provide animal therapy many care homes enlist the help of outside organisations that bring farm animals and other animals to the care homes. Though the visits from these outside organisations are described, by the care providers of the Archipel Eindhoven, as very enjoyable experiences for the residents, the visits do not occur more than twice a year. Reasons for this include the cost of the animal's transportation, and the extra care providers necessary to facilitate these visits, as described by an Archipel employee.



RELATED WORK

RELATED DESIGNS

Over the years there have been products and investigations that aim to create an opportunity for a better quality of life and/or a supportive environment for people with dementia living in care homes. By drawing inspiration from the successes of these endeavours and learning from their challenges I enriched my design concept.

Dementia aprons are a product Dr. C. Treadaway and Dr. G. Kenning have studied and designed, to be highly personalized textile outer garment that provides a sensory interaction for an individual with dementia. During a research investigation for the design of sensory textiles that support the wellbeing of people with dementia, designers paid close attention to specific personal background and the choice of which interaction to include.[18] To me, the success Treadaway and Kenning had by creating a rewarding tactile experience, utilizing simple and recognisable materials, is inspiring.

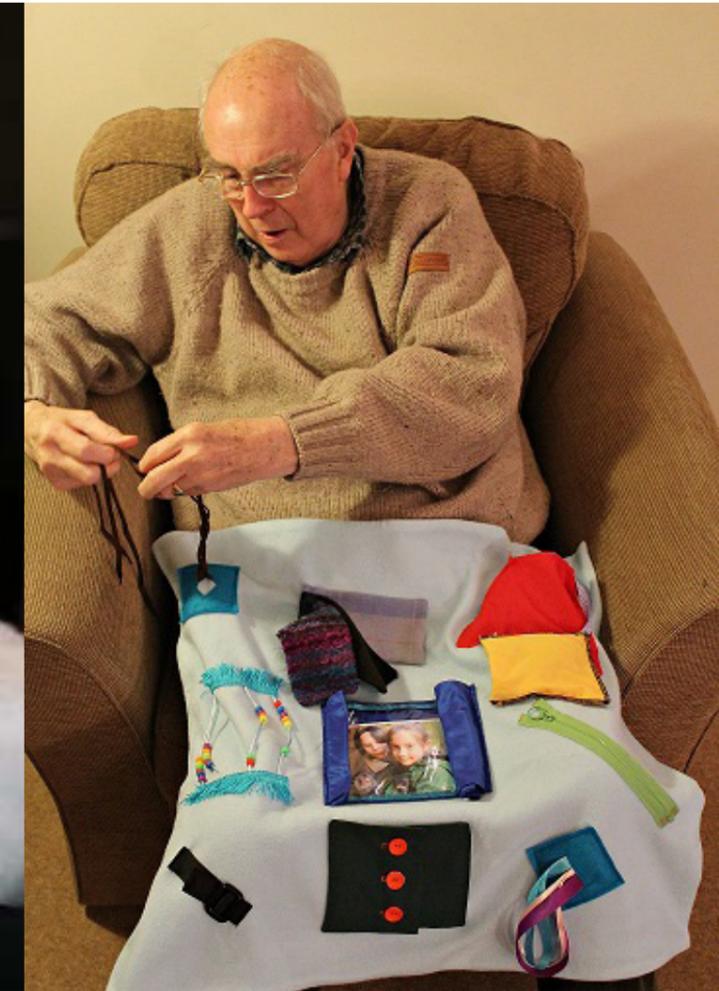
Another product that uses E-textiles is the Tactile Dialogs pillow developed as a collaboration between TU/e

student, Martijn ten Bhömer, and stakeholders like De Wever Borre Akkersdijk. This pillow facilitates communication between seniors that have dementia and heir loved ones by touch. Here, technology supports a very simple interaction, which allows for an implicit, sensory experience.[19] Recently the Discover Dementia Pillow developed by TU/e student Eriano Troenokarso was nominated for the best care idea competition in the Netherlands. In this concept, technology, integrated into a pillow with many patches, allows people with dementia to play different pieces of music though simply touching the different patches of fabric.[20]

Other designs take a more holistic approach and look at the environment of the care home. John Zeisel, also has experience with designing for people with dementia in the context of healing gardens. Zeisel describes the importance of outside cues to what time of day or season of year it is for people living with Alzheimer's disease due to the damage to their chiasmatic nuclei (cell in the brain that function as an internal clock), which can lead to



Paro, a robot baby harp seal, carbot



Dementia aprons

disrupted sleep patterns.[21] It feels natural that these healing gardens can have such an effect on the residents living with dementia, when one considers the work of Bjørn Grinde and Grete Grindal Patil. In their work, “Biophilia: Does Visual Contact with Nature Impact on Health and Well-Being?”, they consider the link between nature and healing in indoor contexts.[22] Grinde and Patil note that “viewing natural landscapes provides psychological and health benefits, including a reduction in stress”. Interacting with nature too, they mention seems to have “positive effects on health and wellbeing”. [22]

In order to combine the benefits of closeness to nature and animal therapy, some products have been developed to support people with dementia. One such example is Paro, a robot baby harp seal that responds to touch, sound, heat and movement.[22] Where arranging for contact with therapy animals might cause logistic challenges, this carebot seems to draw out much of the same reaction interacting with a real animal, but does not require the same care a therapy animal does. However,

these kinds of care-bots, do propose an ethic dilemma. Dr. Lane. Shannon Vallor, a virtue ethicist and philosophy professor at Santa Clara University, questions whether we are deceiving the residents of the care home with such a lifelike carebot, if the care providers allow them to believe the animal is real.[24]



Many care homes decorate the home to give a feeling of space, but use static images and plastic plants to mimic the outdoors.

Several products that exist in the care homes attempt to use buttons and screens, to suggest interaction. These products do not always speak to the seniors with Alzheimer's because the interaction with technology is not familiar to them from their youth.

The value that these therapies and products provide is the sensory stimulation, which encourages the resident in many stages to engage with their environment. This stimulation is beneficial not only to provide a pleasant experience but because it can stimulate the resident to communicate which might postpone further cognitive decline. The clear drawback to the above mentioned therapies and products is that though animal therapy and being in nature have positive effects on people with Alzheimer's disease the care providers and care home have trouble providing for these opportunities. Though doll therapy answers a need for the residents to feel they contribute, the acceptance of family of this method often lacks. While creating life-like carebots, which the people living with dementia cannot distinguish from reality poses moral question. All in all these current therapies and products do not provide an appropriate immersive sensory experience that will allow the resident of the care home to engage with the installation so they can feel closer to animals and nature.

DESIGN PROCESS

EXPLORE

BLOGS

DOCUMENTARIES

DESK
RESEARCH

PAPERS

EXPERT
MEETINGS

RESEARCH/ FRAMING

DAY-IN-THE-LIFE

PRESSURE
COOKER

SHADOWING
SITE VISIT

INTERVIEW

EXPERT
MEETINGS

ITERATIVE DESIGN CONCEPT

CONCEPT 2

REFINING

CONCEPT 3

FINAL INSTALLATION

FINAL
PROTOTYPING

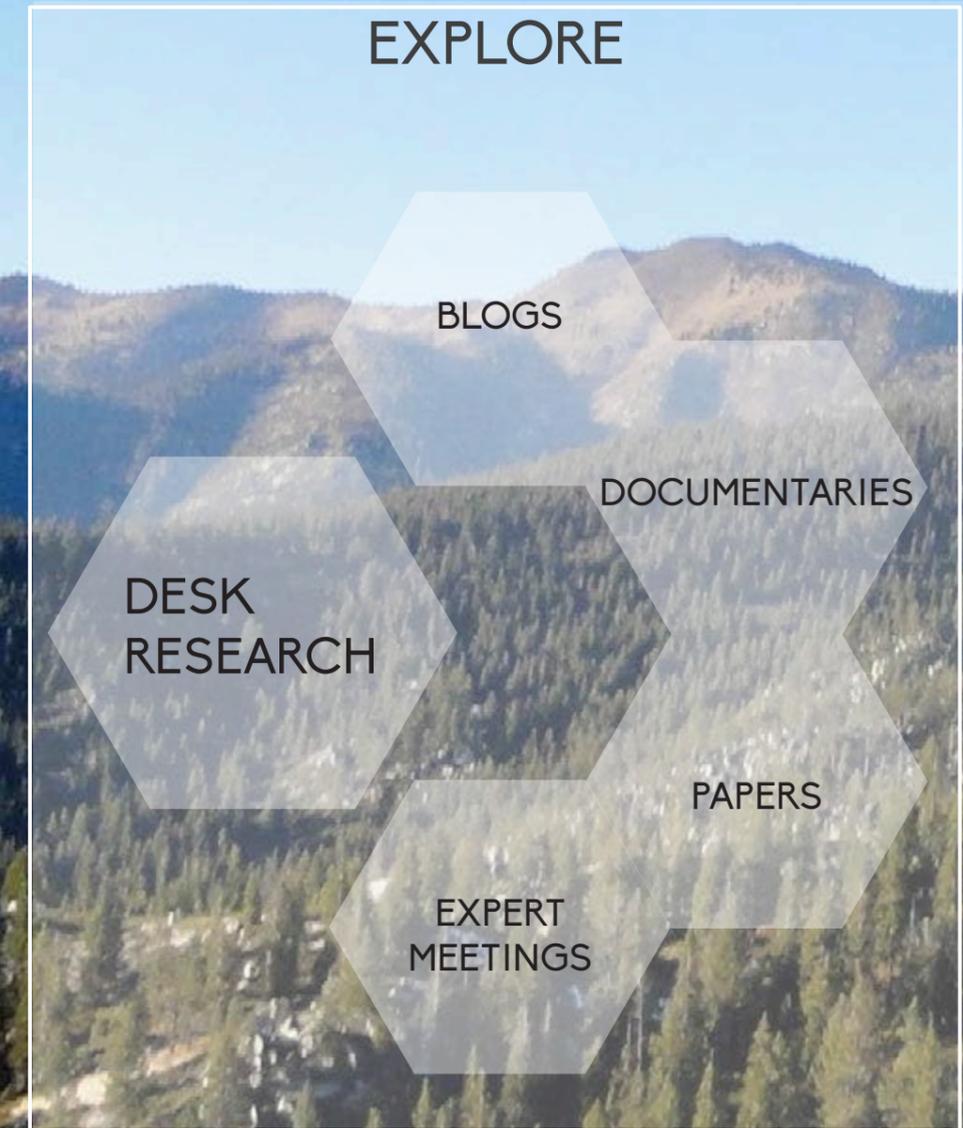
BUILDING
PROGRAMMING
FILMING

EVALUATION

EXPLORE

My design process started with desk research in which I explored not only papers and articles but also a considerable amount of video footage and documentaries about the subject of dementia. This approach was driven by the idea that in order to really understand my user group, whom I might have trouble communicating with directly, I needed to combine methods. It is a challenge to understand the emotional, mental and physical needs of people with dementia due to the increased difficulty communicating. While continuing my desk research, I planned meetings with experts that have experience working with people with dementia, whom would be able to give me advise on how to approach the challenge of designing a supportive environment for this user group and insight into what is most essential for this group of people. Dr. Gail Kenning, Research Associate at University of Technology Sydney and Co Investigator International on a UK AHRC funded project: LAUGH [25] , gave me much initial insight into people with dementia.

From this initial exploration I found that there is potential to improve the emotional being or mood of the people living care homes, who are suffering from anxiety, and constant confusion and loneliness. Addressing these emotional needs, might have the capability to improve some of the problem behavior people with dementia suffering from negative emotions exhibit, such as endless wondering, which can cause health and safety concerns. Once I found what it was about this problem space that sparked my interest and excited my curiosity I started to research more into this subject and approach a project frame.



RESEARCH/ FRAMING

DAY-IN-THE-LIFE

PRESSURE
COOKERSHADOWING
SITE VISIT

INTERVIEW

EXPERT
MEETINGS

RESEARCH AND FRAMING

DAY-IN-THE-LIFE

After my initial explorations, I did a day-in-the-life exercise that I found experts have used in the past to allow care providers and family to gain a better understanding of the frustrations people with dementia face. [26][27] [28] For this activity I outfitted myself in the recommended attire, to mimic some of the physical challenges seniors with dementia usually face. I put on gloves and taped my fingers to mimic arthritic hands. As the method suggested, I wore a wireless headphone, which emitted a very loud droning noise, which was supposed to make it difficult to concentrate to mimic cognitive decline in people with dementia. A fellow student constructed a unique list of tasks I was to complete in a certain time limit, each with several steps. I wanted another person to come up with the list of tasks so that I did not have any prior knowledge of them. I shared my resources with the other student and explained the criteria for the task list. The whole experiment was caught on film so even after I answered the post-activity interview questions I could look back and reflect on the

experience. Though it is nearly impossible to simulate the exact conditions of dementia through a day-in-the-life exercise like this, I felt I did gain insight through this experience. The noise on the headphones was loud and distracting so I felt isolated. The noise was so distracting I forgot part of one task and finished another incorrectly. Furthermore many activities became more of a challenge due the impaired vision and simulated arthritic hands. Though I cannot know what it is like to live in a care home with dementia after this exercise I see how constant confusion and irritation would be natural responses.



Goggles that mimic cataracts and uncomfortable shoe inserts; more tools I used to outfit my day-in-the-life investigation

RESEARCH AND FRAMING

PRESSURE COOKER

The day after my day-in-the-life experiment, I did a pressure cooker to brainstorm and prototype a concept as a very short first iteration. At this time, I was focusing on improving the feeling of connectedness between the resident of the care home and their family. I wanted to achieve this by giving the resident a picture frame with a photo of their loved one in it, which would display animated colored lights if the family were on their way for a visit and when the family wanted to communicate to the resident. When the frame drawing attention to the picture before a family visit, it might serve to prime the memory of the person living with dementia. If this allows the visit to be less confusing for the resident and thus probably more enjoyable for both the resident and the family, who may end up visiting more often. In addition, the frame would allow the family to send voice messages. The frame would light up when there is a message waiting for the resident. Instead of pressing any buttons to hear the message the frame reacts to touch through capacitive sensing and will play the voice message. The senior with dementia would then hear the

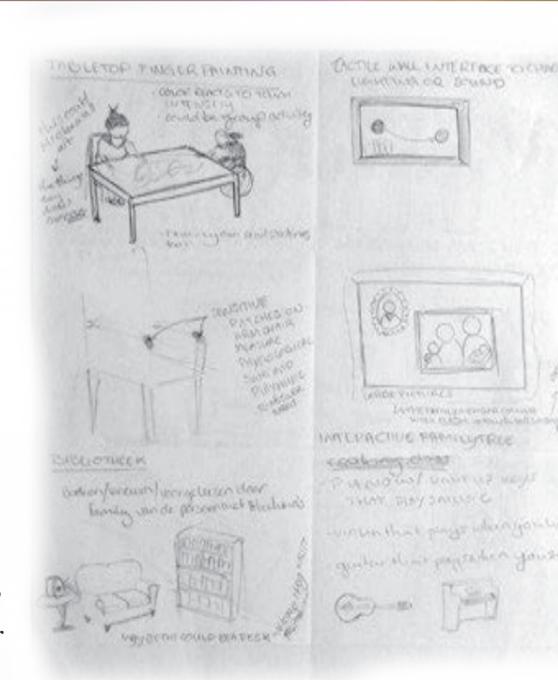
voice of a loved one while holding their picture, looking at their face. Many clues can make abstract situations easier to understand by people with dementia.

FEEDBACK INTERVIEW

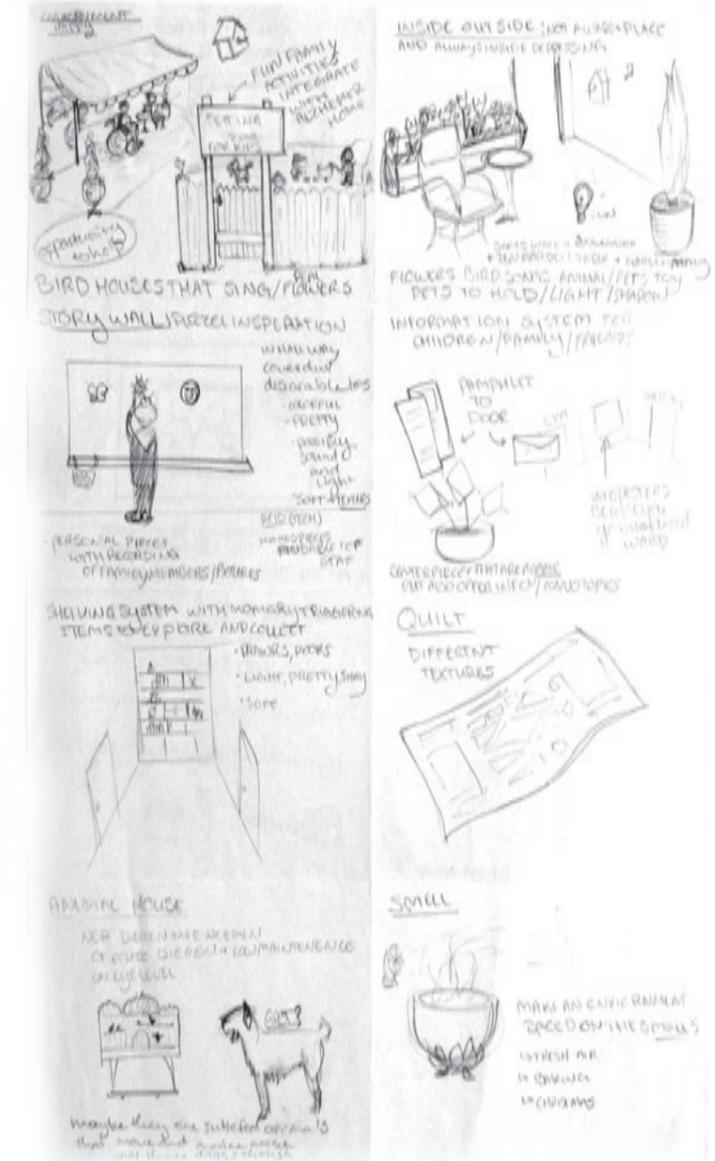
I took this first iteration to the Archipel Eindhoven, where I shadowed the care providers for a day, to get some feedback from them on this initial direction. Thought the idea seemed to come across positively, one care provider mentioned a very important concern. She said that though many people might benefit from the increased interaction with their family, the personal backgrounds of many of her residents are very diverse and not everyone would benefit from increased contact with their family. For some residents, family visits can be too stimulating and result in their agitation. Other residents might pine and miss their family if the frame draws too much attention to the fact that they are not with their family. From this feedback I gained that a design direction that was more neutral, calming and constant might be more appealing to a larger group of residents.



Iteration One: picture frame to support connection to family



Notes from brainstorm session during pressure cooker



RESEARCH AND FRAMING

SHADOWING

Through shadowing the care providers I was able to understand more about the work they do and how busy they are taking care of their clients physical, mental and emotional needs. The day I was shadowing there were only four caretakers for twenty residents. The residents that wondered the halls endlessly gave me the idea to try to create something that would allow these people to stop wondering and redirect their attention to a pleasant experience.

*INTERVIEW WITH RESIDENT*

One gentleman who was in relatively early stages of Alzheimer's disease was kind enough to allow me to interview him. He expressed a very clear affection for nature. He said that if there was anything that he could change about the nursing home, it would be to put it closer to "wild" nature and they would allow him to go outside more. His main passion and hobby is bird watching and he reminisced about how nice it was to watch the birds. He also confirmed what one of the care providers had already told me, which was that the days on which the therapy animals come to visit were a very positive experience.

Interviewing this resident motivated me to bring nature closer to the care home somehow. I then started to looking into more theory about how nature can affect people's mood and wellbeing and found that even just looking at nature can improve people's sense of wellbeing. [28]

ITERATIVE DESIGN CONCEPT

ITERATION 2

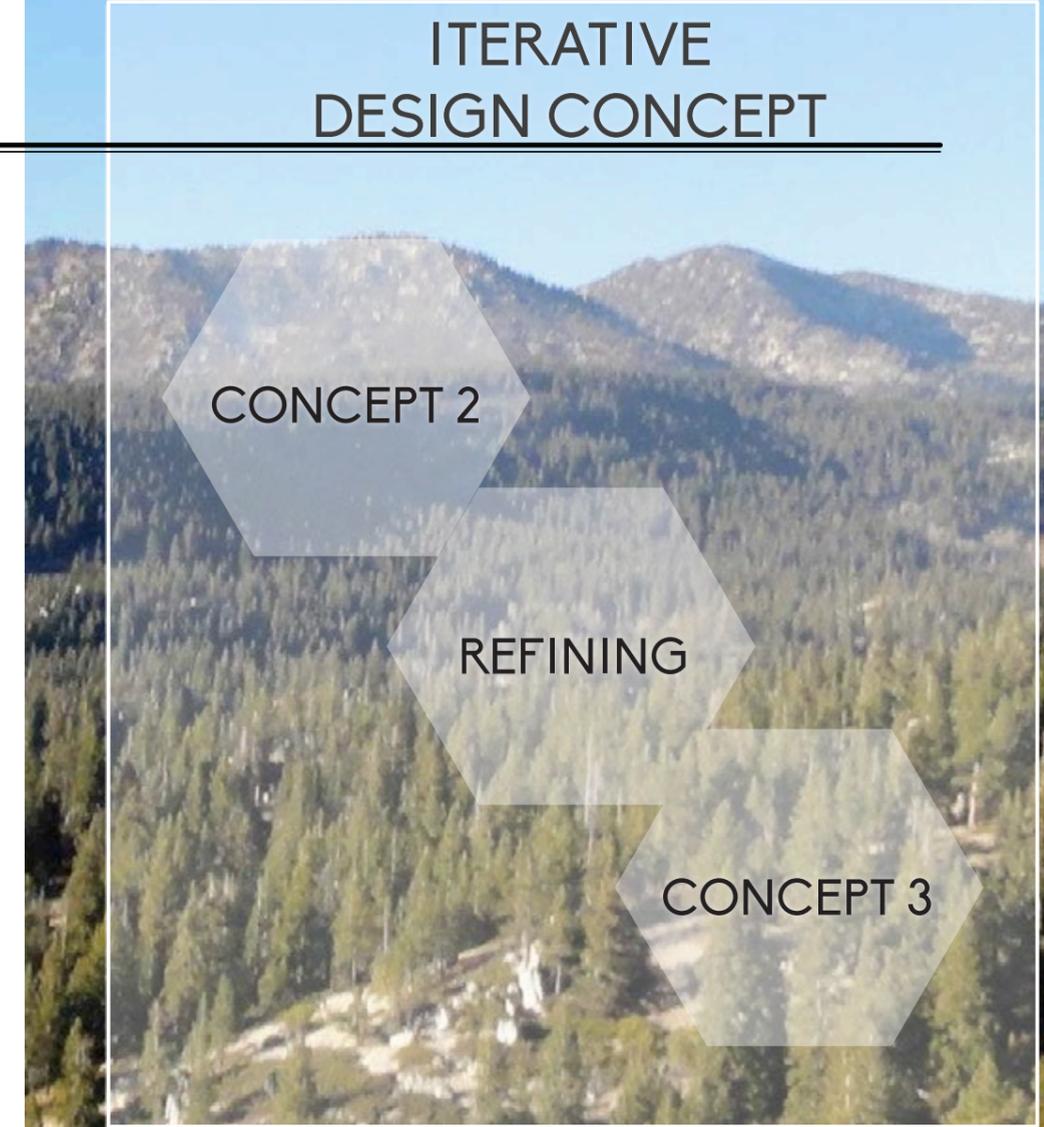
For my second iteration I drew inspiration from the snoezelen rooms and added an element of nature. I explored how augmented virtuality can create a more immersive experience of being in nature, inside the care home. This early iteration of my final concept entailed a wall-sized screen showing live feed of a forest scene. The tree branches on the life feed would seem to continue into the room of the care home, where artificial electronic tree limbs and branches would mechanically react to wind sensors at the location where the life feed was taken, so that they would sway in much the same rhythm as the trees outside in nature. In addition, I thought about how to include light to add to this atmosphere of a kind of nature snoezelen room. I thought about how to utilize outdoor sounds, real plants and natural aromas to stimulate the senses of the residents.

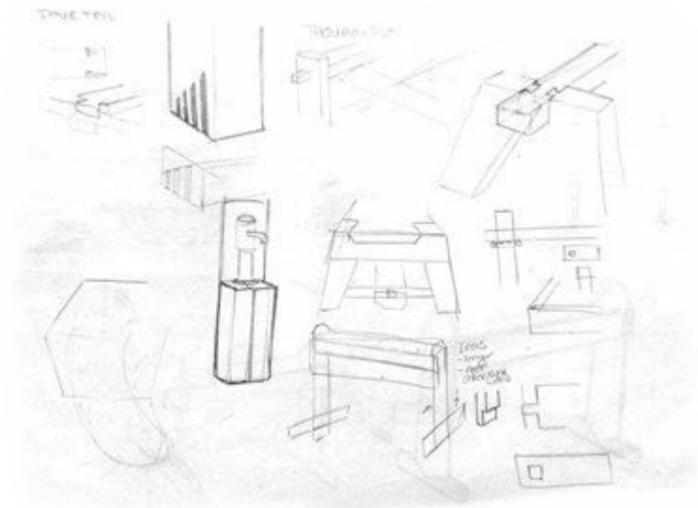
ITERATIVE
DESIGN CONCEPT

CONCEPT 2

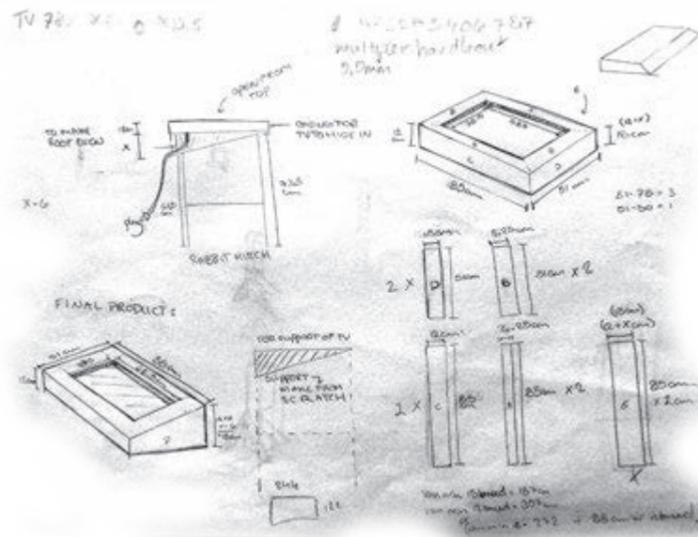
REFINING

CONCEPT 3

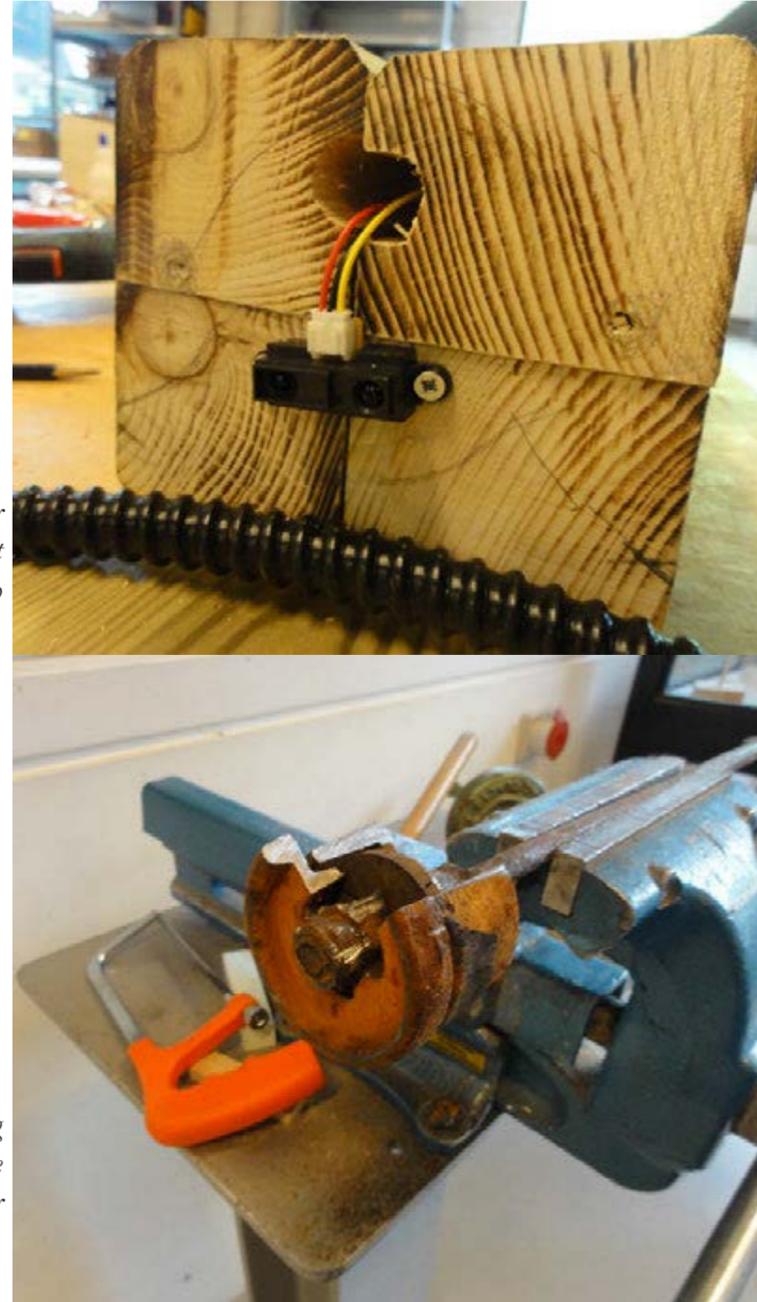




*Infrared motion sensor
being installed in the cast
iron water pump*



*Original pump piston being
modified to accommodate
electric pump hose and sensor*

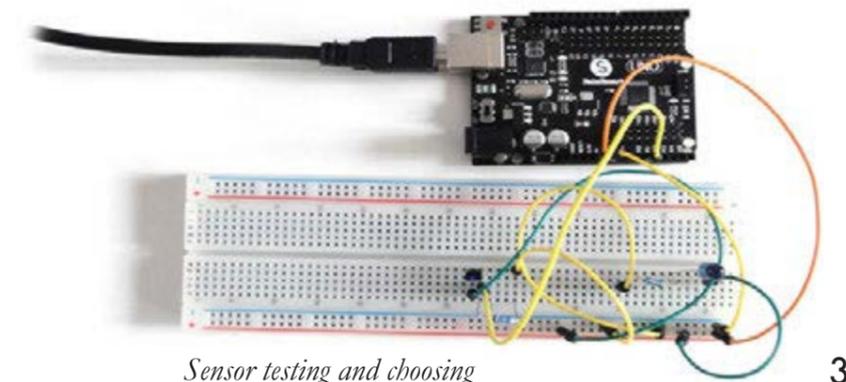


ITERATIVE DESIGN CONCEPT

FINAL PROTOTYPE

My final installation required me to build a trough short enough for the animals to feed out of, then alter the same trough so adults could comfortably reach it without stooping down, so it would be identical on the projection and in the physical space. I needed to install an infrared motion sensor in an antique cast-iron pump to recognize if the pump is being used and connect an electric water pump to a relay which is switched on and off by Arduino code when the it detected movement through the sensor. I used reclaimed items like the metal trough and the cast iron pump, and combined them with wood from the construction store, which I used to build sturdy trough legs high enough for adults to use. The entire installation needed to be designed to be easily taken apart and put back together as I knew I would have to show and set up my installation in different locations. With only four screws and a friction fit cross bar the trough and pump come apart quite easily, yet are still sturdy. Besides the physical prototype I had to write code to make the installation interactive. The Arduino code takes

input from the sensor and controls the relay for the electric pump and also sends, via serial communication, a notification that the pump was being played with to processing. Processing continually plays the life feed unless a signal from the Arduino interrupts this. At this point processing selects a random video of goats being fed, to play. The residents can continue to pump the water pump while the video of the goats being feed are playing without disrupting the video, because processing will only listen to the next interrupt once it is done playing that video of the feeding.



Sensor testing and choosing

FINAL INSTALLATION

FINAL
PROTOTYPING

BUILDING
PROGRAMMING
FILMING

EVALUATION



DESIGN CONCEPT

FINAL DESIGN CONCEPT

This installation aims to offer a richer living environment to people with Alzheimer's disease living in care facility, through suggesting a connection with nature. This project combines the natural soothing effect of nature and the principles of animal therapy to provide an opportunity for residents to feel more connected to nature. The concept consists of a large high-definition screen that continuously sends a live feed of a rural location, or animal therapy farm the care home has an established relationship with. This will allow the residents of the care home to gain implicit information about the weather, time of day and season of the year. For the prototype I created this semester, I used a projector to attain the life feed effect on the wall of the larger animals and a big screen TV combined with a realistic living enclosure to attain the life feed effect for the smaller animals; rabbits in their rabbit hutch.

Besides the aesthetic interest of the life feed, this installation also offers a simple tactile interaction; a water pump that pumps real water. The pump has been modified in order to make pumping less strenuous and the installation easier to install in a care home. Once the system detects that a resident of the care home is interacting with the pump, it sends a video feed of the animals being fed. This interaction suggests a kind of caring action or fulfilment of responsibility, which might give a resident a positive sense of self. Due to the low threshold for engaging and the simple interaction this installation should be attractive to several stages of dementia and can be used by the residents without much guidance from the care providers.





EVALUATION



User test Mariënburght, Budel



User test Grijze Admiraal, Eindhoven



User test Archipel, Eindhoven

APPROACH

In this process it was challenging for me to get direct feedback from my users as most of them had difficulty communicating due to their dementia. In an attempt to understand my user's reaction to the best of my capabilities I used a mixed methodology approach to validate my design. For this approach I depended heavily on experts, and important stakeholders; the care providers at the home, on my own observations as I took the role of a researcher, and on both qualitative and quantitative data collection.

INVESTIGATION ONE

Initially my research question, examined how and to what extent this installation would have an effect on the mood of residents in the care homes in different stages of dementia. After a very insightful discussion with Dr. Kenning and a pilot visit Zorgcentrum Mariënburcht in Budel, I designed my first investigation as follows.

PROTOCOL ONE

Care providers fill in background information about the general emotional state and stage of dementia that the residents are usually in before showing the residents the installation. This would not only help to understand which profile of resident would benefit most from the installation but also be able to compare to my notes about the emotional state of the resident after and during the interaction with the installation.

Then the caretakers observe the resident and possibly aid in the interaction with the installation. During this time, I take detailed notes while practicing fly on the wall observation so as not to interfere/influence with the interaction too much. After the resident was done with

this interaction I interviewed the care providers about their observations of the resident's reaction. In addition, I had a few short answer questions about for whom this interaction would be the most effective.

DISCUSSION

From this first iteration of my evaluation process I found that I already assumed that this installation and interaction would have an effect on the users. This might not be the case. Instead of comparing for which profile of resident this installation offers the most value, I should seek to understand whether the interactive installation offers an advantage over the current state: large picture of nature hanging on the wall. However, if I was to compare my installation with the current state, large photographs of nature on the wall, then I could face the problem of not knowing if the reactions I collected are reactions to my installation or to the excitement of seeing something new in the room. This is why for my final round of investigations I choose to compare the interactive installation to a just the projection of life feed on the wall.

FINAL INVESTIGATION

For my evaluation I choose to utilize an externally validated questionnaire often used for therapies called the credibility/expectancy questionnaire [29] to compare the expected result of using the interactive installation compared to only the nature and animal life feed. This credibility and expectancy questionnaire consists of likert questions participants fill in to “derive the two predicted factors ... and that these factors are stable across different populations.” (Deville, Borkovec 2000) [29]. There were 12 participants who completed the survey, 3 male and 9 female, ranging in ages, all employed as care provider for people with dementia in the Archipel Eindhoven. This was a within subjects study, as all the participants, were to see and compare the two installations.

PROTOCOL

Each of 12 care providers in the care home Archipel Eindhoven were introduced to the live feed of the farm only, without the interactive element of the installation. They were allowed to ask me any questions about what they were seeing. Residents were also encouraged to look at the life feed and many care providers engaged in

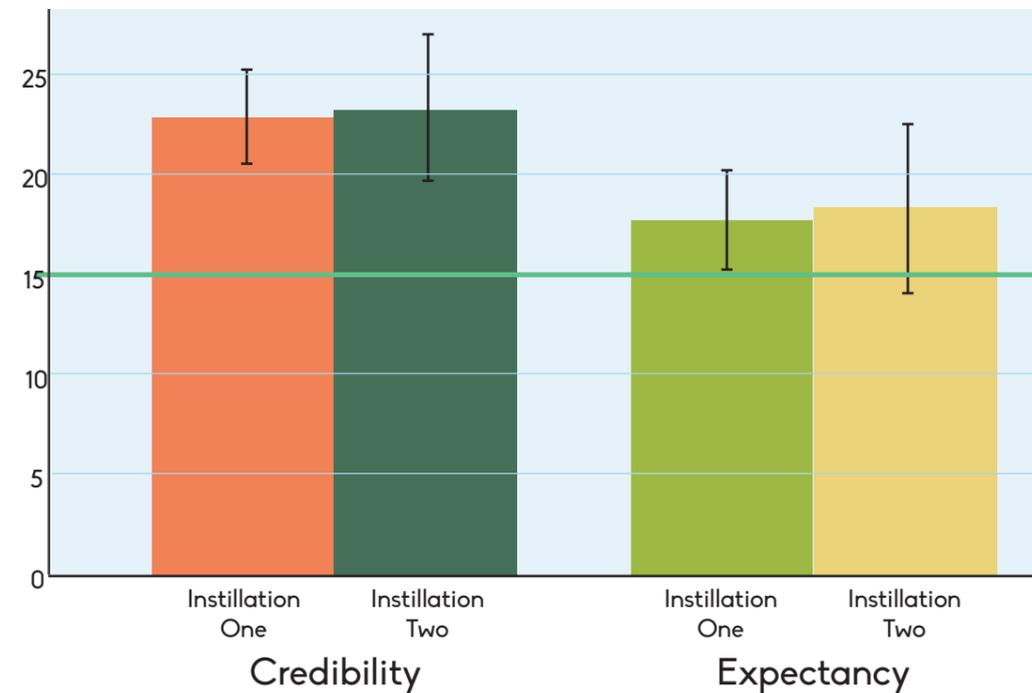
conversation about the life feed project with the residents and with their colleagues. After this they were given the credibility/expectancy questionnaire, which they were asked to complete immediately after their encounter with the installation and in the same room as the installation though I made sure to mention their answers remained anonymous. When all 12 care providers had seen the first installation of only the life feed projection I set up the interactive pump as well. Each of the 12 care providers was then asked to come back to experience the second installation. They again were given the opportunity to ask me any questions they might have and observed residents interacting with the pump. They too were invited to play with the pump and watch the animals react. As after experiencing the first installation, the caretakers were asked to fill in the credibility/expectancy questionnaire immediately after they experienced the interactive installation. At the end of this credibility/expectancy questionnaire there were also some short-answer questions that asked about the way in which the care professionals envision the installation being used and what profile of resident they expect to benefit most for the interactive installation.

QUANTITATIVE ANALYSIS

CREDIBILITY/EXPECTANCY QUESTIONNAIRE

In the credibility/expectancy questionnaire, the participant can choose to rate each answer on a likert scale from 1 to 9. The first three questions are about credibility and the second three questions are about expectancy. The highest attainable rating any participant can give the credibility, by answering “9” for the first three questions, is 27, while the lowest rating any participant can give the credibility is a 3. If the participant feels neutral and selects the middle number on the likert scale a five then the credibility rating will be a 15. Thus, if the average of the sum of the answers to the first three questions of all 12 participants is above 15 then there might be an indication that the people are positive about the design’s credibility. The standard deviation can tell us if this positive attitude toward credibility is significant. The same calculations can be made for the expectancy. Credibility rating of installation one, just the life feed of nature is 22.92, with a standard deviation of 2.33. The expectancy rating of installation one, just the life feed is 17.85, with a standard deviation of 2.56. Credibility rating

of the interactive installation two, is 23.08, with a standard deviation of 3.62. The expectancy rating of the interactive installation two is 18.18, with a standard deviation of 4.24. There seems to be little difference in the credibility and the expectancy rating between the life feed and the life feed with interactive installation.



QUANTITATIVE ANALYSIS

ANOVA ANALYSIS

I also used SPSS to run a two-way within subject ANOVA analysis. There was no significant difference found during the two-way ANOVA analysis of the credibility/expectancy questionnaire of either installation one or two.

Subjects of questions asked on the credibility/expectancy questionnaire	Significance
Logic (question 1)	,660
Success (question 2)	,689
Trust (question 3)	,845
Improvement in three months of use (question 4)	,187
Feel improvement (question 5)	,658
Improvement if permanent (question 6)	,615
Credibility Score	,894
Expectancy Score	,838

QUALITATIVE DATA

During all the interactions with the installation I took notes on what the care providers, visiting family members and the residents themselves said. I also took notes on their movement and the way in which they interacted with the installation. All of these detailed notes both from observation and interviewing the care providers are the data points I used to do my qualitative data analysis. For the coding I used NVIVO, a tool that allows you to easily organize qualitative data, or “nodes”, into themes or sets. This tool allows you to easily organize different types of mediums too so I was able to efficiently code the quotes from video footage of interviews and observation sessions without having to transcribe the audio. I used an open coding approach as used in grounded theory to code all of these data points.

RESULTS

Overall the reactions were positive from the care providers and residents alike. The main themes that presented themselves were types of interaction (both observed and predicted), which stage of dementia this speaks to, and over all general positive feelings about the system. The reactions of many residents were often coded under interaction, because many of them did not speak a lot. Residents that did speak talked about the animals, reacting to the goats that nudge each other or naming what the rabbits were eating. Residents also spoke a lot about their farms and the animals or pets they had had. Care providers overall predicted that the interaction would be pleasant for the residents and called it inviting and fun. Most care professionals thought that this installation would be appropriate for all stages of dementia. In interviews some care providers expanded on this and mentioned that people in different stages would use the installation differently. In this way someone who is still in an early stage of dementia might really interact with the pump and talk while someone who’s dementia

has progressed further might just like to sit and watch the animals. The overall positive feeling about the systems category was mainly gathered from the care provider interviews and questionnaires. They called the installation fun original and felt it had potential.

The concerns that were addressed, though in a lower quantity than the prior discussed categories, are important to examine. Mostly the concerns had to do with safety: care providers were concerned about the projector, the troth legs being a tripping hazard and the residents wanting to walk into the wall where the animals were. Most of these concerns can be fixed in a new iteration of this design which will be built to be more permanent in the care home. One concern which I think is important to think about for this next iteration was whether if water was spilled it could cause a slipping hazard. This can likely be remedied by putting some anti-slip mats/floor covering down when this installation is built to be more permanent. Another concern which came up a few times was how much this installation would cost to put in the care home. A few care providers were worried that their

care home could not afford the installation. Though, I would need to look into this concern further to know the cost exactly, I feel that the installation does not have to be very expensive project because most of the materials it takes to build are readily available.

DISCUSSION

The data gathered in the test did not show a significantly higher expectancy or credibility rating for the interactive installation vs. just the life feed projection. This could be due to short time span the installation was present in the care home. Due to the limited resources and borrowed materials such as a projector, it was not possible to keep the installation at the location for longer periods of time.

Another reason, which could have influenced the results, is that the participants were rushed because it was the end of their shift while filling in the second questionnaire. It would have been best if I had been able to have six care takers look at only the life feed first and then the interactive installation, while the other six saw the interaction first and then the life feed. However, time did not allow for this during this investigation.

At this moment we looked at the credibility and expectancy of the system, essentially I asked the participants what they thought and felt of the installation. A better test might be to monitor the residents mood over a longer period of time and then install the installation for several weeks in the care home, while keep monitoring the residents mood to see if this improves. The care providers take notes about how each residents are doing to hand over to the next shift. If they could let us have these notes (made anonymous of course) on the resident's emotions and if there were any disturbances or agitation, this could provide lots of qualitative data points both about the state before we put up the installation and after. Alternatively we would ask them to fill in a survey after they have done their daily paperwork. The advantage here is that over a longer period of time experts in the field write down their observations, plus they will likely be unbiased observers.

We could consider putting the two installations in two separate rooms; only live feed in one room and the life feed with interaction in the other room. Then we would record where the residents spend the most time and which room they returned to. We would need to counterbalance this to eliminate other factors.

In order to do this longer-term study, I also suggest a more robust construction of the prototype with not a projector but a screen. In this way the residents cannot interfere the beam of the projector. The more robust construction makes it safer for the residents to use.

CONCLUSION

Though, further investigations need to be done to see if this installation has a real positive effect on the mood of the residents by providing a feeling of connection to nature, the positive reactions from care providers, the interactions with the various residents and the interest from management to place the installation permanently, seem to make a strong case that further investigation is warranted.

NOTE ON REPORT STYLING

Throughout this report I have chosen to use some pictures from my own travels as they symbolize the memories I cherish, as a reminder of the personal stories and memories people living with dementia lose. I also hope it serves to make my theme of nature more visible.



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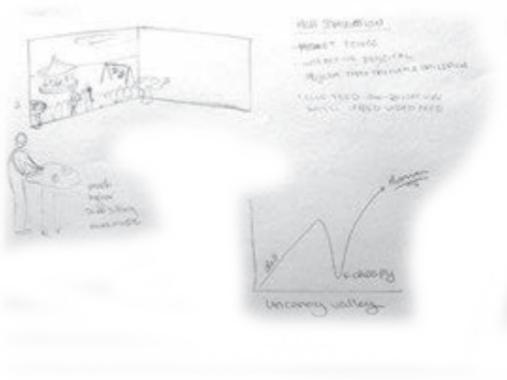
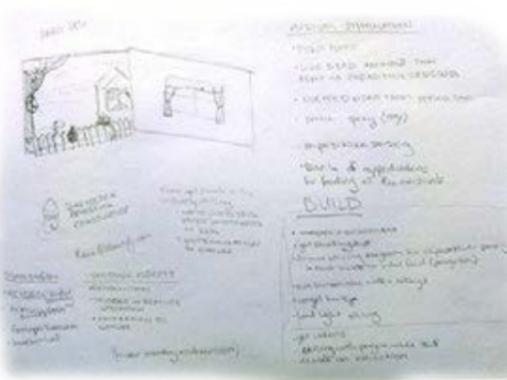
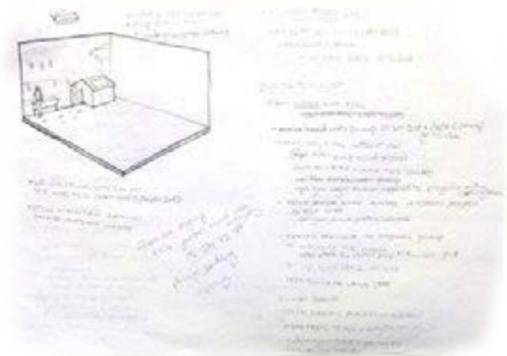
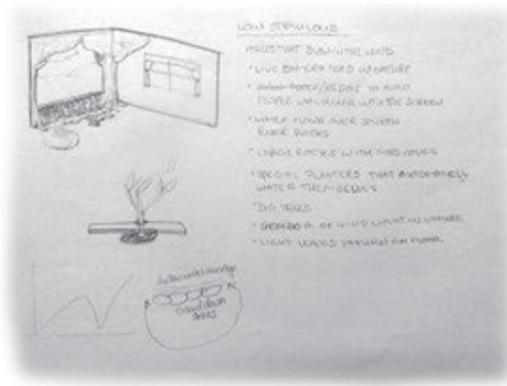
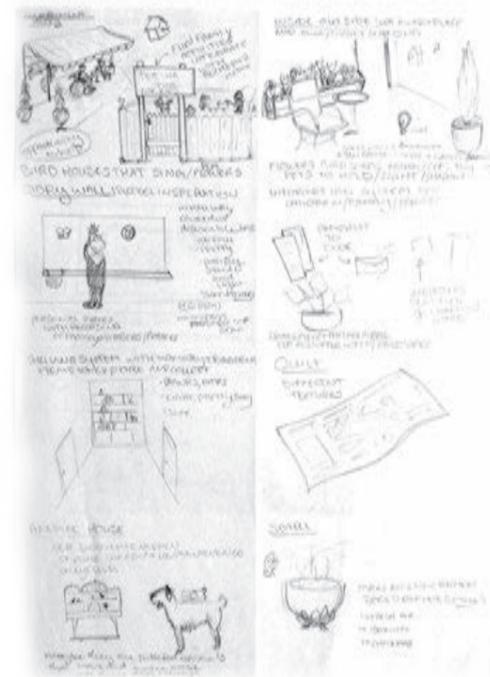
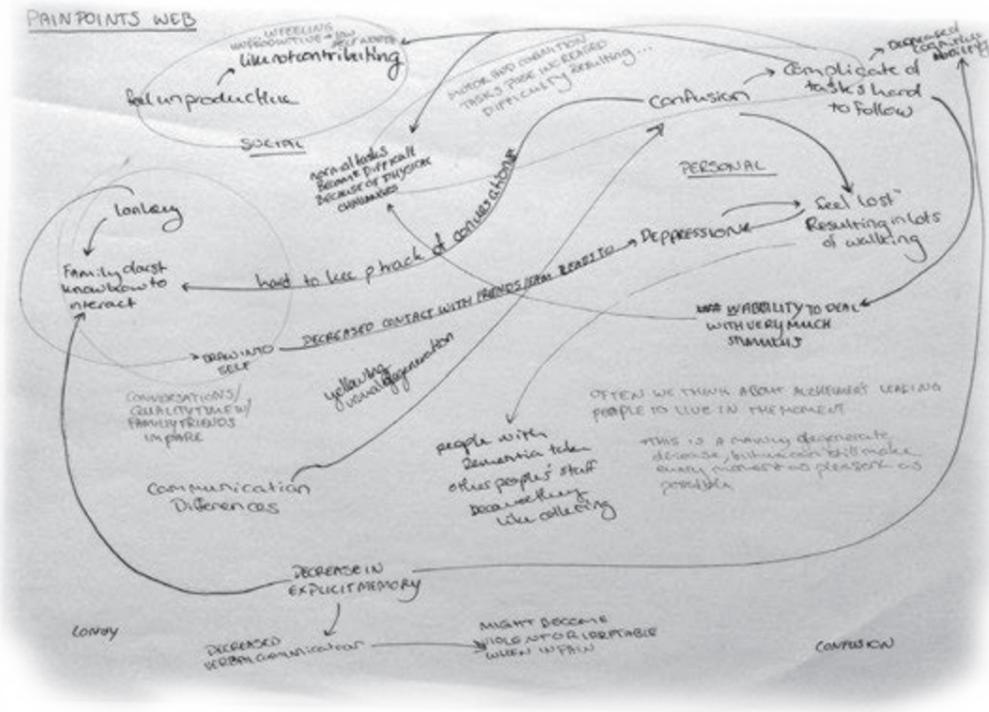
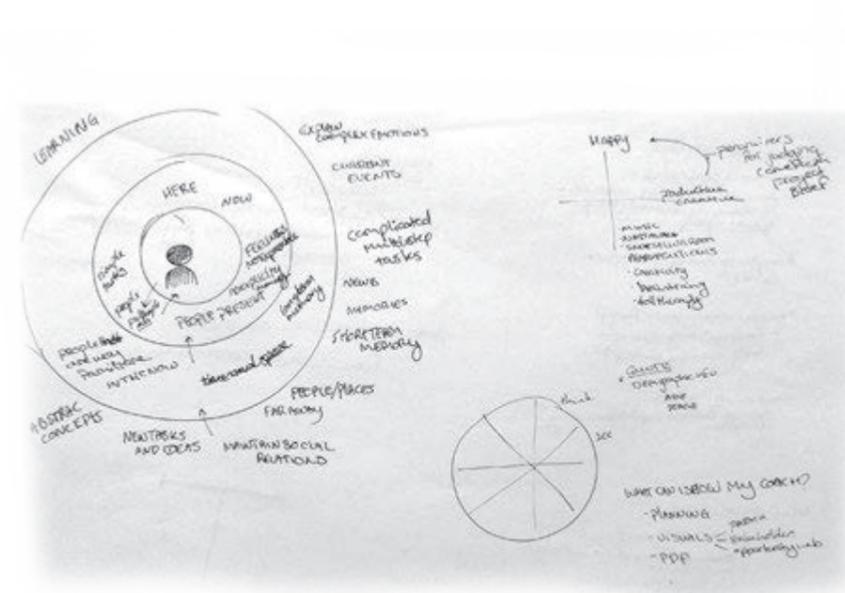
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PROCESSING CODE

```

/*This code will receive input from
Arduino that at that time,
will choose a random video to switch to
from the life feed it
plays as default.
M1.2 Valk
*/

//variables
import processing.video.*;
import processing.serial.*; // import the
Processing serial library
Serial myPort; // create new myport
serial object

//int r =0;
long time;
int wait1 = 95000;

int wait2 = 60000;
int wait3 = 29000;
int wait4 = 45000;
int wait5 = 49000;
int wait6 = 50000;
int wait7 = 56000;
int wait8 = 38000;

int caseNumber = 0;

long previousMillis = 0;
long interval = 1000;
long lastTime = 0;

Movie livefeed;
boolean isPlayingLive;
boolean isLoopingLive;

Movie feeding1;
boolean isPlayingFeeding1;
boolean isLoopingFeeding1;

Movie feeding2;
boolean isPlayingFeeding2;
boolean isLoopingFeeding2;

Movie feeding3;
boolean isPlayingFeeding3;
boolean isLoopingFeeding3;

Movie feeding4;
boolean isPlayingFeeding4;
boolean isLoopingFeeding4;

Movie feeding5;
boolean isPlayingFeeding5;
boolean isLoopingFeeding5;

```

PROCESSING CODE

```

Movie feeding6;
boolean isPlayingFeeding6;
boolean isLoopingFeeding6;

Movie feeding7;
boolean isPlayingFeeding7;
boolean isLoopingFeeding7;

Movie feeding8;
boolean isPlayingFeeding8;
boolean isLoopingFeeding8;

//Set up
void setup()
{
  size(1100, 720);
  frame.setBackground(new java.awt.
  Color(0, 0, 0));
  //sketchFullScreen();

  frame.setSize(1100,720);

  livefeed = new Movie(this, "livefeednew.
  mov");
  livefeed.loop();//plays the video over
  and over

  feeding1 = new Movie(this,
  "feeding1HD.mov");
  feeding2 = new Movie(this,
  "feeding2HD.mov");
  feeding3 = new Movie(this,
  "feeding3HD.mpg");
  feeding4 = new Movie(this,
  "feeding4HD.mov");
  feeding5 = new Movie(this,
  "feeding5HD.mov");
  feeding6 = new Movie(this,
  "feeding6HD.mov");

  feeding7 = new Movie(this,
  "feeding7HD.mov");
  feeding8 = new Movie(this,
  "feeding8HD.mov");

  lastTime = millis();
  time = millis();//store current time

  // Serial
  String portName = Serial.list()[0];
  myPort = new Serial(this, portName,
  9600);
  // read incoming bytes to a buffer
  // until you get a linefeed (ASCII 10):
  // myPort.bufferUntil('\n');
}

//draw

```

PROCESSING CODE

```

void draw() {
  switch(caseNumber) {

case 0: // play lifefeed
  background(0);
  livefeed.play();
  image(livefeed, 0,0);
  break;

//case 1: // play livefeed again
// //feeding1.pause();
// background(225);
// livefeed.play();
// image(livefeed, 0,0);
//break;

case 1: // play first feeding video
  livefeed.pause();
  background(0);
  feeding1.play();
  image(feeding1, 0,0);
  if(millis() - time >= wait1) {
    feeding1.stop();
    caseNumber = 0;
    time = millis();
  }
  println("1");
  break;

case 2: // play Second feeding video
  livefeed.pause();
  feeding2.play();
  image(feeding2, 0,0);
  if(millis() - time >= wait2) {
    feeding2.stop();
    caseNumber = 0;
    time = millis();
    println("2");
  }
  break;

case 3: // play third feeding video
  livefeed.pause();
  feeding3.play();
  image(feeding3, 0,0);
  if(millis() - time >= wait3) {
    feeding3.stop();
    caseNumber = 0;
    time = millis();
    println("3");
  }
  break;

case 4: // play third feeding video
  livefeed.pause();
  feeding4.play();
  image(feeding4, 0,0);
  if(millis() - time >= wait4) {
    feeding4.stop();
    caseNumber = 0;
    time = millis();
    println("4");
  }
  break;

case 5: // play third feeding video
  livefeed.pause();
  feeding5.play();
  image(feeding5, 0,0);
  if(millis() - time >= wait5) {
    feeding5.stop();
    caseNumber = 0;
    time = millis();
    println("5");
  }
  break;

case 6: // play third feeding video
  livefeed.pause();
  feeding6.play();
  image(feeding6, 0,0);
  if(millis() - time >= wait6) {
    feeding6.stop();
    caseNumber = 0;
    time = millis();
    println("6");
  }
  break;

case 7: // play third feeding video
  livefeed.pause();
  feeding7.play();
  image(feeding7, 0,0);
  if(millis() - time >= wait7) {
    feeding7.stop();
    caseNumber = 0;
    time = millis();
    println("7");
  }
  break;

case 8: // play third feeding video
  livefeed.pause();
  feeding8.play();
  image(feeding8, 0,0);
  if(millis() - time >= wait8) {
    feeding8.stop();
    caseNumber = 0;
    time = millis();
    println("8");
  }
  break;
}
}

```

PROCESSING CODE

```

}
break;

case 4: // play third feeding video
  livefeed.pause();
  feeding4.play();
  image(feeding4, 0,0);
  if(millis() - time >= wait4) {
    feeding4.stop();
    caseNumber = 0;
    time = millis();
    println("4");
  }
  break;

case 5: // play third feeding video
  livefeed.pause();
  feeding5.play();
  image(feeding5, 0,0);
  if(millis() - time >= wait5) {
    feeding5.stop();
    caseNumber = 0;
    time = millis();
    println("5");
  }
  break;

case 6: // play third feeding video
  livefeed.pause();
  feeding6.play();
  image(feeding6, 0,0);
  if(millis() - time >= wait6) {
    feeding6.stop();
    caseNumber = 0;
    time = millis();
    println("6");
  }
  break;

case 7: // play third feeding video
  livefeed.pause();
  feeding7.play();
  image(feeding7, 0,0);
  if(millis() - time >= wait7) {
    feeding7.stop();
    caseNumber = 0;
    time = millis();
    println("7");
  }
  break;

case 8: // play third feeding video
  livefeed.pause();
  feeding8.play();
  image(feeding8, 0,0);
  if(millis() - time >= wait8) {
    feeding8.stop();
    caseNumber = 0;
    time = millis();
    println("8");
  }
  break;
}
}

```

PROCESSING CODE

```

    feeding8.stop();
    caseNumber = 0;
    time = millis();
    println ("8");
}
break;

}

void keyPressed() {
    if (key == 'p') { //test if the feeding
        video plays
        // start feeding

        // myPort.bufferUntil('\n');
        //caseNumber = 1 ;
        caseNumber = (int) random(1,8);
        //caseNumber = round(random(4,6));
    }
}

void serialEvent(Serial myPort) {
    // read the serial buffer:
    String myString = myPort.
    readStringUntil('\n');
    myPort.clear();
    if ( caseNumber == 0 ) {
        time = millis();
        caseNumber = (int) random(1,8);
        println("serial detectr");
    }
    //else caseNumber == 0; else do nothing
}

void movieEvent (Movie m) {
    m.read();
}

```

ARDUINO CODE

```

//This code will turn a relay on when the
IR sensor ditects movement
//This code will also communicate to
processing to change its video feed
//M1.2 Valk

//variables sensor
int inputPin = A0;
const int numValuesInArray = 150; //
here we define how many values in the
array
int distanceValueArray
[numValuesInArray] = { 0 }; //here
we are making an array (list of values)
initialized at zero
int spotInArray = 1;
long total = 0; //Sum of all readings
int average = 0; // the average of the
readings

int delta = 0; //the difference between
the average and the last reading
int absoluteDelta = 0; //when delta is
absolute it is abosolute
long previousMillis =0;
boolean isActive =false;

//variables relay
int relayPin = A4;

//Setup
void setup() {
    //setup sensor
    Serial.begin(9600);
    pinMode(inputPin, INPUT); // we want
to gather information from the sensor
which means this is an input
    delay(10);
}

//setup realy
pinMode (relayPin, OUTPUT); // we
want to turn the relay on and off so its an
output

//so that we dont have to wait too long
before the array is ful we make a for loop
before the loop
for (int arraySpot = 0; arraySpot < 150;
arraySpot++){
    didPumpMove();
}

//the loop
void loop() {
    // if pump moved start water for 3

```

