



Front Matter

Executive Summary

In this international project, students from Luleå University of Technology and Stanford University have been globally collaborating to develop a product that could enhance the wellbeing for elderly.

In light of the "baby boomers" after the war in the 1940s and the limited recourses in elderly care there are fewer employees that are supposed to take care of a growing population in the future. Further more the population tends to get older and older, this is a problem in Sweden and the rest of the western world. The quality of care differs a lot between elderly homes, cases of rather alarming circumstances at elderly homes are a reoccurring discussion in the media.

In Luleå a new elderly home is to be built and it should be ready in first quarter of 2007. The idea is that the new elderly home will be a model for elderly care and the most modern in Europe, not only with high-tech aids and a nice surrounding, but also with excellent care from employees.

During this open-ended project the team members developed a product based on the needs that was found during needfinding. The elderly have a lot to tell and if their stories and knowledge disappear it is a big loss for us all. The product developed during this project is individual and promotes the social interaction between elderly and relatives and therefore increases the wellbeing of elderly. The product will





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be implemented in a new elderly home in Luleå.

The mission was to "Enhance the wellbeing for people in their latter part of life". That statement was all the team had to start out with. In order to achieve this, the meaning of 'wellbeing for elderly people' first had to be investigated. The project began with a characterization of wellbeing. It has been defined as a combination of physical, mental, and social health, displayed in Figure 1. To truly improve the wellbeing of elderly persons the team believes that all three factors must be enhanced. The team visited many facilities and consulted several experts in both America and Sweden. In the beginning of the project the team focused on helping aids. But as the project got further they realised the importance of social and mental stimulation. During the needfinding and benchmarking they realised that this was a rather unexplored area compared to helping aids. After benchmarking the team went back to needfinding when focusing on social and mental needs trying to find things that support social activities and interaction. From this needfinding the team realized that pictures were a good trigger for social interaction. A lot of concept was generated and after testing two of the concepts the whole team could come up with a final prototype, the Nösphere. The idea is to present a picture on a globe with rear projection and

changing the picture when rolling the sphere. The pictures that are projected on to the sphere are provided by Flikr and you can personalise the content with using an identification system called Radio Frequency Identification. By making it personal you can also have different modes, advanced and easy for



advanced and easy for *Figure 2: render of the finished prototype* example. The final prototype is shown in figure 2.



Glossary

API

An application programming interface (API) is the interface that a computer system, library or application provides in order to allow requests for service to be made of it by other computer programs, and/or to allow data to be exchanged between them.

API Kit

Prepackaged software for constructing API systems.

Ballr

Flash program developed by Team Sirius to control the media on the Nösphere.

DMK (Division of Computer Aided Design)

A department at Luleå University of technology

Critical Function Prototype (CFP)

A model designed to test a particular component, subsystem, or function.

Dark Horse Prototype (DHP)

A prototype that challenges the team to think beyond their current project direction and prototype an idea that they otherwise would overlook as too unrealistic or difficult

Flash

Macromedia Flash, or simply Flash, refers to both the Macromedia Flash Player and to a multimedia authoring program used to create content for it as well as games or movies created using the program. The Flash Player, developed and distributed by Adobe Systems (formerly by Macromedia), is a client application available in most web browsers. It features support for vector and raster graphics, a scripting language called ActionScript and bidirectional streaming of audio and video.

Flashr

A Flickr API kit for Macromedia Flash and ActionScript.

Google

A U.S. public corporation, first incorporated as a privately held corporation in September, 1998, that designs and manages the Google search engine.

Idea Box

Suggestion box placed in a Swedish nursing facility.



Ingridshem

High end nursing home in Luleå, Sweden.

LTU

Luleå University of Technology, located in Luleå, Sweden.

Multi-sensory Stimulation

The excitation of many senses at once in order to calm or excite an individual. Conducted by trained professionals, this can make a person more responsive and increase their ability to interact.

PRO

An organization for elderly in Sweden which are arranging meetings, trips, education etc to support elderly.

RFID

RFID (Radio Frequency Identification) is a technique that uses radio frequency to collect information from small programmable tags. This technique is used in many different applications such as, tracking containers, identification of dogs and car keys.

Snoezelen

A method of care which concentrates on personal attention and sensory stimulation.

Sundowners Syndrome

A mood disorder from which sufferers experience periods of extreme agitation and confusion during the late afternoon or early evening hours, leading to irritability towards caregivers or hospital staff.

Tag

A tag is a keyword which acts like a subject or category. A keyword is used to organize WebPages and objects on the Internet. Each user "tags" a webpage or image using his own unique tag.

USB

Universal Serial Bus (USB) is a connectivity standard for attaching peripherals to computers.

Wiki

A type of website that allows users to add and edit content and is especially suited for collaborative authoring.

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1: Introduction

1.1 Background/Project description

The mission that was given to the team was to *"Enhance the wellbeing for people in their latter part of life"*. A project called NeedInn acted as liaisons. The NeedInn project stretches over two years and the keywords for it is needfinding and innovation. The goal for NeedInn is to create a method, a working process, which contributes to a need centered product development process within e-health. To make this happen they need to develop a way to find the needs and to make them more clearly for users and solution providers. This project was supposed to be a pre study for the NeedInn project to give an example of how this process could be conducted.

The task given to the team by NeedInn can be found in appendix D.



1.2 Team introduction

The project team consisted of eight students, four from LTU and four from SU.

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2: Distributed Engineering

2.1 Distributed collaboration

The whole project was conducted through global collaboration between the four students from Luleå University of Technology, Sweden, and the four students from Stanford University, USA, working together as a team. This proved to be a challenging task due to the two universities having different theories of approaching product development as well as geographical and cultural differences. The product development mentality at LTU is more focused on the large industry sector compared to Stanford University. Stanford Masterplan contains parallel writing of the report and building small prototypes in contrast to the Sirius Masterplan, which can be found in appendix D. It was a new experience for all the team members. The experience of working cross-national was still worthwhile due to that diversity in views gives the best ideas of two worlds. Both halves of the group contributed with their skills, professional and personal, to the process and brought different points of view into the design process.

The teams used videoconference to work synchrony and e-mail for the asynchrony work. The more informal contact was held with Instant Messaging such as MSN. During the conferences the teams often used picture and other physical things when they tried to get a better understanding for functions and prototypes. From the beginning at least one video conference a week was held but as the project preceded the need of conferencing more often arose. Furthermore the team tried to be online as much as possible so that they could get in touch when ever something needed to be discussed.

Collaboration is definitely a challenge but both team halves learned a lot and it has given wider dimensions to the project as well as it has brought it further than it probably would have come without collaboration.



In aspect of the collaborative work there were two turning points during the project. The first one took place in early January when the whole team met face to face for the first time as the Stanford students came to visit Sweden. During these few winter days much work was conducted and many ideas generated. Part of the reasons why this was the case was because the team finally could get to know each other in a more informal manner, which is an important part of collaborative teamwork. Also, it proved to be much easier to have fruitful discussions and to understand each other when being physical in the same place.

After the first meeting it was easier to work together even when all had gone back to their points of departure. During the videoconferences many and good ideas could be generated together and the team dared to take discussions as they came. But even so it was somewhat difficult to get a jointly flow in the work process. Therefore it was decided that a second meeting was needed. This final meeting took place in the beginning of April when the Luleå team half went to Stanford, USA. After had been working on similar concepts but still with some slight differences the team was eager to tie the project together and gather towards a jointly goal. The work during that trip gave good results.

2.2 Globally distributed communication tools

Video conference

Throughout the project the team met each other through videoconferences once a week. During those meetings, each team half described the past week's activities, shared new documentations that had been created, and discussed plans for the upcoming week. Also a few brainstorm sessions were performed. In the beginning the team used Marratech, but later on they changed to Confero. The resolution of the picture is much better with Confero but it also demands a better Connection. Both programs worked well as soon as you had learned to use them properly. Confero allowed both teams to open documents from their respective computers that could be seen and edited by the global partners.



The time difference of nine hours sometimes made difficulties in finding convenient times for both groups. Often the cooperative work was conducted either early in the mornings or late in the evenings. During the upstart of the project the conferences was held, at 7:45 Stanford time and the 16:45 Luleå time, every Monday and Thursday. Later it changed to 12.30 respective 22.30 pm. In spite of challenging working hours, having the opportunity to meet each other once a week facilitated the collaboration and made the team work harder.

IM

For informal sporadic communication, instant messaging programs, MSN and ICQ were used. Both programs allow two or more people to send text, files and pictures and in addition it is also possible to carry video and audio chats. These programs are both freeware.

E-mail

For more formal communication e-mail was used. E-mail is also a freeware that makes it possible to send electronic mail, files and pictures.

Project portals

In Stanford a website called the Wiki was used to organize documentation and centralize the information for the project. That kind of website allows the users to add and edit content and is especially suited for collaborative writing. In Luleå the team used an online application, Project Coordinator. This web-based project management tool is capable of storing files, tracking events and milestones and provides an easy way to work. Additional features include support for SMS, personal and team blogging and discussion boards.



3: Guidelines for the FEE Project

3.1 Statements

3.1.1 Problem statement

A new facility for elderly care is being built in Luleå with the aim of becoming an excellent model for old-age care regarding reception, treatment, and environment. It is to stand ready for opening in 2007. The facility will house residents with late stage dementia, Alzheimer's disease and those nearing the end of their lives. The quest for the Future elderly environment project was to create a service or physical product that was based on realistic needs to improve the wellbeing for the residents. The main focus of the project was the needfinding part and testing partial prototypes through out the design process.

3.1.2 Vision statement

When the project started the team came to an agreement that every elderly at an elderly home should have the possibility to talk, walk and think each day. Each person should be treated as an individual. With these statements in mind the team also felt eager to create something new and innovative that was based in needs. Some keywords were also stated to have something to strive to achieve; activity, stimulation, social, intuitive and individual. Further more the product should be useful; something that really had a meaning to it.

3.1.3 Need statement

Some nursing home residents are unhappy with their quality of life, as they face the loss of independence, mobility, and mental acuity that they maintained in their youth. In particular, nursing facilities are generally unable to provide adequate human interaction and stimulation to dementia and Alzheimer's patients. These residents spend most of their days passively sitting in wheelchairs or beds, while their minds and bodies degenerate. Without mental stimulation, residents experience memory loss and an incapacity to perform activities of daily living. A decrease in physical activity causes muscle atrophy and stiffness that



may lead to permanent immobility or similar health concerns. New technology to improve nursing facilities has the potential to drastically enhance the wellbeing of the residents and the environment for the caretakers. Although the need for new nursing home technology is apparent today, this concern will heighten over the next fifty years. The baby boomer generation of the late 1940's is approaching the age of 60. which will spark a tremendous growth in the population of the elderly that will steadily increase during the subsequent thirty years. Additionally, people are living longer than ever, creating a swell in the population of retirees. A valued market for improving elderly care exists, as the spending power of the baby boomers is 2 trillion dollars per year according to the U.S. Census Bureau [3]. The upcoming generation of elders possesses different interests than those of the current elderly population. Baby boomers have a greater proclivity towards technology and a much higher comfort level with computers. The lack of adequate stimulation for nursing home residents, the drastically growing population of the elderly, and the changing interests of the future residents all exude the need for nursing home improvements.

3.2 Design Requirements

3.2.1 Introduction

Although the problem statement provided by the liaison is unrestrictive, the team was able to create many project requirements from knowledge gained while researching, benchmarking, and need-finding. The design requirements are divided into functional and physical sections, and they are not focused on any one design solution. Each vision created by the team should therefore fit into the following requirements.

3.2.2 Functional requirements

"Enhance the wellbeing for people in their latter part of life."

The primary requirement of the project is to improve the overall quality of life for the residents of the new facility. The form of this improvement can take the shape of a product or a service, but the enhanced wellbeing of



the resident is a primary necessity. For residents that are mentally sharp enough to provide verbal feedback, wellbeing can be assessed by directly surveying the physical, mental, and social health of the elder. In most cases, the patient will not be able to speak coherently, so wellbeing can be evaluated through decrease of weight loss, improved sleeping patterns, and calm or pleasant behaviour. The following items describe sub-requirements for this broad, primary requirement:

Adaptable to a broad range of physical ailments and mental capacities

The residents of the Luleå nursing facility will be nearing the end of life, demonstrating poor physical condition, low mental ability, or both. However, mental capacities could range from short term memory loss to the inability to form words. Physical ailments could span from having a slight limp to being bedridden.

Create a buy-in factor

In order for the product to enhance the wellbeing of the elder, the resident must accept the product as a service or device that will provide a clear advantage to his/her lifestyle.

The product should promote enthusiasm within the user. The effectiveness of a buy-in factor can only be evaluated through feedback from the user and the demand for the product. Verbal feedback is most effective to learn if the elder feels the product provides a distinct advantage to his/her lifestyle. The demand for a device or wait-list for a service will be a solid indicator of a successful buy-in factor. The product should also:

- o Improve the environment for the caretaker
- Enhanced wellbeing of the elder should not come at the inconvenience of the caretaker.
- Improve the caretaking experience for employees.

For example, the caretaker could save time by being able to quickly locate patients. A logistical task could be removed from his/her schedule to allow more time to focus personal attention on the residents. Perhaps



an increased general happiness among the residents will make work a more enjoyable experience for the caretaker.

3.2.4 Functional Constraints

- Must be safe to use

- The product/service may not in any way pose a threat to the health of the user or caretakers.

3.2.5 Functional Assumptions

-Wellbeing consists of physical, mental, and social health-Wellbeing is defined as a contented state of being happy and healthy.To achieve maximum happiness and healthiness, physical, mental, and social factors need to be enhanced.

- Improving only one facet of health can certainly enhance wellbeing, but perhaps not to the extent as if all three were improved. This does not discount the possibility that a device focused primarily on physical health can also improve mental and social health.

- Target dementia/Alzheimer's patients

- Elders remain in their homes as long as possible, receiving care from home nursing services and relatives. It is not until they are in need of 24hour assistance that elders move to nursing facilities. Late-stage dementia and Alzheimer's disease are the most common illnesses represented in nursing homes, much more so than physical ailments such as severe arthritis or immobility. Dementia is also significantly more common than other mental diseases such as Parkinson's disease.

3.2.5 Functional Opportunities

Functional opportunities can be a service or a product that brings wellbeing to the residents.

The problem statement provided by the liaison allows the product to take the form of a service or a product. The project could result in something that physically aids the residents, such as a mobility device or location sensor, or it could manifest as a multi-sensory experience.



3.3 Design Methodology

The Luleå team has been working according to Sirius masterplan. The masterplan is a way to go from a users' need to a finished product. The idea is that if you follow this you will not miss any important step in the product development process and make sure that there is a need for your product. The plan consists of different phases and in each phase you can choose different ways work through the phase, the most important thing is to work trough all phases. There is no right and wrong and you need to adjust the plan to what ever product you are doing, you can also use the plan on what ever product you want. The masterplan is a result of research at Luleå University of Technology.

team realized that some adjustments needed to be done, overall the team is satisfied with the plan and the work has been proceeding well.

The Sirius Masterplan starts with the Planning phase. During this phase the team is supposed to set team roles and establish the goal for the project, to make sure misunderstandings are avoided.

The Planning was followed by the Design Space Exploration phase. During this phase the three sub phases; Needfinding, Benchmarking and Related technology, are performed.

The Needfinding process aims to uncover the needs of the anticipated users by observing their everyday habits and by gathering their wishes and thoughts. This is best done through interviews and surveys. The information gathered was compiled and the results were categorized in order to get a clear picture of the essential needs.

Benchmarking is a process to systematically improve ourselves by learning from others that already are established on the market. It is a way of determining who sets the standards and to find out what has already been implemented and works and what does not. During this phase the market of existing products were scanned in order to find out what is state-of-the-art today. For this the internet was an indispensable source as well as the established contact with Ingridshem. Study visits



were made to different organizations and enterprises associated with the market in question.

The last thing to do in the Design Space Exploration phase is to look for Related Technology, which basically means that you look at products with interfaces or technologies similar to what you are developing. This is to expand your views and to start thinking in new directions.

3.4 Design assignments

During the course the team was assigned three assignments critical function prototype, dark horse, funky prototype and functional prototype. The idea with critical function prototype is that you are supposed to try out a critical function about your product and while doing so you learn more about the product not only that function but you get a better understanding when building stuff.

When you are working in a project it is easy that you are getting stuck and restricted in your ideas, therefore you can use the dark horse prototype to expand your design space. The idea is that you are making a prototype of the concept you have the least expects on. Funky prototype is suppose to be a prototype were you try your whole concept so you see that everything is working, it doesn't need to be completed, it is more of a way to see if it is possible to get the functional prototype working. Functional prototype is the last and final prototype that the team is suppose to be present and as the name says it is suppose to work.

Because the team did not have a specific product to develop, all the prototypes are a reflection of what phase the team were in, while building them. For example in the beginning when focusing on aids the critical function was a walker with modified wheels



3.4.1 Critical function prototype

During the needfinding phase the team found that elderly people have problems while passing over a curb when they are using a rolling walker.

The wheels get stuck and it is heavy to lift a walker up on the sidewalk in front of your body. The critical functional prototype was designed to be "a walker which manages curbs without having to lift it up". The team brainstormed and from several ideas one was chosen. A walker from a team member's grandma was borrowed and



the team started building. The original

Figure 3: Walker with improved front

front wheels were removed, a new construction with two wheels on each side and a spring that made the suspension was mounted. The modified walker worked when the team used it, but the team did not feel confident that it would work while handled by an elderly. To much force has to be applied to get the walker over a curb and the walker tends to "dive" during breaking and acceleration. The new walker could, with some modifications, be a potential product but there are several walker producers on the market, so there is already great competition. The prototype is shown in figure 3.



3.4.2 Dark horse

The idea was to try RFID (radio frequency identification), to see if it was possible to direct the radio waves and use a passive tag for detecting a fall.

RFID technique is a wireless transference of data between a reader and transponders (tags). There are mainly two sorts of tags, passive and active. With a passive tag you don't need an energy source at the tag and the tag can be very small. An example of passive tags is the ones that are used for identification on dogs (often called chips and are inserted in the neck of the dog). A problem however with this is that the range is restricted and not at all as long as the range of an active tag. An active tag contains an energy source and can't be made as small as the passive. With the active tag you can put in different applications and logging data, for example you can measure the temperature at specific times and storing the data until you are reading them with the reader. To save as much money as possible we started to see if we could borrow some equipment from school. It turned out that they didn't have any RFID but they told us to contact Electrotech in Kalix and after some persuading we could borrow some equipment from them.

The team acquainted themselves with the technique and used different materials and range to try directing and screening off the radio waves to see if the signal from the tag vanished.

After some testing it showed that it is hard to direct and screen off the radio waves due to the relative short frequency that are used for their RFID.

You get a longer range and permeability with longer waves, but lower energy. The team wanted to use the shorter waves to be able to use passive tags (you need more energy in the waves when you are using passive tags) because we didn't want to use batteries.

The team also did a concept of what other uses there could be for RFID in an elderly home. Because if the team could show all the things that you could use RFID for, it would be easier to persuade the people in charge that they should implement this technique into the homes. The RFID concept is shown in appendix C.



The experience derived from this was that it is hard predict how RFID will work in a certain surrounding and therefore you should test it in the environment that you are planning to install it in. The team is convinced that it could work by choosing; the right antenna, were to put it and use the right frequency for the radio waves.

3.4.3 Funky prototype

The Funktional Prototype is a prototype that is made to test the function of an idea. The funk in the funktional is to show that it doesn't have to be perfect in any sense but rather a rough prototype in order to save time and money.

The team decided to try an idea regarding pictures of home environment. A problem with elderly homes today is that when you move to this facility you leave your old home behind. Many people living at elderly homes today miss their old house and will show pictures and talk about it when given the chance. The idea was to show pictures of someone's old home stay or the surrounding areas and determine if it would create a good feeling and be stimulating. The vision was that a person staying at an elderly home walked in to a specific room a computer identified the person and showed pictures of surroundings familiar to that person, for example their old kitchen window view. The prototype was made out of two screens placed in a 90 degree angle on which images were projected. The concept test is shown in figure 4.



Figure 4: Outdoor environment



First the team tested the prototype and found that both of the screens should have back projection (one of the screens had front projection), in order get rid of shadows and to the risk of getting the light of the projector shined into the eyes. Testing the prototype was hard since we couldn't move it and it would also be hard to interpret the feedback of the persons testing it since stimulation and good feeling is hard to measure. After trying it out for ourselves the team did a test on a small group of elderly people. During the test the team learned that image substance is a key element. The test also included a video conference between a lady that had suffered a stroke and her husband. It worked well and the thought of having video conferences in future elderly homes grew.

3.4.4 Functional prototype

This, the last one of the prototype assignments; the Picture conveyor, was with further development to be the final prototype that the team presented at the final Sirius presentation the 19th of May. The thought behind this product was to combine all the benefits seen from the previous prototypes. The team decided to work further with the idea of showing pictures in an intuitive and easy way. The idea is that the user should get an instant tactile feedback when scrolling the fabric which a picture is back projected onto. The picture conveyor can be found in section 6.



4: Design Space Exploration

4.1 Needfinding

4.1.1 Purpose

The purpose with needfinding is to collect knowledge about the needs that the customer has. During product development it is important to see your target customer and know what the market wants. It is hard to predict the market and even harder to predict your customer. Therefore it is important to know your customer and know how they use the products that are on the market. To observe and do research is the best way to get an understanding of your customer and find their unfulfilled needs. For this project the elderly living in elderly homes is the target group. Needfinding is a big part of the project and the liaison NeedInn will use the information about how the team conducted the needfinding, in their case study.

4.1.2 Ideology

It is common to ask customers what they want, but if you want to be innovative you need to base your product in needs. A need can be obvious; in some cases the customer knows what they need and try to find something to fulfill that need. Sometimes the customer does not know that a need is unfulfilled until a product is on the market. It is hard to ask the customer because he/she does not know what is missing. To develop a product based on these unspoken needs is one of the purposes of this project.

4.1.3 Methodology

Global team

The team decided that the needfinding process should be done as two groups, one at LTU and one at Stanford, to get as much material as possible. One other good thing that came from doing different needfinding was that the results could be compared, and if both had seen the same things they could be certain that it was real needs.



• Field trips/observation

Much of the needfinding was conducted at elderly homes. Here a team member followed the staff and got to know how the elderly live their lives and trying to see problems, determine the needs and see why something is done in a certain way. Field trips were also made to home services.

• Logging

Writing a detailed log was also a method that the team used, where a team member writes down detailed observations about a specific task that the elderly or the staff does, for example, a task could be; getting out of bed. Later the log is read, and the needfinder tries to see problems with the task and determine the needs.

• Interviews

Interviewing people with relevance of the study is another method. The team interviewed people living in elderly homes, elder relatives, people working in the elderly care, experts etc. A important factor is to get the interviewees to understand that it is not a solution that the team is after but the problem or the need. Another problem with this method is that the attitude among elderly people is that they are satisfied about their environment and feel that their needs are fulfilled. This made the task more difficult.

• Need box

The team decided to place a box on a strategic place inside the elderly home, Ingridshem. The thought behind this was that the staff members could write down an idea/problem/need as soon after they got it and place it in the box. This way the idea/problem/need would not be forgotten until the team had their next visit. However the box didn't meet the teams' expectations. Only one idea was placed in the box during the needfinding phase.



4.1.4 Discussion

Needfinding was a new concept for the team in the beginning of the process and many problems and difficulties surfaced. Needfinding is quite time consuming and the progress is hard to see and measure. Because of this it is easy to get frustrated since the project doesn't seem to move forward. The team also found it hard to estimate how long time the process would take. It is hard to find methods and it is hard to find information on how to use them. Luckily, the team coaches are experts on needfinding and helped the team to keep calm and discuss needfinding problems.

4.1.5 Characterization of wellbeing.

The need of characterizing wellbeing arose as the team had to determine what they were working to achieve. An explicit picture of the characterization is shown in figure 5.



Each individual has a subjective experience of the external conditions it is exposed to. It leads to positive feeling which brings a quality of life and leads to a sense of wellbeing.

Figure 5: Visualizing wellbeing



4.1.6 Dependence

The team felt the need of characterize the elderly since the needs differs a lot depending on what stage in life they are.

The needfinding process started with determining the target group. After some research it was found that there are four types of groups among elderly people;

- Independent
- Help from partner/relatives.
- Help from home service.
- Homes for the elderly.

Independent

By independent we mean elderly people who live in their own home and don't need any kind of help or service.

Help from partner/relatives

These people live in their own home and need help from relatives, partner or neighbors to buy groceries and help with other daily chores.

Help from home services

This category you can find both in their own home and at particular homes for elderly where they have help from home services a couple of times a day.

Homes for the elderly

Here the elderly have staff around them all the time and the elderly who lives here have reduced versatility or suffer from dementia.

Categorization

Every group has different needs. We tried to find out the needs that they all have common.

The only thing we found that are common to all of the groups are, that they have reduced versatility. Therefore we characterized elderly people as people with reduced versatility.



4.1.7 Elderly Homes

Most of the needfinding was conducted at elderly homes because that the team wanted to get the best picture and understanding of the problems in today's elderly care.

Ingridshem

Ingridshem is situated near Luleälven in Gammelstad, 10 km from the city of Luleå. It consists of 41 studios with kitchenettes. The size of the apartments varies between 26.6 m2 to 43.7 m2 and all of them have belonging extra space for storage. The house has got five floors, divided into 5 different wards, each one of them has got common spaces for meals, being together and activities. In the house there are also spaces for culture, activities and training. There is also a warm water pool.

The typical patient at Ingridshem is 85 years old and spends their last 3 years there. The Swedish elderly care moves towards letting the elderly people stay at home for as long as possible. This means that those who live at elderly homes are in quite bad shape.

The staffs consist of caregivers and nursing assistants. There is access to nurse day and night. One full time nurse is employed within the house in daytime. During daytime there are three caregivers working at every ward. At the night there are only two within the whole building.

The motto for this facility is: Nothing is impossible! They are trying to have as few routines in the day as possible and trying to look for the special needs of each elderly. They are striving to have as cosy atmosphere as possible and not having just an "institution". The staffs eat together with the elderly and are trying to keep a broad range of activities to suite everyone's needs and wishes. The nearby surroundings admit many outdoor activities and during the summers they usually keep different kinds of animals, such as hens, roosters, lambs, rabbits and pigs.

The house is not built for the purpose of being an elderly home. From the beginning it was a home for people that needed extra care. Therefore the planning of the rooms and the permanent interiors are not the best for elderly people. The fact that the house consists of several



floors enables the residents to move freely between the wards. Many doors are locked and the residents don't have the strength to walk the stairs. They are therefore reduced to socialize with just the other people at their ward and can not go and see friends in other wards.

The fact that the common rooms is down the hallways makes the surveillance for the staff a difficult task and the hallways are quite narrow. The staffs were also complaining about the floors in the bathrooms. They are slip-safe, which is good, but makes them difficult to clean. Another opinion they had in the bathroom area was about the arm rests on the showering chairs. If they are of the kind when they can be lifted up the whole chair becomes unsteady. Another thing they wished for was wheels so that the showering chairs could easily be moved around.

The issue of clothing for the staff was also raised during the day. They are wishing for working clothes; clothes that are durable, comfortable and have many pockets. Another thing we observed was the way they crushed the medicine for the residents. They simply put the pills in a bag and stepped on it. They could really use a tool for that.



Figure 6: Typical room at Ingridshem





Figure 7: In the all-purpose room at Ingridshem



Figure 8 Ingridshem

Alviks äldreboende

The facility is situated on a hill in the village of Alvik, 30 km outside of Luleå. It consists of 18 apartments that are divided into two wards, East and West. The house is built in 2000 and is all in one level. Along the front of the house there is a large terrace that the elderly can use freely.

The staff members are trying to make the elderly take part in the planning of the activities. They are trying to meet the needs of every individual in both the activities as well as the care the facility is providing. One of the main priorities is to establish good connections with other generations and make the relatives feel welcome.

At Ingridshem there were a lot of problem with the construction of the building since it was not build for the purpose. Many of the problems at



Ingridshem were solved in Alvis elderly home. Therefore the team assumed that those problems were solved in the new elderly home, which later on turned out to be correct.



Figure 9: Living room at Alviks elderly home



Figure 10: Alviks elderly home

Lytton Gardens

Lytton Gardens is an elderly home in Palo Alto, California. They provide different levels of care, such as; independent living, assisted living and skilled nursing. The Stanford team has visited the facility many times especially during their needfinding. They got to know the patients and conduced interviews with experts.

The LTU team got the chance to visit Lytton during the trip to Stanford. To compare, the skilled nursing ward was the most similar with a Swedish elderly home. Swedish elderly care is leaning toward give the



elderly the care they need at their home so that they can stay at home for as long as possible. Lytton Gardens is an example of where you can move pretty early in your life when you are not in need of assistance and stay at the same facility to the end. Some of the work is volunteered based which is another difference from Swedish elderly homes.

Classic Residence by Hyatt in Palo Alto

The Hyatt facility, Palo Alto, California, is a high end; luxury based continuing care facility. A continuing care home takes residents when they are typically younger and more active. As the resident becomes increasingly disabled, continuing care at the appropriate level is provided for the remainder of the resident's life. Before being admitted to the facility potential residents are subjected to a rigorous screening process. Therefore, most of the residents in this new facility are in good health.

The cost of staying at Hyatt is a buy-in cost between 1 and 2 million dollars plus a monthly fee between 2500 – 7500 dollars, depending on which ward you live in and what kind of care you need.



Figure 11: One of the all-purpose rooms in Hyatt

Each resident has their own "memory box" a glass box outside their room with things relative to their life. This contains everything from porcelain figures and airplane models to pictures of their loved ones.





Figure 12: Hair saloon at Hyatt

Hyatt has been granted the Best of Seniors Housing Gold and Silver Achievement Awards from The National Association of Home Builders (NAHB) 50+

Housing Council.

The facility has been visited during the Stanford teamhalves' needfinding and the LTU team made a visit to Hyatt, during the trip to Stanford.


4.1.7 Research

Disability/Disease Research

There are many disabilities and diseases that are common among elderly people. In this section we will bring out the most common the ones that will have effect on the development of our product.

Dementia

Dementia is not a homogeneous disease but a name for a group of symptoms which indicates that the functions in the brain are yielding. Dementia often debuts with yielding memory and reduced ability to work in everyday life. It also leads to concentration issues and reduced ability to take initiatives, abstract thinking, orientation, judgements and emotional blunt.

The Dementia often begins as an insidious disease. The patient can seem depressed, but with time the disease will show more specific problems in handling everyday activities. During the course of disease psychological symptoms can show, as depression, suspiciousness and hallucinations. When the disease has advanced it often becomes necessary with special treatment and living conditions. Dementia not only affects patients, but also people in their surrounding, like the relatives, because the patient often requires a lot of supervision and care in the long-term. It is therefore important to improve information and support to the relatives. They play an important role in the treatment of the patient.

Throughout history the knowledge of demense-illnesses used to be very limited. The doctors did not know much about what caused the cells to die before intended time and there were no relevant treatment to get. When elderly got forgetful and confused they were just called senile and the inconveniences were regarded as a part of growing old.



Luckily the situation has changed. It is now known that the dementia diseases are a consequence of pathological changes in the brain and that there are a number of different diseases with completely different causes.

In our society of longer lifetime the probability of suffering from dementia increases with advancing age. Dementia predominantly occurs in the second half of our life, often after the age of 65 - some experts think that this is the 'price society has to pay' for our higher life expectancy and therefore the term 'dementia' activates similar fears and repression mechanisms as 'cancer' or 'AIDS'.

The frequency of dementia increases with rising age from less than 1% of the 60-65 years is affected, 2% for the 65-69-year-olds, to 5 % for the 75-79 year-olds and to more than 20 % for the 85-89 year-olds. Every third person over 90 years of age suffers from moderate or severe dementia. It has been estimated that in Sweden there are about 100.000 people with serious dementia and prognoses points out that in the future we will have more elderly people in the society and therefore the number of demential people will increase drastically. It has been calculated that the treatment of dementia in the year 2000 will cost society 35 billions SEK, and then the costs of efforts of the relatives not even included. These efforts are in level with the costs of heart and vessel diseases. In the future the yearly costs will rise in connection with the increasing number of elderly. Small progresses as improved research can therefore result in huge positive consequences for the costs of the society.

Hearing impairment

The occurrence of hearing impairment increases with age and is a big problem for the elderly, even though there are many good hearing aids on the market today. This problem was something the team saw when visiting the elderly homes and the staff was also telling the team how big of a problem it was to communicate with the elderly. The problem is that it is difficult for the staff to communicate with the elderly. This is something to take in consideration.



Visually handicap

With visually handicapped you mean people who in spite of the best sight correction still have problem reading regular text or orient in unfamiliar surroundings.

The occurrence of visually handicapped is biggest in the ages 80 years and above.

This is important to have in mind when making a product for people in this age.

Memory Research

Since each one of our five senses can stimulate and evoke memories the team decided to study them closer.

The Sense of Smell

Did you ever experience that you caught a scent and suddenly a crystal clear memory comes back to you from an event that you'd forgotten for years? Or, have you ever perceived a whiff of a certain perfume or cologne that reminds you of people in your life. Distinctive odours associated with certain events or persons can elicit memories and evoke different emotions associated with them. Therefore the sense of smell is also called memory's sense and it can be said that it is being at the mind-body interface. This area and the impact of it on our everyday life is poorly understood or examined. Often we underestimate the importance of smell to our wellbeing. There are persons who have lost some or all of their sense of smell due to some disease, for example Alzheimer's disease, or accident. These people are called anosmics and if they are being asked, they most surely can confirm how important the sense of smell is. Some anosmics suffer from depression and their quality of life is severely affected and at the moment there is little that can be done to help them. For instance almost all sense of taste is in the nose and if you lost the ability to smell, much of the ability to taste is lost too.



The sense of sight

When watching pictures and movies they often affects you in different ways whether you get happy or sad it is a strong trigger for feelings. In research and talking to occupational therapists the team got the same answer everywhere; pictures are a powerful tool when trying to exercise the mind and stimulate people to remember. A problem with elderly people is that they often tend to have bad vision.

The sense of touch

How often have you felt the need of a hug? The need of being touch is strong for the human being and often forgotten when working with elderly. When working with the sense of touch it is important that the touch do not turn into pressure so that the elderly feel uncomfortable.

The sense of sounds

Sounds often triggers memory and gets you moving, you want to move to the music. Because of his music stimulates both physically and mentally.

Exercise

Elderly people receive very good and quick results from exercising. Most elderly still have got the ability to adapt to different stages of physics. Aerobic exercise improves the functional capacity and decreases the risk of develop diabetes. High intense weight training improves the strength fast and also improves the possibilities of leading a more independent and rich life.

Through physical activity the fragility that characterizes elderly can be worked counter to. Studies have shown that most people, including the very ill and fragile, receives big benefits from a combination of aerobic exercise, weight training and movement training. It helps them to retain, and sometimes even improve their independence, quality of life and thereby their wellbeing.



4.2 Results of Needfinding

The needs that the team saw were divided into problem areas which later on were brainstormed trying to solve the issues. The problems are presented below.

4.2.1 Problem Areas

Bathrooms:

Because the reduced mobility that elderly has, a lot of the problems are in the bathroom when they are showering or doing their other needs.

• Problems:

- To be able to take a hot bath but not in the exercise pool or using a tilt bath since it is hard and dangerous for an elderly to step in and out of a bath tub.
- Mirror, unable to see themselves while sitting in the shower chair.
- Water on the patient during the whole time while showering, otherwise the patient gets cold
- o Shower/toilet chair not adjustable in height
- It is hard to reach over the sink and use the water tap because the limited reach that elderly have.
- Rheumatics have problems using the nozzle handle because of its shape.
- The shower/`toilet chair is sometimes to high and sometimes to low to fit every patient.



Bed:

Some of the elderly are staying in the bed round the clock therefore the demands on the bed are high. At Ingridshem they have old beds but they said that the new beds are much better.

- Problems:
 - Making the bed is time consuming for the staff and is difficult for an elderly.
 - The bed alarm plate is hard and is uncomfortable for the patient.
 - It is hard for the elderly to get in and out of bed.

Alarm:

There are several different alarms on the market today. But, still there are many problems in this area. The alarms makes the elderly feel safe and makes the staff work easier.

• Problems:

- The alarm rug does not work because the patients tries to step over it and tries to put it under the bed so the alarm does not sound.
- If the patient falls it could take a long time to get help if they are unconscious.

Activity:

There is a big need of activity and stimulation while waiting between meals. Every human being feels better from physical and mental stimulation. After the activities at the elderly home the elderly becomes much more active. For example: After the "sing and dance" session at Ingridshem a man continue playing his accordion all night.



Aids:

Overall there are a lot of aids on the market but they all have one thing in common, the lack of design. As an example the elderly are trying to hide the alarms that they are supposed to wear and they don't want to use a walker because they think it is embarrassing.

- Problems:
 - Kitchen chairs are hard to move and hard to sit down into.
 - The kitchen area gets crowded with walkers during the day.

Communication:

Hearing difficulties despite hearing aid. The elderly and even the staff have problems with communication. The hearing aids does not work good enough.

Architecture:

The apartments at elderly homes need to be decorated with things that the elderly recognize and get stimulated by. There should not be a long corridor between the elderly and the staff, which have their whereabouts around the dining room.

Illness:

- Problems:
 - Spetsfot calves muscle to short after lying in bed for to long. The patient forced to walk on their toes.
 - o Blood clot that nobody discovers.

4.2.2 Conclusion

It is hard to make any conclusions from the problems that that the team had been seen because of the big design space. Therefore the team later on narrowed down the problem areas to one, activity/stimulation, that is further explained under the roadmap.



4.2.3 Assumptions

The team did the assumptions that the architecture problems were solved in the new elderly home. Knowledge in the medical field was left to the doctors.

4.2.4 Discussion

Because of the big design space the team had difficult deciding area but when the choice was made and talking to staff and elderly about it everybody was convinced that the right choice was made.

4.3 Benchmarking

4.3.1 Course of action

Because of the fact that there are a lot of aids on the market and it is a market that is expanding, combined with that the team wanted to do something new and innovative, the team started to look at different areas such as the social and mental part of wellbeing.

4.3.2 Products on the market today

Many of the needs that the team saw during the needfinding was already fulfilled with existing aids, they were just not implemented in the facilities where the team did their research.

The problem seems to be that the lifetime of an aid is so long that many of the aids at the facilities today are old and outdated.

Some of the products found are presented in appendix B.

As the team leaned towards developing a mentally stimulating product for picture showing in some way lots of effort was put into looking at similar products already at the market.

Multi-point interaction surface.

"Bi-manual, multi-point, and multi-user interactions on a graphical interaction surface." This surface (plasma screen) makes it possible to



interact with the surface in a greater and very intuitive way. One of the teams' earlier ideas was to place a big plasma screen on the wall that recognise witch person walks by and then showed them their pictures, play their favourite song and invite the caretakers to interaction.

This project with this multi-point interaction is still on research level and isn't on the market yet. [39]



Figure 13: A multi-point interaction surface.

Lcd-keys and keyboard

The Optimus keyboard is a Russian product that will probably be on the market in late 2006. The keyboard has a small display for every key and can therefore change the information showing in an infinite number of ways. For example different alphabets could be used and programs could show exactly what the key is controlling. [40]



Figure 14: Photoshop Quake



Onomy Labs products

The Tilty Table is a table with an image that moves when the table is tilted, Figure 15. This provides unique and intuitive control over media and is especially useful when viewing maps or large documents. The image is projected from above and the movements are read by sensors. They are then sent to a computer which translates the movements through software and adjusts the image accordingly. The table also allows the user to zoom in and out of an image by gently applying torque to the table.



Figure 15: Onomy Lab's Tilty Table

The Interactive Digital Wall is a large scale multimedia timeline. These devices are usually custom designed for large museums and enable the user to interact with a timeline in a new way. As the user moves the screen along its tracks (from left to right) new images and bits of information appear on the screen. If the user pauses on a certain point, additional information pops up. While these devices are useful for specific applications, they lose their appeal after repeated use. Both the Tilty Table and Interactive Digital Wall require an extensive production to update the content.[41]





Figure 16: Onomy Lab's Interactive Digital Wall

4.3.3 Laws and legislations in Sweden

In Sweden, the laws are very general concerning elderly care. Swedish citizens have the right to elderly care and can choose what type of care they want. They have an opportunity to choose, which elderly home they want to live in (in their county). The care should be in a "satisfying way", and the care should be individually designed. The staffs and the people who are in contact with the care have "report duty" if they see anything that is wrong with the care.

In Sweden there are no law that tells you how the elderly care should be carried out, only that you should provide "good care" and there it is up to a judge to decide what bad elderly care is.

4.3.4 Discussion

There are several products that are still in the research stage and under development. These kinds of products are relatively new and are built to be as intuitive as possible.



4.4 Related technology

4.4.1Course of action

In order to get a wider perspective of how different techniques could be combined and implemented in the final product the team took a peak at related technology. As an idea of what the final product should be like already was set up the team mainly focused at technologies in those areas.

4.4.2 Identification

Finger identification

Fingerprint Cards is a Swedish company that produce a module that uses your fingerprint as identification. These cards are easy to use and are becoming more and more popular. There are several different companies and methods that deal with fingerprint recognition.[42]



Figure 17: A fingerprint module from Fingerprint Cards

Voice identification

Voice identification systems recognize every person's unique voice. It is easy to use and you always have your voice with you. It is easy to fool these systems by recording the voice from the user. To make it safer it is possible to make the person speak a different phrase every time he or she uses it.



Eye identification

Eye identification scans and recognizes people by their iris. The iris is the coloured part of the eye and like fingerprints, no irises are the same. The system is becoming more and more common especially on airports.

RFID

RFID (Radio Frequency Identification) is a technique that uses radio frequency and collect information from small programmable tags. These tags have a serial number and when the tags are close to (<20cm) the RFID-reader collect the information. This technique is used everywhere, tracking containers, identification of dogs, car keys for example. This system has many advantages from the other identification systems. It is cheap and the elderly will not notice the technique.



Figure 18: An example how RFID is used in the industry[43]

4.4.3 Projection

There are many products on the market today that uses projection rear or front, such as TVs and home entertainment systems, cinemas etc. The team thought that it would be interesting to see what other products except those, there are out there.



Inflatable Effects





Figure 19 a&b: By Aerostar International, Inc has a 40 feet inflatable sphere which an image can be projected onto. Synchronized projectors can be used to show a movie 360 degrees around the sphere. [44]

Nippura Blue Ocean Rear Projection Screens





Figure 20 a&b: Nippura uses an acrylic screen for rear projection. The screen could be bent in different ways and the proprietary diffuser Blue Ocean® is molded inside of the acrylic.[45]



SMART Board



Figure 21: SMART Board from SMART Technologies Inc. The smart board uses; rear projection, front projection or big plasma screens for their products. The screen which the image is projected onto is touch sensitive and can therefore be used for interaction.[46]

4.4.4 Discussion

There are several products that use front/back projection. And it is becoming more popular now, as the projectors are getting cheaper. The projectors are also getting brighter, that makes it possible to use them in places that aren't completely dark.



5: Roadmap

The purpose of the roadmap is to stake out the path of where to go in the forthcoming product development process, i.e. it can be regarded as a map for the future work that lies ahead. In this phase a description of the product that is to be developed is compiled from the information gathered during the Design Space Exploration phase. The Roadmap is of most importance due to the product development process, therefore the work done here have to be as detailed and of high quality as possible. This is to make sure that the work can proceed smoothly and to have something to go back to in case of a setback. Another important thing is to create a common ground for the team, to make sure that all the members are working towards the same well defined goal. This is to avoid misunderstandings within the team and to create a flow in the working process.

When translating the raw data from the needfinding there are several things to take into consideration. The most important thing is that the needs should be expressed in terms of what the product should be able to do, not in terms of how it might be done. This is to make sure those important needs and facts are not lost when narrowing down to the design space.

Several methods for carrying out this process were studied and the team settled for the Ulrich & Eppinger's method (*Product Design and Development, 2004 [1]*). The main idea of this method is to create target specifications and final specifications. Some changes had to be made to the set-up to suit this specific project due to the lack of clear definitions.

To define the path of the project a Statement and Product Characteristics were established.



In the Mission Statement the needs of the users are compiled and ranked and the Product Characteristics includes the needs transformed into functions that the device should possess.

5.1 Mission statement

5.1.1 Method

It is important to establish the Mission Statement to get a general direction of the project without prescribing a particular way to proceed or a precise destination, and should contain product description, key business goals, primary market, secondary market, assumptions and stakeholders. This is to never forget for whom and why the product is designed. The mission statement of the team was developed according to the Ulrich and Eppinger's design method with a few modifications to better suit the special project in matter.



Figure 22: Quality of life divided into smaller groups

Figure 22 above shows the needs that we found during the needfinding phase. The product that we are going to make will be based on these needs. To make our product as competitive as possible it should cover as many of these needs as possible, and fulfil each need as strongly as possibly. It is hard, if not impossible to do this with just one product. After brainstorming around the needs and benchmarking different ideas



we decided to look closer at the needs that we think are the most important/most unfulfilled, but still solvable with a product that doesn't exist on the market today. The need that we decided to focus on is the Activity/Stimulation-need and hopefully we can include some of the other needs as well. The people in elderly homes today are quite different from each other, not only in terms of the normal differences between people but also in terms like dementia, reduced mobility etc. Because of this the product will deliver a tailor-made activity/stimulation for each person.

5.1.2 Result

Product description: An individual experience that stimulates and encourages socialising by using the essential needs as motivation to use our product.

Key business goals: Improve activity/stimulation for elderly persons living in elderly homes which will improve their wellbeing.

Primary market: If we could do a product that all elderly people could use would be ideal. During the needfinding we find that the needs for elderly vary a lot. Therefore we need to focus on one group. We are focusing on elderly at elderly homes.

Secondary market: Elderly care in general, kindergarten, homes for mentally challenged, clubs and schools are markets that our product or parts of our product could bee used

Assumptions: Liaison says: OK since the product is well rooted in needs. Ingegerd Bucht and the new elderly home will buy it.

Stake holders: The persons and companies that will be affected by the result of our project are: We, NeedInn, The new elderly home, Elderly care in general, elderly and their relatives.



5.2 Product characteristics

5.2.1 Method

When developing a product you have to translate the discovered needs into measurable functions to get rid of the subjective interpretation. The product characteristics should tell the team what the product has to/not to do. But it is very important that the product characteristics don't tell the team how to address the customer's needs because the team wants to keep an open design space.

To be able to translate our needs into product characteristics we used the Ulrich & Eppinger method. The target specification process consists of four steps:

- Prepare the list of metrics.
- Collect the competitive benchmarking information.
- Set ideal and marginally acceptable target values for each metric.
- Reflect on the results and the process.

The idea is to get the metric to reflect the needs as directly as possible. The relationship between needs and metric is central concept of characteristics. When you are satisfied with your metric you should do a competitive benchmarking to be able to compare the values for the different metric. And finally the team reflects on the result and process to establish that the result is consistent with the goals of the project.

Because of the fussiness of our task and the problems that you come across when you are trying of put value and metric on peoples feeling we can not make a product specification in the traditional way. Therefore we made a change in the method and chose to only use metric not value and evaluate the metrics during the process.



5.2.2 Compiling product characteristics Compiling product characteristics

The needs that were found during the needfinding phase were translated into functions that engineers could interpret and leave out the subjective interpretation.

People at elderly homes have nothing to do and they are sitting and waiting. If you ask them what they are doing, a common answer is that they are waiting, not knowing for what. Why is it this way? We feel that there are too little time for the caregivers to do things with the elderly and that the activities that the homes does not take place often enough and does not suit everybody. Therefore we feel that there is room for a product in this area. To understand what the elderly wants to do in their free time we have to look at their needs and what motivates people to do a specific action. Therefore we started to look into Maslow's hierarchy of needs. This is a theory in psychology that with time has been extended. It is often presented as a pyramid starting with the most biological needs at the bottom and gradually extending to more spiritual needs at the top as seen in fig 23 The theory contends that as humans meet 'basic needs', they seek to satisfy successively 'higher needs' that occupy a set hierarchy.

Because elderly people are such a big group of people and their needs vary lot we look at the basic needs in Maslow's hierarchy of needs. To narrow down our task and focus on wellbeing we just look at the three highest steps being; belonging needs, esteem needs, and self actualization. We are assuming that the two first steps are fulfilled at modern elderly homes.

To be able to determine which needs are behind this rather big sections we choose to write down the smaller needs that, alone or together, constitute those headlines.





Deficit Needs

Figure 23: Maslow's hierarchy of needs

The break down of the Belonging needs

When the physiological and safety needs are fulfilled, the next need in the hierarchy consists of the social needs. This step contains emotionally-based relationships in general, such as friendship, sexual intimacy or having a family. It is in the human nature wanting to be part of a group and feel they belong somewhere, whether it is a club, a work group, a religious group or a family. People have the desire of feeling needed and loved, both sexually and non-sexually, and we found three ways in which this need can be accomplished thru; communication, nearness and common denominator. If these necessities are not fulfilled it can result in increasingly susceptible to loneliness, social anxiety and depression. The result of the break down is shown in figure 24 below.



Figure 24 Breakdown of belonging needs

The break down of the Esteem needs

People need to feel self-respect and respect from others. In order to do that, people can engage themselves in different activities that can give them recognition and a sense of contribution and self-value. It can be either a profession or a hobby. If it is imbalance at this level, the results can be low self-esteem and inferiority complexes. But it can also result in an inflated sense of self-importance and snobbishness, which is not something to strive after either. The needs that build up this level were found to be; communicating, feeling needed, nearness and independence, as shown in figure 25.



Figure 25: Breakdown of esteem needs

The breakdown of the Self actualization need

This is part of the "being or growth needs", which is the force behind personal development. When this phase is reached a feeling of satisfaction appears. At this level it is the instinctual need of a human to make the most of their unique abilities and situation. At the highest level of this phase you find self- transcendence that sometimes is referred to as spiritual needs. It can result in a feeling of exceeding once ability of performance. In athletics it is called "*peak performance*". This endures motivations or drivers of behaviour.

"Self Actualization is the intrinsic growth of what is already in the organism, or more accurately, of what the organism is. A musician must

make music, the artist must paint, a poet must write, if he is to be ultimately at peace with himself. What a man can be, he must be. This need we may call self-actualization."

Maslow

When the lower phases of the hierarchy of needs is fulfilled the needs of the next level begins to have an importance. So when this level is reached the outermost behaviors as caring for others and doing things just for amusement and not really looking to any benefits from it apart from just add to the enjoyment and increasing the wellbeing. The breakdown of self actualization is shown in figure 26.



Figure 26: Breakdown of self actualization

We have chosen the communication need and the fun/exciting need. The communication need was chosen because it is represented in both self esteem and belonging need and is not fulfilled in elderly care of today. Figure 27 illustrates different way of communicate that our product should support.





The fun and exciting need from the self actualization block was also chosen because the lack of positive stimulating activities. The team has divided fun/exciting into two subcategories: individual and social. The reason behind this is that both have desirable features. Each person has different tastes in terms of what the like to do and the persons living at elderly homes also have different capacities, both physical and mental. Therefore the product should be individual. The other subcategory: the social, is desirable because it would allow more interaction between the elderly, between elderly/relatives and friends, between elderly and staff. This is a need that is too great to be set aside. The product should be individual and be able to stimulate social interaction. Examples of activities that elderly people like to do and talk about is shown in figure 28



Figure 28: Breakdown of fun/exiting



5.3 Discussion

It turned out that trying to express needs in the way of functions were far more difficult than the team thought at first, and there are many methods in which it can be done. The team decided to use the Ulrich & Eppinger's method, but with some slight changes to suit our project. Since the project was vaguely described it is hard to find a method that fully and completely works. The Ulrich Eppinger's method is much more suited to work with a product that already exists on the market (a bicycle fork was an example in the book). However it would be nice if there was a method that we could use without changes, since the importance of a roadmap is the same for our product than compared to a more traditional. We did not find such a method.

The roadmap was also more time consuming than we first thought and since it states the direction the project will take, it feels important not to rush ahead but rather take the time and make it to a document the team can lean on in the phases to come.

In spite of all the problems that the team came across we learned a lot and we define our task by doing so we feel that we now are on *common ground*.

During the process the team learned that to translate a need into a metric without stating how to do it was the biggest challenge.



6: Concept Design and Prototyping

During this project there have been a lot of wills involved and as a result there have been many concepts and ideas. In this report the team has chosen to present the ones that the whole team liked and has worked on.

6.1 Concept Generation

6.1.1 Brainstorming

The global team worked together with brainstorming using Confero to be able to display ideas to each other and also separately showing them to each other afterwards. The global team also had the opportunity to have syncrone located work when Stanford student visit Luleå and when LTU students visit Stanford. The collocated syncrone brainstorming worked well when the team were using the "Studio" and could use different displays and cameras to be able to present the ideas in a satisfying way. The concept that the team chose to develop is a result of the global brainstorming were one part come from LTU and one from Stanford.

6.1.2 Design Space decisions

When the team looked back on the roadmap they soon realised that fulfilling all the functions from the roadmap could be hard if not impossible. Therefore the team evaluated which of the functions that was most important to enhance the wellbeing of elderly people. The decisions that were made resulted in following function:

- Personal
- Show picture
- Interface that suits elderly

Both team agreed on that using RFID for making the picture personal would be the best solution, they also agreed on that making the interface was the trickiest part.



6.1.3 Defining and distributing the tasks

Both team halves had different timelines and the Stanford team had already started to work on one concept so therefore, to cover as much ground as possible, the team decided that LTU team should work on a different concept. Since the teams had limited time and felt that the concepts were good, agreements were made to do two prototypes and evaluate them to see which to continuing working on.

6.1.4 The generated concepts

Tactile picture frame, the idea was to get the elderly to interact with pictures, to do that the team wanted to make nine small screens that you could flip and by doing so get some sort of feedback. Ideas that come up were using it as memory, build one big picture of the small ones, get new pictures when flipping screen,

The Nösphere

During a local brainstorming session the LTU team came up with the idea to use a big ball to move around in a space of picture. Making it as a big globe would make it easier for elderly to navigate. When presenting the idea to Stanford they expanded the idea and to having an image projected onto the surface of the ball. Having the image on the ball feels like you are moving the picture physically which make it more intuitive.

The Nösphere is an unconventional interface that allows elderly to scroll through a slideshow of their favourite pictures by rotating an 18-inch diameter sphere in one direction. The sphere stands approximately two feet off the ground (ideal wheelchair height) and rotates around a horizontal axis. Using Flickr, an online photo album, residents or caretakers input a key phrase into a nearby computer and a set of matching pictures appear on the ball (i.e. animals, sunsets, pictures of their family and friends, etc). The image is projected on the top of the ball, and as the elderly user spins the sphere, one image rotates off the ball as a new one rolls into view, Figure 29 shows the Nösphere





Figure 29: The Nösphere displaying a projected image

How It Works

The team ordered an 18-inch acrylic sphere from Planet Plastics in Ontario, CA using medium density fibreboard; the team constructed a base to hold the sphere. Urethane wheels were attached to the base to allow rotation in one direction,



Figure 30: Nösphere rotating on urethane wheels attached to an optical encoder



An optical encoder (mouse scroll wheel, in this case) was mounted next to one of the urethane wheels to sense how fast and in which direction the sphere rotates. This information is passed through a Flash program, which retrieves photos from Flickr. The Flash code maps the turning speed of the scroll wheel to the speed and direction of the scrolling picture slideshow. The images are projected onto the acrylic sphere through an external projector mounted above the sphere.

The Picture conveyor

The idea with the picture conveyor is basically the same as with the globe; you get an instant tactile feedback when scrolling the fabric that the picture is presented on. The difference here is that the image is projected from behind.

By using rear projection you do not get a shadow from your hand that could confuse the user. The biggest advantage is that the image is flat so the focus is good on the whole picture. The same software was used in this concept as in the globe. A render of the picture conveyor is shown figure31.



Figure 31: A render of the picture conveyor



How it works

To be able to evaluate the concept the LTU team started to build the conveyor. The frame was welded together from steel profiles. The team did not want to spend a lot of money on buying an expensive screen, instead a curtain from Jysk would do. The rollers the team got from an old dishwasher and the projector was borrowed from DMK. One of the rollers are attached a mouse scroll wheel and by pulling the drape you roll the drape on the rollers. Otherwise it works pretty much as the globe, the same flash program is used with a different speed on scroll setup.

6.1.5 Evaluation in the concept generation phase

The tactile table was out of the question already before the evolution because no one in the team felt that the table fulfilled the needs and that the idea rather came from pushing instead of pulling from the needs. Another aspect was that it would bee to complex for the caretakers. After that there were only two concepts left.

6.2 Concept Testing and Evaluation

The conveyor was tested in Luleå at Ingridshem and at a PRO meeting. At Stanford the globe was tested at Hyatt and Lytton garden. It was hard to get some reliable facts from our testing because of the little time that both team had for testing. However, with the result from testing and using a method called six thinking hats the team felt that they could make a choice.

When testing at PRO the feedback was good, some of the comments were, "super", "that's great", "this would be great for the memory", "I wish that I had one of those" and there were also an old occupational therapist that were excited and thrilled. In figure 32: The test at PRO is shown.





Figure 32: Test at PRO

The team now felt confident testing it in its real environment so therefore the team went to Ingridshem.

At Ingridshem the team didn't get the response that they had hoped for, some of he elderly talked to each other and recognized the pictures but they were not so exited. One of the staff members said that it was probably because that the elderly did not feel comfortable with three strangers. She said it would be better if there were more staff members there to support. Anyway, caretakers liked the idea and thought that we were focusing in the right area. In figure 33 the test at Ingridshem is shown.





Figure 33: Test at Ingridshem

Stanford group were testing the sphere at Hyatt Classic Residence to observe the reactions of elders and caretakers interacting with the sphere. The caretakers were very excited about this new product, especially in the context of calming residents suffering from Sundowner Syndrome. In figure 34 you can see an elderly interact with the Nösphere.





Figure 34: Test at Hyatt

During the brief visit, the Nösphere was only tested with two elderly women in the memory-assist branch of the complex. One of the two had late stage dementia, but the other was fairly cognitive. The more cognitive resident verbally expressed her interest in the sphere: "I like this this is different. You know, it's not just the same old stuff." While she was in the room, she spent the majority of her time with the rotating ball. The more demented patient was unable to speak, but her excitement for this magical ball was clearly displayed throughout her entire body. She simply said "thank you" over and over again.

6.2.1 Results and discussion about the testing

The group gathered and discussed the result and found it hard to tell if the lack of excitement at Ingridshem was depending on the rough prototype, the presentation, and the media that was showed or if it was the group that the pictures were showed it to.

The team also felt that the test at Hyatt was not reliable enough since they showed the sphere to only two elderly and the caregivers. Therefore the team still could not decide which concept was the best.



The team decided that the LTU group would bring their prototype to Stanford so that the whole team could try both prototypes and after that be able to choose.

6.2.2 Stanford evaluation

When the whole team gathered at Stanford discussing the prototype it came clear pretty fast that there were many different wills and it would not be so easy to decide which prototype to continue to develop. At first the team tried to rank different important features and see which of the prototypes got the best results. After doing so it turned out that the only thing that separated the two prototypes were the image and how intuitive the prototype was. With this information the team still did not felt that they could make a decision as a result the team tuned to the coaches.

6.2.3 Contact with coaches

The teaching team thought that the team didn't have enough facts to be able to make this decision; therefore they thought that the team should gather the information needed. There were two ways to get some more facts, the team could go out and do more testing or they could use the six thinking hats method to get better basic data four the decision. The team chose to use the six thinking hats method because of the lack of time when Luleå team visit Stanford.

6.2.4 Six thinking hats

Deciding prototype

The team used the *de Bono method* of the six thinking hats. A general thought was that the team should make the same prototype. The de Bono method helped to make a constructive, playful discussion and helped showing the problems and benefits of each prototype. It forced the team members to think in a different way and made it easier not to be bias over one concept.

The method of the six thinking hats is a way to evaluate different concepts, and can be done in group or individually. Each of the six hats have an own color and symbolizes a different way of thinking, a different



mode, which all are looking at the concept from different perspectives. The key point is that a hat is a direction to think rather than a label for thinking. The method has been used by many successful companies with good results.

The key theoretical reasons to use the Six Thinking Hats are to:

- encourage creative, parallel and lateral thinking
- encourage creative, parallel and lateral thinking
- separate ego from performance
- focus and improve the thinking process
- improve communication
- speed up decision making
- avoid debate

Conclusion

The ball (the Nösphere) was chosen over the picture conveyor. Both teams felt that the Nösphere was better in a couple of aspects such as more intuitive, more interesting to build and more innovative, and still it would not be impossible to build within the timeframe.

6.2.5 Results and discussion

A big problem was that when testing the prototypes the whole group could not attend since one was tested in Luleå and one at Hyatt. It was easy to see the benefit with the prototype that you had been testing since both prototypes got good feedback.

With using the six thinking hats method the team came to the conclusion that the globe was more perfectible and much more intuitive than the conveyor. The team also agreed on that it was easier to get the image better on the globe than making the conveyor more intuitive.

6.3 Concept Selection

With the facts from the evaluation the team felt confident in choosing the sphere to continuing developing. Not just because of the reason that it is more intuitive but the possibilities are endlessly.



6.4 Discussion

Everybody was satisfied with the choice the team had made and felt eager to start working with the final concept. The team agreed on that there were a lot of things that needed improvements.


7: Detail Design and Manufacturing

7.1 Detail Design

When the LTU group was visiting Stanford the team focused on what the ball should look like and what it should contain. The team was divided in to two smaller groups with both Stanford and LTU students in them and the groups started brainstorming around how to present the globe, what features it should have and how the elderly should interact with the ball. After the brainstorming the team evaluated all the suggestions and features that all in the team agreed on. These were:

- Use RFID to detect who is sitting by the ball.
- Angled ball to get a better position for the user.
- Have "click" function in the ball instead of a enter button.
- Specific folders for each person at the elderly home that the relatives can email there picture to or use Flikr to download on website.
- Two modes easy and advanced, in easy mode you don't have to do anything just go to the ball and it shows the picture from your folder. If you are in the advanced mode you should be able to search the web on your own.
- The ball should be adjustable in height so that both people in wheelchair and those who want to stand can use it.
- Rear projection so that there won't be any shadows on the picture from the hand.

When putting an angle on the globe the team noticed that if the projector was to be mounted in the hole it would be rather hard to get close to the ball because of the projector. The team decided to use to a mirror so that the projector could be placed under the ball. One mirror was placed inside the globe so that the image would be 90 degrees from the rotation angle and another one in front off the projector to reflect the image on to the ball trough the hole on the globe. Another solution to this problem would be to place the globe in a hanging position, so the projector is on



top. The benefit with doing so would be that we only need to use one mirror instead of two.

7.1.1 Difference working in Luleå and at Stanford

The construction work started faster in Luleå than at Stanford, since they focused more on the software from the beginning. When Stanford started building they decided to work with profile aluminium instead of welding (see appendix C). Which were great since they could combine the all the adjustments that Luleå team had come up with on their frame and it is much easier to change the construction. The aluminium is also lighter and easier to work with. A problem though that came up when Stanford were using aluminium was that they got vibration because of that the aluminium deflect so much under torsion. The problem was however solved with a more rigid attachment. The software is made at Stanford with influence from the LTU team.

7.1.2 CAD/CAID

Because the lack of time and the small forces involved in our prototype the CAD files that the team made were only made to make sure that everything fitted and to be able to visualize. After finishing the 3D files they were exported to Alias StudioTools to visualise the prototype. In figure 35 a 3D file is shown of the finished prototype.





7.1.3 Shapes and colors

When using StudioTools the team was able to determine how to present the sphere in the room. First sketches were made and later on the ideas were imported to Studio Tools were they are easy to manipulate. The sketches are shown in appendix C.

The team wanted it to be discreet and something that the elderly could relate to. Another thing that came up was that everybody wanted to keep the mystery of it, this means that you should see as much of the sphere as possible so it looks like a crystal ball.

7.1.4 Software

To display images on the Nösphere, a simple Macromedia Flash application was created. The program, entitled Ballr, allows the user to search for a tag on Flickr. Depending on user choice, either the twelve latest images or the twelve most popular images with that tag are downloaded. Rolling the mouse wheel within the program window scrolls the images either left or right. The images will loop around creating a seamless scrolling/rolling experience. The Ballr software retrieves the "medium"-sized versions of the images from Flickr. "Medium" means that the largest dimension is 500 pixels. Smaller and larger images are available. "Medium" was chosen as a good fit for the 800x600 pixel resolution the projectors being used in the project has. Future versions may use projectors with higher resolutions, necessitating the use of larger images from Flickr.

The Ballr software uses the Flashr API kit. Flashr further simplifies the use of the Flickr API within the ActionScript environment provided by Flash.

Future versions of the Ballr software will allow the retrieval of more than twelve images, better alignment of images on the sphere surface, and searching by more than one tag simultaneously. A flow diagram is shown in figure 36.





Figure 36: Software flow diagram

7.1.5 Flickr

Flickr.com is a website where you can upload, store, organize and share your digital photos in an easy way. You can also search for photos that you are interested in. Flickr doesn't cost anything and is easy to use. During the product development process the group caught sight of Flickr and saw the possibility to use that with our product. To have the opportunity to see/show your own photos on the Nösphere and also look at others beautiful pictures without bringing the pictures to it makes the use of it much greater. All you need is an internet access to travel through countries and explore the whole world through beautiful photos. The software of the Nösphere makes it possible to search for a specific genre and then look at either the 10 most recent pictures or the 10 most popular photos on Flickr in that special genre. (www.flickr.com)



7.1.6 RFID

The team where hoping to be able to use the RFID, connected to the Flash program so you could personalise the pictures and the mode of the Nösphere. When getting closer to the end of the project the team realized that there were not enough time and felt that priorities needed to be made. Therefore the RFID was never implemented on our prototype but it still is a part of our concept.

7.1.7 Discussion

Even though the team decided not to use the RFID for the prototype everybody felt that the issues with bad image and rear projection were solved. The team has been working with detail design and manufacturing phase at the same time in order to save time but also to be able to make adjustments to get the best ergonomic design.

7.2 Manufacturing

Most manufacturing were made at Magnus' place since the team felt that working there saved much time. Since there were no need for high demands on tolerance and the force involved are so small all parts are hand made. The exceptions being: the globe, the projector and the foot.

7.2.1 Manufacturing while designing

To be able to determine where the mirror should be we used trial and error. To be able to test all this things the team first made a frame shown in figure 37.





Figure 37: Frame with the globe lying on it

This allowed the team to put the ball into the frame and adjust the angle of the ball. Next step was to get hold of a bearing big enough for the hole in the globe, so that the bearing did not bind the image size. After searching for a while and talking to some experts it appeared that a bearing this size was very expensive and the team id not want to put that much money on a bearing knowing that other things needed to bought, such as a new projector. The team decided to manufacture a bearing in plastic, but after re-thinking the team decided to use a mill to cut out the parts for a bearing in MDF. After trying this it turned out to work just fine and it was a lot less expensive. The bearing is shown in figure 38.





Figure 38: The bearing

When the team had solved these issues there were one big problem left, how to be able to spray paint the inside of the globe. At first the team did as it was prescribed on the label and added 5 to 10% water to the paint. The paint did not dry fast enough; it got runny and got ugly. On the next attempt no water was added, and then it worked. When using the projector on the sphere small dots in the paint were noticeable. This dot is probably a result of the lack of air inside the globe and all the dust that stays inside the globe instead of dropping to the floor as it usually does. The Team didn't know if these dots would be that big of a deal but a solution to the problem was to paint the globe outside and put a sealing on the paint in form of a clear coat.

A new globe was ordered because the quality of the image has always been of big importance for the team so if improvements could be made they should.

After painting the globe on the outside the team evaluated the result. The surface got much smoother with having the paint outside therefore the team chose to do that.

When the globe was painted, the team made adjustable holders for the mirrors to be able to tune in both mirrors.



For motion detection of the globe the team used the scroll wheel from a mouse, the benefit with this is that we can use the "click" sensor in the scroll if we want for the advanced mode. The motion sensor is shown in figure 39



Figure 39: Showing the motion component

To get as big picture as possible the team bought a projector with large throw angle and short throw distance.

The team chose to make a prototype standing on a pedestal just for the presentation. There is definitely a need of mounting it hanging but the lack of time makes it impossible to make both. To get a nice clean look on the prototype the team chose to make a box to cover the bearing and the projector and paint it black with a clear coat to get a nice shining look. A render of the final prototype made in Studiotools is shown in figure 40 and in figure 41 the finished prototype is shown.





Figure 40: A render of the finished prototype



Figure 41: The finished prototype



7.2.2 Assembling physical prototype

The prototype was assembled during the whole manufacturing phase to see if it fitted and when the prototype was ready the team took it all apart and fixated some of the adjustable parts to make it more solid. Finally the physical prototype was to consist of four parts; the foot, box with the frame inside, the globe and the projector that all were mounted after the paint job.

7.3 User Test

Unfortunately the team did not get the chance to try the product in its true environment before the product lunch. Since the sphere concept had been tested before and the team only had been doing improvements the team felt confident in the solution.

7.4 Discussion

Considering the short time the team had from the deciding concept to final presentation the whole team were proud of the final prototype and felt that it worked great. The only thing that did not worked out as planed was that RFID interface but that is not a big problem to solve if some one wants to continue developing the product and put it on the market.



8: Product Launch

8.1 Product display and presentation

The 19th of May 2006 the FEE project had a presentation at LTU for the public. A press release was sent out earlier to notify the media. The team also had a show case, where the public could use the Nösphere prototype and ask questions. Nordnytt (the local news TV station) made an interview, as did Kuriren (one of the local newspapers). The presentation went very well and the team got good feedback from the people visiting the show case as well as teachers and coaches. Many discussions and ideas were shared regarding the Nösphere. In figure 42 you can see the LTU team in their showcase with the Nösphere.



Figure 42: The team in their showcase.



9: Project Reflection

The global collaboration between LTU and Stanford has worked very well. In fact the final prototype is a product of a brainstorming session through videoconference. The videoconferences were held in English and were a barrier at first but a barrier the team soon overcame. It is also a bit special communicating through videoconference and it takes some getting used to. The Stanford team and the LTU team used different agendas, the LTU team used the Sirius Masterplan and Stanford used theirs, which sometimes made one team fall behind. A good thing about this was that the LTU teams adopted Stanford's prototyping tasks and built more prototypes than would have been built otherwise. The project was open-ended and in the beginning the team members found it frustrating to have such a fuzzy task. But with time, and support from coaches, the team grew to understand the benefits of this kind of project.

The team feels that the project has been a big learning opportunity and has improved many of the member's skills.

Looking back at the time spent on the project everybody realize that running this sort of project from needs to a functional prototype takes time. Most of all the team has learned that depending on what project you are in you must let some of the phases in Sirius Masterplan take a bit more time.

Overall everybody is happy with how the project turned out, not only with a good product but also with experiences that the team members got from global collaborating. Everybody made new friends that they never would have otherwise.



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Appendix A

Research

Alzheimer's disease

The most common form of dementia is Alzheimer's disease, which stands for approximately 60% of all cases. It was first described in 1907. It increases the death of nerve cells, especially in the temple lobs of the brain. People with this disease suffer mainly from deteriorated memory and orientation, limitations of concentration and speech and walking disorders. The most commonly known symptom is confusion which can lead to an unpredictable behaviour and the person becoming estranged from the surroundings. In the late stages of Alzheimer's disease, it often affects a number of body functions such as swallowing and the excretion process. As the patient gradually lose its independence, effects on social relationships and perceptions starts to show. It is a natural phenomenon to loose a certain number of nerve cells during ageing but this loss occurs much more rapidly in people suffering from this disease. As a result the brain does not function normally any longer. Studies show that the probability of developing Alzheimer's disease is higher for women and for people having a lower standard of education. The disease can also be caused by genetic changes, though this is very rare. In these cases symptoms usually occur before the age of 60 and progress rapidly.

Alzheimer's disease is a progressive disease, which means that the symptoms of the disease will show up incrementally. Dealing with the progression of Alzheimer's disease and caring for people through these stages is often a worrying and distressing task. The disease is typically divided into three stages; mild, moderate and severe.

Alzheimer's disease is most common caused by vascular dementia. The basal and clinical research have brought new knowledge of why the nerve cell's dies and new medicines will be developed, which not only just alleviates the symptoms but also hopefully will have healing effects in a long term. The treatment has wigh the new knowledge been improved. Increased knowledge and publicity have also created a change in attitudes towards dementia diseases in society, especially towards Alzheimer's disease, but there are still huge needs of research in the area.

Vascular Dementia

The second next most common form of dementia is vascular dementia, or blood vessel dementia. It is caused by changes in the vessels in the brain and stands for 20% of all dementias.

Frontal lob Dementia

Frontal lob dementia strikes the frontal lob, as the name indicates, but also the temple lobs. This kind is quite rare but can hit even young and healthy people in the middle of their life, which causes special kinds of problems.

There are also other conditions, called secondary dementias, diseases which show symptoms very similar to those of dementia. Dementia can also be a consequence of other diseases, for



example abuse of alcohol, dementia along with Parkinson's disease, damages to the brain or metabolism diseases. Sometimes it can be hard to separate dementia from other diseases, or even a normal state of growing old. Known risk factors are increasing age and a certain degree of hereditary. Significant less is known of how lifestyle and different environmental factors influence the risk of having dementia.

It is of great importance that all people with suspected dementia symptoms will be examined by a doctor and go through a careful investigation. Yielding memory and changed behaviour can be vague symptoms in the beginning, and be caused by a number of different things. The point with the investigation is to find other causes to the symptoms that possibly can be cured, such as depressions, hormonal disorders and lack of vitamins or infections.

An examination of a dementia patient aims to determine type and difficulty of the disease to be able to supply optimal treatment and care to the patient. Equal important is to supply information and advices to the relatives. The first thing that is examined is if it actually is a dementia disease behind the symptoms. Very often the preliminary examine is done by a general practitioner that gives a referral to a division specified on the actual affliction. A more extensive research is done to decide what functions of the brain is affected and how severe the damage is. All this is very important for being able to help the patient to compensate the yielding functions. With extended blood tests, sometimes even analysis of liquid from the spinal marrow, infections in the brain can be revealed. Typical changes can also be detected with EEG that examines the electrical activity in the brain. Nowadays there are also magnet cameras which supplies detailed pictures of the brain to make it easier to detect dementia and exclude diseases that are similar to it.

Exercise

To most people the ability to move around freely is a matter of course. But with ageing comes unwanted issues such as loss of muscle power, stiffness and pain. All of these leads to decreased freedom of movement and are a few of the complaints elderly seeks care for.

The consequences of reduced ability to move are shown in a number of different ways in the life of the elderly person. The quality of life decreases with the ability to work and practice hobbies. The self-confidence, sleep and mood can also be affected. If it gets really bad the loss of physical activity can risk the functions in many of the organs. The risks of getting heart and blood vessel diseases, diabetes and cancer increases. And if the trend can go on undisturbed the daily life will be undermined and common things as dressing, daily hygiene and shopping becomes insurmountable hinders.

There are a number of reasons why the physical capacity reduces with ageing. Apart from the genetically factors and diseases the diet and lifestyle makes a big difference. The genetically factors are difficult to influence, but the others can be interesting to study in order to prevent the physical decomposition.

When ageing the muscles changes in many ways. If you compare the ability to produce new cells, the strength of tissues and skeleton between a young and an old person you will find many differences. But you can also find that the decline that can be related to ageing varies a lot between individuals, and in extreme cases some functions of a 68 year-old can have a



higher capacity than an 18 year-old.

Most changes in tissues associated with ageing can be related to a number of factors, such as loss of muscle cells and changes in the production of boon and cartilage cells. Also the environment around the tissues changes, for example the circulation and production of hormones.

The changes of the musculature among elderly are striking. Between the age of 30 and 60 the strength of the muscles in back, arms and legs declines with around 60 percent. This corresponds to a loss of muscle mass of 4 percent every decade between 25 and 50, and 10 percent every decade from that point and forward. Furthermore the persistence of the muscles declines which results in elderly getting tired faster.

Aged muscles are easier damaged by their own contractions and demands longer time for recovering. Consequences of this can be fatal because the long time injuries take to heal and place the person for a longer time in inactivity. If this time gets to long the person will never regain normal strength and risks getting injured easier in the future. Once this bad circle is started it is very difficult to break it.

The changes in joints related to ageing can lead to stiffness, loss of ability to move and increased risk of getting injured. In cartilage the reproduction capacity of the cells changes and makes it difficult to repair injuries.

It can be hard to decide whether the loss of muscle capacity, which takes place when ageing, is genetically pre-programmed or if it is a result of social, mental and psychological factor. In any case there seems to be a link between ageing and loss of physical activity whatever the changes are in the tissues. Research have shown that regular physical activity can slow down, and even stop, many of the negative changes that are associated with the loss of strength, persistence and flexibility when ageing.

A decline of aerobic condition contributes very much to the loss of ability to move. The processes can be prevented by training. Potentially a well balanced training of elderly people lead to same profits as for a younger person.

The most dramatically changes in state of health among elderly are done by weight lifting. Many research reports prove that it is very effective for both elderly and younger persons.

Not long ago it was believed that physical activity did not have any good effects after a certain age. Some even said that it was harmful for elderly to train. Nowadays it is no longer a doubt that most elderly have big winnings with training, and is the biggest target group when it comes to start with physical activity and weight lifting.

Not only the budget for medical service that would have great benefits, but especially every individual person can have great advantages. Therefore it's very important to make big efforts in the area.

Water gymnastics have been considered to be improper exercise for persons with cardiac insufficiency. The background for that assumption is that the water itself causes a pressure on the body and makes the blood move from the legs to the trunk. It's been known to cause more load on the heart.

Now studies shows that bathing in a warm water pool actually reduces pressure on the heart, gives improved pump function and reduced heart frequency. By training in warm water the



muscle function and work capacity can be improved.

"Training in warm water pool can therefore with great benefits be used in rehabilitation of patients with chronic cardiac insufficiency, both with and without type 2 diabetes. To offer patients with a pronounced impairment a "smorgasbord" of different kinds of training solutions can lead to more patients can remain physical active high up in ages.", says Åsa Cider, certified physiotherapist



Appendix B

General benchmarking

This was made before the team chose area.

Liko

To get a better understanding for how aids are made and how the producers do their research, team went for a fieldtrip to Liko.

Liko is a Swedish company that builds helping aids for elderly, mostly lifts and walkers, their motto is "lifts with care".

The team went to Liko with an open mind just to see what kind of products they manufacture and how they work with their design process. It was interesting too see how they do when they are deciding on how and what they are suppose to do.

Gunilla Enquist was guiding the team around and answered questions; and there were opportunities to try some different lifts and a walker. The lifts varied a lot both in prize and in functionality and it are really hard to imagine what the lifts feels like for the elderly. Even if it is possible to try the equipment it is very hard to understand what it is like for a person that has to deal with it every day. What was surprising was that people rather buys the cheaper ones when it seems like the more expensive is much better and not that more expensive. We think that the best lifts that Liko provided are very god and fulfils the mos relevant physical needs, the biggest problem with helping aids seems to be that their life cycle is very long and they do not get replaced very often.

Liko claims that they develop their products with the best for the users in mind, but their only contact whit them seems to be through their salesmen's. Therefore the team took a closer look at their lifts to see if they could stand up to what Liko promised.

Medication

Wrong medication cause suffering and costs millions SEK per year. How the staff handle the medicine is changing. Now they get small plastic bags with medicine from a doctor, unique for each caretaker. The caretaker that can handle the medicine by themselves uses very old medicine-boxes (see figure 3). These boxes are hard to handle and has no reminder if the person forgot about the medicine.



Figure 3: The most common medicine-box.





- 6 -

Figure 4: A new Swedish medicinebox/reminder

There are lots of new medicine-boxes, with very smart solutions. The medicine box from Pharmacell (see figure 4) reminds people to take the medicine and also makes it impossible to take too much by using a clock that only makes it possible to take the medicine on the right time. There are also some medication reminders that are formed like a regular watch.

Walker

In the beginning the team had an idea about making a new type of cane that do not fall down when the elderly leave it behind. The cane is being replaced by the walker and the research was conducted in standing devices and especially the walker. There were plenty of different walkers that several companies produced. In a meeting with the physiotherapist at Ingridshem she told us about some problems with a standing table. Several of things can be improved for example like our walker prototype (see CFP), but most of the problems are solved in the producers next models (see figure 5 and 6).



Figure 5: Walker made by Liko AB



Figure 6: Standing table made by Etac

Hearing Aids

The first time the team went to Ingridshem the caregivers told us that the hearing was a big problem because they could not communicate with the elderly so it came naturally that the team needed to look in to hearing aids.



There are basically two levels of hearing aid technology; analogue and digital. Analogue technology has been around for many decades. Analogue technology offers limited capability, but is sometimes perfect for specific purposes. Digital technology is the most sophisticated hearing aid technology. Digital technology gives the audiologist maximum control over sound quality and sound processing characteristics.

There is qualitative and quantitative evidence that digital instruments outperform analogue hearing aids. Digitals are not perfect, but they are extremely good. Even though most of them are very good one should be aware of that all digital hearing aids are not the same. Within the "digital" world, there are better and worse units.

There are 4 basic styles of hearing aids. Behind the Ear (BTE, see figure 7), In the Ear (ITE, see figure 8), In the Canal (ITC, see figure 9), Completely in the Canal (CIC). There are variations on the four basic styles Example of hearing aids:

Example of hearing aids:



Figure 7: Behind the ear



Figure 8: In the Ear



Figur 9: In the Canal



Toilets

After seeing how they work at elderly homes the team felt that there is a big need of privacy in the bathroom which can not be obtained since many of the caretakers need help. Therefore a lot of research was made in this area. It's very common that the bathrooms are too small and a combined solution should be a product with large possibility. One of the team members used one of these automatic toilets and liked it a lot. There are several toilet producers that sell different solutions of automatic toilets. In Japan these toilets are quite common (see figure 10).



Figure 10: Automatic toilett. http://www.burkesbackyard.com.au/2003/__data/page/3790/382003_Toilet02.jpg



Appendix C

Concepts

RFID

During the research and development of the funky prototype many different functions that RFID could support came up

Outdoor:	Open doors for those who are able to take care of them self outside.
	Automatic heated seats in the garden that do not need to be on all the time,
	instead it starts when the elderly are at a particular range.

- Security: Safety oven that is impossible to start if the wrong person is trying to use it, it "recognizes" the RFID tag and through that who the user is. Fire security system that sense that everybody is outside the building but also make it easier to locate someone who is trapped inside. Combined alarms, tracking, fall alarm, guiding light, and bed alarms.
- Personal: Personalize media such as TV, games and for example use a touch screen to get information and picture from relatives that they have E-mailed or download to server.





Pictures from building the conveyer:

Figure 11: Different stages of building "The picture conveyor".



Pictures from building the noosphere:



Figure 12: Different stages of building "The Nösphere".



Six Thinking Hats A summary by Sylvie Labelle

"Early in the 1980s Dr. de Bono invented the Six Thinking Hats method. The method is a framework for thinking and can incorporate lateral thinking. Valuable judgmental thinking has its place in the system but is not allowed to dominate as in normal thinking. Dr. de Bono organized a network of authorized trainers to introduce the Six Thinking Hats. Advanced Practical Thinking (APTT), of Des Moines, Iowa USA, licenses the training in all parts of the world except Canada (and now, Europe). APTT organizes the trainers and supplies the only training materials written and authorized by Dr. de Bono.

Organizations such as Prudential Insurance, IBM, Federal Express, British Airways, Polaroid, Pepsico, DuPont, and Nippon Telephone and Telegraph, possibly the world's largest company, use Six Thinking Hats.

The six hats represent six modes of thinking and are directions to think rather than labels for thinking. That is, the hats are used proactively rather than reactively.

The method promotes fuller input from more people. In de Bono's words it "separates ego from performance". Everyone is able to contribute to the exploration without denting egos as they are just using the yellow hat or whatever hat. The six hats system encourages performance rather than ego defense. People can contribute under any hat even though they initially support the opposite view.

The key point is that a hat is a direction to think rather than a label for thinking. The key theoretical reasons to use the Six Thinking Hats are to:

- encourage Parallel Thinking
- encourage full-spectrum thinking
- separate ego from performance

The following is an excerpt from John Culvenor and Dennis Else Engineering Creative Design, 1995)

White Hat on the Hats

There are six metaphorical hats and the thinker can put on or take off one of these hats to indicate the type of thinking being used. This putting on and taking off is essential. The hats must never be used to categorize individuals, even though their behavior may seem to invite this. When done in group, everybody wear the same hat at the same time.



White Hat thinking



This covers facts, figures, information needs and gaps. "I think we need some white hat thinking at this point..." means Let's drop the arguments and proposals, and look at the data base."

Red Hat thinking

This covers intuition, feelings and emotions. The red hat allows the thinker to put forward an intuition without any need to justify it. "Putting on my red hat, I think this is a terrible proposal." Usually feelings and intuition can only be introduced into a discussion if they are supported by logic. Usually the feeling is genuine but the logic is spurious. The red hat gives full permission to a thinker to put forward his or her feelings on the subject at the moment.

Black Hat thinking

This is the hat of judgment and caution. It is a most valuable hat. It is not in any sense an inferior or negative hat. The rigour or negative hat. The black hat is used to point out why a suggestion does not fit the facts, the available experience, the system in use, or the policy that is being followed. The black hat must always be logical.



Yellow Hat thinking

This is the logical positive. Why something will work and why it will offer benefits. It can be used in looking forward to the results of some proposed action, but can also be used to find something of value in what has already happened.



This is the hat of creativity, alternatives, proposals, what is interesting, provocations and changes.



This is the overview or process control hat. It looks not at the subject itself but at the 'thinking' about the subject. "Putting on my blue hat, I feel we should do some more green hat thinking at this point." In technical terms, the blue hat is concerned with meta-cognition."

http://members.optusnet.com.au/charles57/Creative/Techniques/sixhats.htm



Using the six hats to decide prototype

The picture conveyor	Ball
White hat	White hat
Need to know	Need to know
Information about surface Better tactile feedback Friction Size? How do we get the content Personalize Make more mobile Hide technique Make believable Make more accessible	How to do internal projection Image correction How big must the ball be Test with pictures of relatives
Know	Know
Can complete the project Cheap to make Visual cues are powerful	People have been playing basketball for 1 000 000 000 years Design X loves the ball
Red hat	Red hat
Boring? Different way of view a slide show Not as interesting to those familiar with technology Not so intuitive Counter intuitive but learnable Flat one might as well be a touch screen Better presentation would improve Feel that it would never be intuitive	Not looking at the "same" picture, not natural to sit 4 Pictures would support 12 Not 4 is horizontal spinning How could someone look at the same picture Distortion of image is relative Fun to build and explore Inspire Many different possibilities
Black hat	Black hat
How are they going to use it? Is someone going to type for them all the time? Would people feel comfortable touching photos? High maintenance? Software sucks! Sanitary issues Flammable	Distortion→difficult to maintain Diffusion Difficulty projecting 360 degrees Mechanical difficulties of a sphere Heat transfer issues Software Not accessible to everyone Weird → giant white ball Rolling down stairs



Too big?	Could kill someone
Not as social as it could be	Sanitary issues
Not very organic	Enough time?
Yellow hat	Yellow hat
Easy to make	Intuitive
Cheap	Tactile
Picture quality is excellent	Different
Infinite pictures anytime	For people of all ages
Could be personalized	
Can finish in time	
Fasy way to project pictures	
Mentally stimulating	
Rooks movies	
Mora familiar interface (book computer	
monitor)	
Fact to make mobile	
Easy to make moone	
Easy to change size	
Easy access	
Green hat	Green hat
Green nat	Green nat
Just make the flat one a touch screen	Self maintaining
Touch screen and possibilities are endless	Power steering on the hall
Power steering	Multiple axis modes
Use the touch screen as a way to navigate	Cover up more of the ball
through media	Cover up more of the ban
Triangle/square \rightarrow more social	
Chair moves	
Different modes	
Wands, not just nistures	
words, not just pictures	
Flootric shool/hyzz	
Change temperature NWinter mistures and	
Change temperature \rightarrow winter pictures are	
Flip back	
Scroll	
Voice detection /menus	
Dive het	Dive het
Interaction removing the keyboard	
Decide the interface first we need to build	
something	
Need beging	
Deep on studios/pacedfinding	
base on studies/needfinding	

Sketches of how to present the noosphere:





Sketches of how to present the noosphere:


Sketches of how to present the noosphere:





CAD-files of Stanford prototype





Appendix D

Task





SIRIUS: Future Elderly Environments A project within the scope of Design for Wellbeing (<u>www.designforwellbeing.org</u>)



Introduction

Today, care for the elderly has limited resources. The poor quality of living in a retirement home and lack of activities for elderly are problems discussed frequently in the media. The problem is likely to exacerbate as "baby boomers" pass the retirement age, resulting in a situation in which fewer employees have to support a growing population of elderly. A number of efforts around the world, including the EU-project "Our Life as Elderly", are aimed at addressing this problem. An new retirement facility with 50 apartments will be built in Luleå as part of this project. The aim is that the new facility will become a model for old-age care in Sweden regarding reception, treatment and the environment. Today, a variety of technology is used by the caregivers to make their work easier (e.g. lifts, alerts) but little exists to improve the wellbeing or quality of life of the elder.

The task

The project begins with need-finding: uncovering the needs of users and translating those needs into concepts. The project proceeds to the development of one or more solutions that meets the needs and enhances the wellbeing for people in the latter part of life. An emphasis will be on using conceptual prototyping to create various artifacts during the project. The final prototype will be implemented for users in a new retirement home. The Participatory Product Innovation (P2I) process will act as a guideline throughout the project.

Collaboration partners

Stanford University is forming a new center, Stanford Center on Longevity. The center's research and teaching focus on subjects that aim to enhance the quality of life for elderly people. The design team on this project will collaborate with these resources at Stanford University. The project will also be closely connected with NeedInn, a research project at Luleå University of Technology in which needfinding methods are used to ensure the development of better products and services for healthcare.

Deliverables

Presentation and documentation of all stages of the product development process, including needfinding, concepts, concept selection, and design rationale. Both virtual and physical prototypes will be delivered throughout the project. Presentations will be a recurring part of the project.



Planing

Gant report

The Luleå team Gant report that were constant updated as the work preceded, this was how it looked at the end of the project.





Budget

Please note that the costs for transports, telephone and travelling below are estimated costs.

Aktivitet	Matriel	Datum	Kostnad
Kick off	gokart	2005-10-02	308,6
kick off Abbot	middag	2005-11-23	1356,37
Planering	kontorsmatriel	2005-11-03	79
verkstadsutb			1636,88
trebuchet	lokalhyra		200
CFP	Hobby hjul	2005-11-25	96,80
Telefon			880,00
Representation	Ice hotel bil&bensin	2006-01-05	2433,00
	Middag	2006-01-06	5080,00
Funktional			(00.00
prototype	Duchdraperi/lakan	2006-03-25	409,00
Functional	profilrör	2006-03-20	300,00
prototype	gjutformar/boll/gips	2006-04-19	270,00
	boll/gipps/visp	2006-04-20	383,00
	RFID kitt	2006-04-21	2500,00
	2st globar	2006-04-21	2284,00
	POM olast 250mm	2006-04-24	1398,00
	screen goo	2006-04-26	1500,00
	profilrör	2006-04-25	340,00
	stålkulor	2006-05-03	114,40
	screen goo	2006-05-08	1398,00
	glob	2006-05-05	1000,00
	mdf färg	2006-05-11	750,00
	projektor	2006-05-05	9209,00
	pasthäft	2006-05-05	94,00
	inlines hjul	2006-05-05	108,00
	skruv	2006-05-05	264,00
	transport kost		3000,00
	klarlack	2006-05-16	260,00
	kardborre	2006-05-16	100,00
	stålkulor	2006-05-16	50,00
	godis redovisning	2006-05-19	132,00
	telefon usa resa		1000,00
	bords ben till		750.00
LISA roop	prototyp		20000 00
Diamana di hudarat			20000,00
Planerad budget			
tolofon			2000.00
	milersättning för		2000,00
Bil	resor		3000.00
		summa	64684.05



Sirius Masterplan



Timeline





SIRIUS: Project Timeline* (as of 2006-04-10)

* This timeline relates to the project deadlines and activities only. The schedule and deadlines for lectures and assignments can be found in Fronter.

SEPTE 23/9	MBER 2005	Kick-off (Kallax Go-kartbana + Exotic, Kungsgatan)		
20/0	11.00	Hon on (Hanax oo harbana - Enolo, Hangogalan)		
OCTOR 2/10 3/10 7/10 14/10 21/10 28/10 TBD	BER 2005 16.30 14.45 15.45 16.30 16.30 16.30 16.30 TBD	Deadline: Deliverables for Group Review #1 uploaded on Fronter Administrative Routines Walkthrough (Ann-Marie Keskitalo) Presentation: Group Review #1 Deadline: Designer's Logbook uploaded on Fronter Deadline: Designer's Logbook uploaded on Fronter Individual meetings with coaching team		
2/11 3/11 4/11 11/11 18/11 25/11 7-11/11	16.30 13.00 16.30 16.30 16.30 16.30	Deadline: Deliverables for Group Review #2 uploaded on Fronter Presentation: Group Review #2 Deadline: Designer's Logbook uploaded on Fronter Deadline: Designer's Logbook uploaded on Fronter Company visits (some teams visit other times)		
DECEN	ABER 2005			
2/12 9/12 16/12 16/12 TBD	16.30 16.30 16.30 16.30 TBD	Deadline: Designer's Logbook uploaded on Fronter Deadline: Designer's Logbook uploaded on Fronter Deadline: Designer's Logbook uploaded on Fronter Deadline: Grading document uploaded on Fronter Individual meetings with coaching team		
JANUARY 2006				
13/1 20/1 27/1	16.30 16.30 16.30	Deadline: Designer's Logbook uploaded on Fronter Deadline: Designer's Logbook uploaded on Fronter Deadline: Designer's Logbook uploaded on Fronter		
FEBRUARY 2006				
3/2 8/2 10/2 12/2 13/2 17/2 24/2	16.30 08.15 16.30 16.30 13.00 16.30 16.30	Deadline: Designer's Logbook uploaded on Fronter Blind review (Informal project discussion) Deadline: Designer's Logbook uploaded on Fronter Deadline: Deliverables for Group Review #3 uploaded on Fronter Presentation: Group Review #3 Deadline: Designer's Logbook uploaded on Fronter Deadline: Designer's Logbook uploaded on Fronter		
MARC	H 2006			
3/3 8/3 10/3 17/3 24/3 29/3 30/3 31/3 TBD	16.30 12.00-14.00 TBD 16.30 16.30 16.30 16.30 13.00 16.30 TBD	Deadline: Designer's Logbook uploaded on Fronter Photo shoot (D514a) Brochure meeting Deadline: Designer's Logbook uploaded on Fronter Deadline: Designer's Logbook uploaded on Fronter Deadline: Designer's Logbook uploaded on Fronter Deadline: Deliverables for Group Review #4 uploaded on Fronter Presentation: Group Review #4 (E632) Deadline: Designer's Logbook uploaded on Fronter Individual meetings with coaching team		

06-04-10