Communication of remote context through lighting

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Semester Report M1.1

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ntroduction

s semester report I will discuss my activities and developments during this semester. first describe my project, then the modules and finally a global reflection on emester. Every chapter of this report consists out of a description of the process emented with a personal reflection.

Abstract of the Messenger M1.1 project.

In face-to-face communication of social and emotional experiences between de usually happens through phone or other media like e-mail, IM (instant messaging) abcam (e.g. Skype). The context in which the experiences were experienced plays aportant role. Neither the technology nor our way of describing enables us to nunicate this context in a way it can be "experienced" by the other person. There are a few layers of formulation & interpretation in between: you can only imagine. project focuses on the design of a system that is able to communicate the real-time ext of a remote user so that the receiving person is able to "feel" as if he/she is without the translation steps that are required when describing an experience. hasis is on the visual element in experience and thus imaging technology. The final ept is a modular system of connectable triangles that can be mounted to the wall can project areal-time abstract display system of a remote visual context.

Background of the Project

e: Visual interaction zones.

project was initialized by Richard Appleby as aside-track of his PhD work in the uning Quality in Interaction Research Group. The goal in this project is to develop tial design concept that connects the experience of a remote person to another, mitting different types of visual contextual observations and events in real time. The result should demonstrate the value of contextual media.

ested design direction by Richard Appleby:

lesign direction requires a system that has an aesthetic continuity and completeness interaction between physical form, user and the surrounding atmosphere created. aspects are simple geometries and a consistent visual language.

al dimension: The relation between user, product and space rial dimension: Physical form definition and user interaction m dimension: System awareness and interaction

tive user: Products and events that challenge current use behavior

1.3 Approach

1.3.1 The 2-3-7 method

As suggested by my coach, Jun Hu, in this project the 2-3-7 week design approach is used. This means that there will be three iterations of the project. Every iteration will have a full design cycle. This means that after every iteration there should be a deliverable in the form of a prototype/demonstrator and a design direction. In this report I will describe the separate iterations one by one.

1.3.2 Working together with IvoStuyfzand

This project is done in collaboration with IvoStuyfzand. The project description suggested that a team of two studentswould do this project. The start-up phase of the project has been done together. The activities described have been done individually unless indicated otherwise. At the end of the report I've included a reflection on the collaboration between Ivo and me.

1.3.3 Learning Objectives

During my IBP I've done a very concrete project [14]. Now I would like to go through an explorative design process. At the start of the project the project description was relatively abstract. It leaves room for exploration. That is also one of the reasons I chose to do this project. By choosing an abstract project I wanted to take the risk and freedom to challenge myself to come up with really innovative solutions and hopefully surprise myself. In this project an explorative process has been followed. In my Design project I would like to focus on the design aspects of Design. Every since I started this study I've had a big affiliation with Technology and therefore I'm always looking for ways to challenge and improve myself on that field. User and Business development will be aimed for in the Research Project. The one elective module in this Semester has become Quality Complaints in Consumer Products. More on this in the Module section.

2. Day 1: Activity Week.

On the Friday of the activity week we got the assignment to run the project in one day. The project was still very abstract. We demonstrated a prototype that showed a possible interpretation of the project. We beamed a blurred image of a view outside a car window at night onto a plate. The image of the remote location is blurred to get it "out of focus" aimed at only showing the context and not the concrete, focused information. This demonstrator was a very literal interpretation of the project description but already gave some interesting leads.

During the exhibition it became clear that not everybody recognized the image as a view outside the window of a driving car at night. This introduced the interesting process of "interpretation", which has become a subject throughout this entire project. A small example: A man is cooking and the projection represents the remote location of his wife. At first it's difficult to interpret projection. But after we described that the wife may be on the road most people interpreted it correctly. Therefore it's likely that when you are familiar with the possible situation and context of the remote person, it could be easier to interpret the projection of the remote context.







Far Left: Set-up during exhibition: kitchen environment Left: Agent with built-in picobeamer and projects the image on the plate Right: Top view from projection.

3. Start of the Project: Iteration 1 (first and second week of the project)

3.1 Point of departure.

This was the real start of the project. The goal of this iteration was a set of ideas based on our preliminary interpretation of the project. This way mainly done through literature research, brainstorming and discussions between me and lvo and with our coaches.

3.2 Literature Study

Listed here is a selection of interesting leads I came across in my search for similar projects/studies. Some of them will be referred to or discussed throughout the report. A separate list of references can be found at the end of the report.

1. The Ubiquitous Camera: An In-depth Study of Camera Phone Use [1] Kindberg et al. (2005) describe a study to see how and why the camera, you find in most new mobile phone, is used. The biggest part (35%) of the photos was used to capture a mutual experience.

2. Capturing the Invisible: Designing Context-Aware Photography

Hakansson et al. (2003) describe an ongoing research project in which sensor data is coupled to photo manipulation filters. In this project they use information from the context to manipulate the image of the same context. One concept of context photography is a digitalized version of Lomography by distorting an image according to movements of objects or background sound.

3. LumiTouch: An Emotional Communication Device[3]

Chang et al. describe a set of photo frames sensitive to touch used to create an emotional connection between the two sides.

4. The Past is a Different Place: They Do Things Differently There(Sensecam) [4] Harper et al. (2008) describe a study in which a MicrosoftsSensecam is used. This is wearable device, like a collar capable of making pictures according to the sensor inputs. In this study the Sensecam is used to see if memories can be revived with automatically made photos. For this project it's interesting because the remote user could be using a similar device to capture the context.

5. Timeline: Video Traces for Awareness [5]

Nunes et al. describea study in which a permanent camera feed is recorded and presented on a timeline in an abstracted way. This image also provides the user interface enabling the user to look back in time.

6. More Than Meets the Eye: An Exploratory Study of Context Photography [6] Håkansson et al. describe a study on context photography. In context photography, sensors gather real-time context information, which visually affects a photograph as it is taken.

7. Exploring Design Concepts for Sharing Experiences through Digital Photography [7] Jung and Connelly (2007)explored meaningful design directions for future photography applications with a focus on the experiences around sharing.

Photography has various purposes, including practical information recording, emotional memory reminding, and professional artistic activities. In this research, they focus wheir analysis on the interpretation of digital photography around sharing moments and memories.

8. Photo Tourism: exploring photo collections in 3D. [8]

Snavely et al. suggest that Photo Tourism implies possibilities of new social relationships among unknown people who are mediated through an experience of visitingthe same place

9. Virtually Living Together, A Design Framework for New Communication Media [9] In this paper Tollmar, Junestrand&Torgny (2000) discuss the possibility of a holistic approach in the design of new media for interpersonal communication. They refer to the area of research as telemetric emotional communication. - a type of communication media that serves other than purely practical purposes. Basic questions that need to be asked: what non-verbal communication can actually express and how media-richness and multi-modality affect the outcome

They found:

- a great need to improve the communication between family members who live apart.
- That practical arrangements and discussions often are an excuse to talk.
- That family communication does not have to be direct, often it is preferable that it is abstract
- That the desire for privacy is not in accord with the desire to receive information.

Suggest the kind of prototypes:

- Concept prototypes, that make it possible to demonstrate an idea in shape, color and weight.
- Demonstrational prototypes which are normally constructed for specific purposes and work best at exhibitions.
- Functional prototypes thus make it possible to test and evaluate certain aspects of the design solutions.
- Evaluation prototypes, finally, make it possible to carry out field tests

Scenarios on the impact of IT (Information Technology) in the domestic space. How people will furnish their homes, as socializing over IT becomes more common.

Socializing over IT; the basic incentive for many of these activities is people's attraction to, and interest in, other people, rather than the aesthetic or entertaining value of the media.

room?

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10 Vodafone future vision [10]

http://www.vodafone.com/start/innovation/future vision0.html

On this website Vodafone presents their vision on the future of communication. Vodafone may be particularly interested in projects like this because it could mean a new application of their data communication network and thus new business as phone calls are getting shorter and shorter.

Conclusion Literature Study.

I've used this search to discover what is already being done and what principles may be a kick-start of the project. Especially the Virtually Living Together [9] paper is interesting because it suggests a design approach that is not suitable for this design project but may be used during my M1.2 Research project. The papers have helped me to get more familiar with notions like context, telepresence, and emotional communication. The papers have also given me a scope of reference: What is there already and where's still

3.3. What value does adding context have?

This was one of the first questions we came across. Why would anybody want this? In other words: howcould communicating context add value for people? Why is it important to communicate context and what kind of value can get people out of it? We tried to get an idea of this through a analysis session of a pile of selected photos. In a combined effort we searched for pictures of people in an "interesting" context. After the gathering of pictures we've tried to analyzed them and see if commonalities in value could be found. This led to an overview of the kind of values communicating context can have for the receiving, as well as the sending person. All images got a small scenario attached where the particular value was described specifically for that situation.

The groups:

- 1. Intimacy, Empathy & Connectness: value in connecting to or empathizing with a closely related person.LumiTouch[3] would fit into this category
- 2. Extremes/Skills: value in showing skill and lifestyle to other people, possibly sharing the same extreme/skill
- 3. Control/Reassurance: value in keeping and eye on somebody (close) and receiving reassurance through this information. The may also evolve into a negative scenario)
- 4. Past Experience / History Reviewer: value in re-experiencing a past context in order to revive memories. Sensecam [1] fits into this category.
- 5. Private Moment: private moments and privacy are an important aspect when considering a system that (constantly) (autonomously) transmits information
- 6. Explore / Understand: value in experiencing a different lifestyle, culture or place to understand or explore). Virtual traveling as suggested in Photo Tourism [8] would fit here.
- 7. Practical information: value in interpretation of context to derive practical information like: "he's already in his car so he will be home in 30 minutes")

Scenario 1: Two partners able to experience eachothers context which enables them to empathize. Value User: + A billy to anticipate state of mind of partner e.g. after day of work & a feel of partner better / gatter better Value Remote User: + / Seing understood ty partner better / feeling of being under survaliance.	Scenario 6: Elderly equipped with contextual link to child. Value User: ++ Being able to keep an eye on parent. Reassur- rance. But bigger responsibility Value Remote User: ++ / - Reassurance (that somebody can help) / feeling of being under survallance.	Scenario 11: Two sporters connected via a contextual link. bothing sharing a lifestyle & able to suport eachother. + Ablity to support the remote user. Making training appointments, not having to train alone. + Ablity to support the remote user. Making training appointments, not having to train alone.	Scenario 16: Contextual Link between one lifestyle and a interested person. Value User: ++ Ability to take a look in the lifestyle of another profession. Value Remote User: +/. Gotting more appreciation / Feeling of being watched
Scenario 2: Family where the son had a bad day. Through the context the mother on a remote location can see that it is going better.	Scenario 7: Contextual link between partners.	Scenario 12: Two housemates / partners connected through Contextual Link.	Scenario 17: Contextual Link between one culture and a interested person.
Value User: + / - Being understood by /partner better / feeling of being under survaillance.	Value User: ++ Being able to keep an eye on partner.	Value User: ++ Ability to estimate practical ussues like: "He's almost home" or "I'd better call a bit later"	Value User: ++ Ability to take a look in the life of somebody in another culture.
Value Remote User: ++ Ability to anticipate state of mind of family- member on location & a feel of connectivity	Value Remote User: Feeling of being under survaillance.	Value Remote User: + / - Better alignment of agenda with other people's agendas. / Feeling of being watched.	Value Remote User: + / - Getting more appreciation / Feeling of being watched
Scenario 3: A friend/familymember is travelling. The communi- cation of context enables the user to experience the progress of the travel and the state of mind.	Scenario 8: Contextual link between parents & child.	Scenario 13: Personal contextual recorder. Ability to record the context. When reviewed later the captured contexts can revive memories.	Scenario 18: Contextual Link between a person in a special situation (e.g. demonstration) and a interested person.
Value User: + Reassurance, seeing that everything's ok. & Sense of connectivity, being part of the trip. Value Remote User: + / - Sense of connectivity / Feeling of being watched.	Value User: ++ Being able to keep an eye on child. Value Remote User: - Feeling of being under survaillance & annoying	Value User: ++ Ability to recollect memories by projections of contexts. Value Remote User: + / - Not a clear remote user.	Value User: ++ Ability to take a look in the life of somebody in a special situation. Value Remote User: + /- Getting more appreciation / Feeling of being watched
Scenario 4: A family (man, woman &young child). Both parents are working. Through the direct contextual link the parents are also part of the childs day.	Scenario 9: Parachute / Rallydriver / Crosser with a contextual link to unfamilair people with an interest in their skill/ability / lifestyle.	Scenario 14: A woman with a contextual link to a random person would not want this kind of context to be visible to any remote person.	Scenario 19: Contextual Link between a person on a different location and a interested person.
Value User: ++ Reassurance, seeing that everything's ok. & Sense of connectivity, being close to the child.	Value User: ++ Being able to connect / get a feel of a combined/desired lifestyle.	Value User:	Value User: ++ Ability to take a look in the life of somebody on a different location.
Value Remote User: + / - Sense of connectivity / "Annoying".	Value Remote User: ++ Ability to show-off skills.	Value Remote User:	Value Remote User: + / - Getting more appreciation / Feeling of being watched
Scenario 5: A project team where one team member is in a foreign country. The contextual link enriches the group dynamics.	Scenario 10: Professionals (E.g. Army / Police / Firefighters) with a contextual link to colleagues.	Scenario 15: Contextual link between two persons. Everybody needs private moments. Which in some cases can be shared with other very close persons.	
Value User: ++ Sense of connectness & collaboration	Value User: ++ Ability to assess the remote situation When approaching a situation from different sides/moments	Value User: + Ability to anticipate on the "private moment" e.g. postpone call.	
Value Remote User: ++ Sense of connectness & collaboration	Value Remote User: + Support when something goes wrong and better teamwork.	- Possibility of people "being there" while in "private moment"	

The small scenarios pasted onto the photos



Overview Photo Value Collage.

3.4 What makes an experience an experience?

In the project description it is suggested that visual context has got an effect on social and emotional experiences. Therefore it became important to know what an experience is, or more importantly what makes one experience different from another. Dey defines it as: "any information that can be used to characterize the situation for an entity (place, person or object)" which it was taken [3]. To figure this out we did out own analysis. Three different experiences have been "experienced" and filmed. The analysis of these experiences have lead to the notion that an experience can be communicated into another environment by braking up and extracting the characteristic impressions that make up an experience and presentthem as "true" as possible to the receiver. All these impressions combined can make the recipient " feel" as being in the remote place. Another conclusion after this test was that an experience is not merely a visual thing. For me a characteristic impression of a train ride is the tempo the bench I sat on shook. This project could've been done focused any modalities. However in this project I was invited tofocuson the visual modality.

On the right the first ideas are displayed. They are based on the concept of taking one impression of all impressions that make up an experience and regenerate this impression on the other location. When all impressions through all modalities are regenerated, the receiving person, theoretically, will have the same experience as the sending person.

3.5 Reflection Iteration I.

The start of the project was pretty heavy. Because of the explorative nature I had the feeling I was floating around a bit. That's the pitfall of these kinds of projects. The lack of requirements makes it difficult and may cause me to stall in the first phase of the project. From previous abstract projects I know that sometimes you just have to go a way despite it may be wrong way. Often the insights gained in that process eventually guide me to the right way, it happened just like that in this project.

At the start of the project the teamwork with Ivo was very important. Because of the discussions on the different interpretations of the project we had, the project became clearer much faster and protected us from stalling. The clearest result of this process was the value collage. After sliding around the pictures for hours we extended the mental model of the project subject. I was satisfied with the result at the end of Iteration I. It gave a design direction to move on with in Iteration II.



Analysis of the experiences projected in the upper image

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System overview of Messenger system after Iteration I



First ideas based on the concept of the system on the left.

4. Iteration II (week 3-5)

4.1 Point of departure

Iteration I was completed with a set of ideas based on the concept that an experience is build up out of several impressions a person endures via it's senses. We were invited to further experiment with the interpretation of the project description by making explorative prototypes. The prototypes have been made individually. All prototypes were "assessed" by doing a quick testing session with some of my fellow students to get some reactions on their perception of the prototype's effect and it's potential. Parallel to the development of the different prototypes we did a qualitative study to get an idea of how and when people communicate with their closest (partner, family, friends). This study was based on the things learned in the module "Qualitative Research Methodologies"

4.2 Prototype 1

4.2.1 Description

During one of the joint coach meetings (coach meetings with all coaches and students from the Visual Interaction Zones theme together) the suggestion was made to look into the 360-degree view of context. Right now the only way to look at the visual context of somebody else is through a standard camera. The first challenge was to see how a standard camera could provide a 360-degreeexperience.

This prototype consists out of a computer with software and a webcam with 2 variable resistors attached to the bottom. By keeping the resistor still and the camera moving, the computer can derive the orientation of the camera. The software will then make snapshots of the displayed real-time image as the orientation of the camera moves. After while you'll see a 360-degree still image of the visual context. On top of that at the angle of the current orientation a real-time feed is shown.

4.2.2 Result.

The result on the screen was a wide-angle picture. In that sense the creation of a 360-degree view worked. After some playing around I noticed something interesting. Imagine what would happen when the person carrying the remote device walks straight forward for 10 meters turns right and walks for 10 meters again. On the left side of the screen you would see a real-time image of the current view of the remote person. On the right side of that image would be the last picture taken from the orientation right before he/she turned left. This way this concept can also show the road to the current context instead of only the current context. I came across a connected project called Timeline [4] in which one location was filmed over time and generated an abstracted image based on the change of the image over time. The interface allowed the user to look back in time.

The big downside of this prototype was the lack of a 360-degree feeling. The image is still on a screen or beamer image and not really in the space around you. I wanted to make the projection of the visual context more spatial. This lead to the creation of prototype 2.



Prototype1: Webcam with the attached variable resistors



4.3 Prototype 2

4.3.1 Description

With this prototype I wanted to investigate the effect it would have when the picture and thus visual context is projected in the same orientation as the remote user sees it in. So when the remote user changes orientation the orientation of the image should change accordingly. This prototype consists of the same camera as the one used before, a beamer and a mirror with servo. As the orientation of the camera changes by turning it, the mirror underneath the beamer (aimed down) is turned by the servo. The software also takes into account the turning of the image when turning the mirror.

4.3.2 Conclusion

Experiencing the change of orientation of the remote user gave a good sense of the way the remote user moved through the remote context. In this prototype the context was represented by a very literal image of the remote location. This still gave a sense of focus. I realized that context in fact is more about "the lack of focus". This lead to the creation of prototype 3.

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Prototype2: Top: projected image Bottom: turning mirror with beamer. the webcam was placed on the other side of the wall



4.4 Prototype 3

4.4.1 Description

The goal of this prototype was to display an abstraction of the visual context, an out of focus image. This prototype consists out of 12 RGB LEDs inside 12 ping-pong balls. These balls have been placed in a spatial (outer visual range) setting. The RGB LEDs have been interfaced with the software via a PhidgetLED64 board. The software takes a sample from the target remote location movie and controls an RGB LED accordingly. This way the image of the remote location is abstracted into a 12 pixel version where the pixels have been mapped in the space. Part of the experiment was also to see what would remain of the recognizability a remote location when it's abstracted to only 12 pixels mapped in space.

4.4.2 Test

After the creation of the prototype I did a few tests to see to what level people can interpret the displayed abstracted visual context. This test was meant as to see the potential of the concept. First I asked them to interpret a series of pictures and videos with very different visual contexts. Secondly I had a discussion with the participants to share thoughts and possible application scenarios of the concept and its potential. In this test 7 static images were displayed through the prototype and the participants were asked to describe and interpret what they saw. After the open questions I asked them whether they thought the image was taken inside or outside and during daylight or at night.

4.4.3 Results.

It seemed quite difficult for the participants to extract concrete information from the abstract image that was displayed. This was to be expected since it's an abstraction. However their answers were not random. Especially the element of "blue sky" was mentioned several times, as it was one of the best recognizable patterns; a few balls on the top of the image turning blue. Sometimes I was surprised by the detail some of the participants managed describe. For example:

P2, image 1: " open space, warm like beach, as if you look over something". When you look back to the image you can see that this description is quite close (looking over a dune)

P2, image 5: "blue sky and it's as if something floats on the water". Although the description is not sufficient to interpret a skyline, visually it's a correct description of this image.

P1, P2, P3, image 2:"the top ball is white and that could be a moon"

With the daylight/night, inside/outside question it depended on the image if a good estimation could be given. All participants were correct on image 5, 6 and 7. 2/4 participants were correct on image 1. In some of the images the entry of light was blocked by e.g. a building or trees. In these scenes the time of day was often referred to as Dusk.

When looking at the results it seems that still some information can be derived from the projections despite that it's very abstract. The participants were several times in the right direction. I believe it's about the process of interpretation; about finding patterns and referencing them to earlier experiences. And that is what I believe this prototype is able to provide. It gives only small cues of contexts and it's up to the user to interpret it.

Color

This prototype was made with a PhidgetLED64 board. Getting the color of the balls right was very difficult. I looked into it and the cause was a too low input voltage of the LED driver ICs used on a PhidgetLED64 board. Therefore the Blue and Green part of the RGB-led will never get the maximum amount of current resulting in a red-ish glow over the image. During the test a lot of comments were based on the colors of the balls mapped in space. Therefore the color and intensity of the balls is very important. In future versions this color problem should be fixed.

Dynamics

During my internship at Oce [14] I was given the assignment to design an alternative interface for a printer/copier that could provide a richer interaction. Another challenge I gave myself was to do something about the problem that quite often a user of a printer/ copier is not able to resolve a paper jam because of the complexity of the printer (the number of action possibilities and being scared of breaking the device). The concept consisted of a series of fireflies (represented by orange LEDs) that could fly around the printer and guide the focus of the user to the part of the device that was relevant at that time. The result was that with only a few animated LEDs it was possible to give very detailed information through the appearing patterns. I became interested if this would also be possible in this prototype by giving the ping-ping balls some dynamics by adding video.

These two leads have been taken to the start of Iteration III.



4.5 Qualitative research study (interviews)

As an extension to the research on value of context communication we found it important to get to know more about communication between people. The value collage contained connections between people that know each other and that do not know each other (e.g. showing off lifestyle). In this project I've decided to design for a scenario in which the two persons are close. It's more likely that social and emotional experiences are shared among closely related people. To get more insight in this process Ivo and I conducted interviews. They were mapped by using an affinity diagram. For me the most interesting scenario would be of 2 partners because they already are willing to share intimate information and would be most open to concepts like this one. The approach of this project is an explorative one and therefore not directly bound to a user scenario.

General conclusions.

- The communication through technical means during the day is influenced by whether or not people meet in the evening. An exception is the communication of practical information regarding meetings or diner.
- All participants included their parents when we asked them to note down the most important people in their lives. But all participants indicated that they communicate with friends and partners more intimate than with their parents.
- All participants indicated that the communication with their brother or sister is kind of superficial but that it's improving. All participants included at least one of their sisters and or brothers in the list of most valuable people.
- After asking the participants to write down their most valuable people they usually first noted down their partner secondly parents, sisters and brothers and lastly very good friends.
- Eventually family is very important but in terms of communication is less intimate than the communication between partners or very good friends.

Specific interesting issues

- P3 has a very close family and is very socially engaged.
- P2 is concerned about his brother and would like to check-up on what he does during the day.
- The traveling of P1's father is something that interests both.
- P1's grandmother provides his with lessons from her own life.

This research was supplemented with the findings of Tollmar, Junestrand and Torgny (2000) in Virtually Living Together, A Design Framework for New Communication Media [5]

They found:

- a great need to improve the communication between family members who live apart.
- That practical arrangements and discussions often are an excuse to talk.
- That family communication does not have to be direct, often it is preferable that it is abstract
- That the desire for privacy is not in accord with the desire to receive information.

This qualitative research session left us also a few leads to move on with Iteration III.

4.6 Conclusion of Iteration II

This third prototype was also shown during the interim exhibition. The reactions during the interim were mainly positive. Like my test participants the visitors of the exhibition had difficulties extracting concrete information from the 12 pixels. Thisactually is not a bad thing because displaying context is displaying something out of focus. I concluded that it would be worthwhile to explore further on the topic of abstraction of remote contexts. Iteration II had left me with a few interesting leads like:focusing on implementation of dynamics, another technology with respect to color representation and the more detailed scenarios that can be derived from the qualitative research. I also still have the theory generated in the first Iteration about the "interpretation of abstract information". With these guidelines and the experience gained in Iteration I and II I started the third and final Iteration.

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4.7 Reflection Iteration Two.

The prototypes have been essential in the start-up process of the project. Because of the explorative nature of the project the aim was to find a nice opportunity, principle to pursue, instead of a solution to a problem. Going though the different prototypes has helped tremendously. Also here you see that the interpretation of the project changed substantially in between the prototypes. This progression may not have been possible without the prototypes. In this Iteration I've been able to exploit my natural technological orientation by making several quick and dirty but functional prototypes in a limited amount of time, three prototypes in 2 weeks.

It was good to see that I could cross reference to an older project and use insights gained there in this project. Parallel to the prototyping we've done a qualitative research session. We've been able to define the project a bit more detailed. In order to reach a higher accuracy it should have been more elaborate. In this context it was more used as a probe than a focused study. The plan was to do a follow-up of this study in Iteration III.



Overview of the affinity diagram

5. Iteration 3 (week 6-12)

5.1 Point of Departure.

Iteration II and the interim exhibition had left me with some good leads to proceedwith in Iteration III. The ping-pong ball prototype was the first try in creating a system capable of projecting an abstracted version of the impressions that make up a remote context. In this final Iteration I created a more elaborate version.

Points that had to get special attention after the test and exhibition of the ping-pong ball prototype:

- proper transformation of the color.

- Implementation of flow of movement into the projection of the remote context.

- The mapping of the contextual cues in space is important for the successful perception of the remote context.

In this chapter I will describe how these points combined with the results from the qualitative research and the insightswhile doing the iteration have lead to the final design and prototype.

5.2 Final Design

5.2.1 Final Concept

The final concept is a modular system of connectable triangles that can be mounted to the wall and generate areal-time abstract display system of a remote visual context. Essentially the receiving person is presented with a selection of the visual impressions the remote user endures throughout the day. These visual impressions are captured by a device that is worn by the remote user. There can either be a dedicated context grabbing device but may also be an evolved version of a personal communication device (mobile phone). The captured visual information is analyzed and the visual impressions are filtered and projected onto a abstract overview representation of the visual environment. This dynamic image is then transmitted and projected through the system of triangles. The projection of the remote context should reside in the periphery of the attention of the receiving user. This will give the receiving part the possibility of getting the same visual impressions the other remote person endures during the day.

The concept is not meant as a replacement for a phone call; making a phone call is a focused activity. To get a sense of what the other person endures during the day the receiving user should be in contact with the remote visual context and thus the system for a considerable time. Therefore this system is meant as a continuous and always-on real-time connection between two people. Because people move throughout the day the triangles can be installed on any often-visited location (work, living room, kitchen, hallway, etc.). The modular character of the system allows for easy configuration on any place with some vacant space on the wall.



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The poster presented at the final exhibition. On the top right a schematic overview of the system. On the left a few of the many different configuration possibilities

Different Environments Modularity





















Description

The non face-to-face communication of social and emotional experiences between people usually happens through phone or other media like e-mail, IM (instant messaging) or webcam (e.g. Skype). The context in which the experiences were experienced plays an important role. Neither the technology nor our way of describing enables us to communicate this context in a way it can be "experienced" by the other person. There still are a few layers of formulation & interpretation in between: you can only imagine. This project focuses on the design of a system that is able to communicate the real-time context of a remote user so that the receiving person is able to "feel" as if he/she is there without the translation steps that are required when describing an experience. In this projects emphasis is on the visual element in experience and thus imaging technology.

The remote user has to be equipped with either a dedicated separate wearable device or a personal communicator (mobile phone) which may also be proficient as they get more advanced with features like cameras and GPS. Based on the available sensor information and the privacy level the projected image is generated by the system. When there is no visual information available (because of privacy restrictions or covered camera) the visual information can be gathered from a virtual camera inside a virtual world (like Google Earth) based on the positioning information from the remote user's sensors.

The displayed design consists of a modular systems of triangles that can be arranged in any way and therefore can also be mounted around existing objects on the wall. This system is meant as a continuous and always-on connection between two people. Because people move throughout the day the triangles can be installed on any often visited location (work, living room, kitchen, hallway, etc.).

M1.1 Design Project



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5.3 Development of the Concept

In this chapter I will describe the development of the final concept and prototype.

5.3.1Form

The concept consists out of a system of triangles that can be clicked together and mounted to the wall. There are a series of reasons and considerations that lead to this design. Those are discussed in this chapter.

Flow of movement

During the ping-pong ball prototype and the internship project [13] described before I saw that a lot of progress could be made by not only converting the image of the remote visual context but also the dynamics (movement) within the remote context, like is also done in More than meets the eye [6]. The ping-ball prototype was limited because of the low resolution and the big distance between the pixels. In this design I was looking for a shape that was able to provide the perception of a flow of movement through the animation of LEDs.

Modularity

The receiving person should be in contact with the triangles a considerate amount of time throughout the day. Most people move throughout the day. I believe that there area few spaces people spent most of their time (living room, bedroom, office, kitchen). Therefore I wanted to make a modular system that allows for a free configuration of triangles according to the limitations of the space it's installed in. So that it can also be mounted around existing objects on the wall. Also the number of triangles can be defined according to the amount of space available and the time spent in the room. For example the living room may have an elaborate system while the kitchen has a more basic configuration when more time is spent in the living room. There may even be a configuration present outside the home environment, e.g. at the office.

Integration

I use light as a medium to project the abstraction of the remote context. In a sense the body of the system is only a carrier of the signal and should not bother the signal itself. I'm looking for a design that provides modularity and is able to project the signal into the visual context of the receiver and should be able to provide the dynamic nature of the changing remote visual context.

The final shape of the system has become a series of triangles. Triangles provide a freedom of configuration without having too many open ends. Through renderings the possibilities of this shape versus other shapes has been explored. The kind of freedom the shape offers in configurations and more importantly how it would carry and compose the signal. One of the interesting aspects that evolved during the exploration was that with the proper dimensions of the triangles the edges of the triangles when connected make circles. And because the signal is a negative of the carriers the formed signal gets circular. This round characteristic allows for the flow of dynamics.Like when a car is passing and the filling of a circular area of light enclosed by the edges of the triangles.

The ends of the triangles have a subtle profile to indicate that the triangles can be connected to each other.

The original idea was to have the light reflect directly onto the wall. However this had a few disadvantages. The first one is the color of the wall. When the color is very dark or saturated the light gets distorted. Therefore the light from the LEDs first goes through a piece of sandblasted Perspex before hitting the wall. This way there still is some reflection via the wall but the edges of the triangles always have the right color. The color of the top plates of the triangles on the prototype are white. I've been in a dilemma. I had to choose between black or white. Black because that would give the most contrast relative to the lit edges at the cost of the increased eye-catching-ness. Or white because that would leave room for the triangles to merge with the background which would leave only the lit edges and thus the signal visible. Because the signal is the important thing and the body is merely a carrier of the signal I went for the merge ability. Since most walls have a light color, the top plates have become white.

5.3.2 Reflection on Design

The process during the design phase of this project was similar to the prototyping phase in Iteration II. Through an explorative process I've tried to find interesting effects that connected to the requirements defined by Iteration II. The design phase essentially had two parts: the signal and the carrier of the signal. They both had their own requirements. They didn't always go hand in hand very well and priorities became important. This we for example we saw with the color of the top plates of the triangles. Essential in this process was to keep focusing on the goal of the prototype: express the kind of signal defined by Iteration II. The signal was priority 1.

Once again the value of discussion and interaction with fellow students and coaches was proved to me. In process of designing this prototype they have been a great source of validation and inspiration.

During my IBP[14] I designed a beacon system for firefighters. It was a successful design but with a completely different focus: functionality. It had to be visible in all kinds of lighting conditions, had to stand still while water flowing against it and had to be easy deployable. This design task was different. This was a system that would have to be used within a private environment, e.g. home. Therefore it had more focus on the aesthetical quality of the design. That was quite a different cup of tea. Again in an iterative process through mainly computer renders I've been able to develop this final design. Considering the remarks I got during the exhibition I believe I've been successful in this task as the design embodies the requirements set in Iteration II and it has aesthetical quality. I've even had a few people asking me when they would be in the shop.







First test model. Used to measure dimensions and do light diffusion tests.

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per



5.3.2 Technology

5.3.2.1 Prototype

In order to demonstrate the concept as displayed in the renders quite a bunch of RGB leds had to be interfaced. The mapping of the colors in space (top – bottom and left-right) is an important element in the design. Therefore a considerable amount of triangles should be made to cover those dimensions. I estimated (with paper prints) that 10 triangles would be big enough to get the proper effect while still being feasible to realize

5.3.2.2 Hardware

Color of the LEDs

Driving 3 sides x 3 groups of LEDs per side x 10 triangles = 90 LEDs requires 90 x $R,G,B = 90 \times 3 = 270$ channels. The easiest way to drive this is with 5 PhidgetLED64 boards (5x 64 = 320 channels). However with the ping-pong ball prototype I had the problem that the color of the LEDs was heavily red-ish. It was possible to compensate for this. A kind of white light could be established with the following relative intensities: R40%, G60%, B100%. Because of this heavy compensation it was not possible to make acceptable mix colors. Since color is an important feature in this design I had to search for another solution. Besides that, 5 PhidgetLED64 boards are quite expensive.

The reason that the PhidgetLED64 is not capable for producing proper RGB colors is because the driver IC's in the PhidgetLED64 are driven with 3.3 V which is not sufficient for Blue LED which have a voltage drop of 3.6 – 4.6 Volts.

After some research I found the TLC5940 LED driver. This LEDdriver is capable of driving LEDs with max 17Volt and max 160 mA per channel. The use of this LED driver would also enable me to put 2 RGB LEDs in parallel to achieve a higher light intensity and homogeneity through the sandblasted Perspex on the edges of the triangles. The TLC5940 can be driven by a Serial protocol via Arduino boards by making use of the public library of Metalab [15]. The TLC5940 can be daisy-chained. This means that the Serial-OUT channel of one IC can be connected to the Serial-IN of the next IC. This makes it possible to drive 4 TLC's with just as much Arduino pins as one TLC.

The displayed prototype is a configuration of 10 fully functional triangles. In the prototype the freedom of configuration is limited. The triangles are configured in sets of

Every triangle holds 3 sides x 3 channels x 2 LEDs = 18 RGB LEDs. This makes a total of 180 RGB LEDs.

Every set of two triangles holds an Arduino microcontroller board along with a homeetched circuit board embedding 4 TLC5940 daisy-chained LED driver chips which each offers 16 4096 bit resolution LED drive outputs.

These circuit boards are of my own design and etched at home through the toner transfer method [16]. I also etched the circuit board for the LEDs. Without these circuit boards this prototype would not have been possible in the limited amount of time. The circuit board consists out of a set of header pins, 4 TLC5940s and 4x 1kOhm resistors to limit the maximum current of the TLC's outputs to 40mA.

Power Supply

At full load the system can draw 180 x 3 channels per LED x 20 mA = 10.7 Amps. A Power supply capable of supplying this is a PC power supply.

Heat Issues

After connecting all the LEDs and supplying them with 5V the driver IC's became too hot and started to fail. To solve this problem Geert van den Boomen came up with the solution to dissipate some of the power outside of the package by dropping the voltage from 5 tot 4.4V by using 5x an adjustable Voltage Regulator MIC29450. This worked perfectly. The MIC's got pretty hot (75 degree) but the LED drivers were kept within the margins.

Modularity

As a concept the system consists out of one master triangle and the rest can be slave. On the ends of the triangle 4 connect point are present. One Vcc (power supply +), one GND, and two for the Serial communication. When the triangles are close magnets will make sure they make contact. Because all triangles are equal in size and though communication they know what triangles are connected to what triangles the entire configuration can be detected. The only thing the master does is reference it with his own orientation (tilt).

5.3.2.3 Software.

The software was made in Flash. The software is capable of playing videos that have been captured before and can display a live feed of the webcam. Every 1/20th of a second Flash measures the RGB values underneath the mapped LEDs for it's value and then sends it to the proper Arduino. The protocol used to drive the Arduino is as follows: 63 bytes followed by the value 255 to indicate the end of the transmission. To compensate for possible color difference I've implemented a correction factor for every color.

LEDs efficiency becomes lower as the current through the LED grows. This means that at low currents the amount of light is relatively higher than at higher currents. This combined with the way the eye perceives light makes that a fade from 10% - 50% versus a fade from 50-100% is much bigger. This has got an influence on the perception of color. Therefore I've implemented a formula with a variable called "power". It's the following formula: Output Value = ((value / 255)^Power*255). With most scenes a power of 1.5 or 2.0 gives the best perception of color.

5 Arduino

method.

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Used parts: 5 home made circuitboard 20 TLC 5940 180 RGB LEDs 40 mtr UTP cable 20 10hm resistors 5x 5 mtr USB cable + USB Hub

5.3.2.4 Reflection on prototype

The main goal of the final prototype was to bring the experience from the design phase to life and to see if it would really have the effect I anticipated. The essence of a prototype is that it does not have to a finished product. It's merely used for testing or demonstration purposes.

Before building a prototype I have a design on how to establish the targeted experiencewith technology. Then I estimate if I'm able to build it and what the benefit would be if I do. In this project it was a tough call. Building this prototype with PhidgetLED64 boards would've cost me less time with nearly the same effect, except for one thing: the color. It was unacceptable for me to have this prototype with a red-ish glow over it, I think that would've had a big impact on the experience. This decision offered a great challenge because it made the prototype a lot more complex. And complexity costs time. But it was also a nice challenge

I like to challenge myself, especially considering technology. But I have to be careful not to loose myself in the technology so that other parts of the process diminish. I took the risk of drowning in the complexity of the prototype and build it with the alternative

Throughout the study I've searched for the limits of what is possible in the amount of available time. This was a close call. I had carefully planned and tested all separate parts before the start of the real building. But ofcourse, like with most prototypes, when the modules are put together problems arise, which take time. I believe this prototype is on the edge of what is doable in the given amount of time without disturbing the balance with other tasks during the process. Taking on this challenge invited me to search for more time efficient and reliable tools, like home etched circuit boards, which saved me a lot of time. I believe this challenge has put my technology and prototyping skills to a new level.



Left image: Top and Bottom design of circuitboard Right image: Close-up of LED circuit board after etching & drillina

Fully soldered LED control board

Software interface. The digital representations of the LEDs have been mapped on top of the moving image underneath

diam'r.



Drive by night	Train Station	Indicators:	on off
Citv	Train 1	GlobalInt	100
Shopping Mall	Train 2	RedInt	100
Tree	Train 3	GreenInt	100
Forrest	Garden 2	BlueInt	100
Garden 1	Webcam	Power	2.5

Choose Remote Visual Context

test screen											
1	2	3	4	5	6	7	8	9	10	11	12
Bravia 1											
Bravia 2											

6. Conclusion on Final Prototype & challenges / Opportunities for further development.

In the following paragraphs I will go into separate interestingcharacteristics and implications of the (development of the) design.

In this explorative project I've tried to make prototypes that evoke some discussion on this still abstract topic. Therefore the presented characteristics and implications were the result of own observations and discussions with coaches and fellow students during the final exhibition. Some of the paragraphs could be a lead to a new research topic. Maybe even a M1.2 project. These opportunities are also discussed in this chapter.

6.1 Value

At the beginning of the project lvo and I did an analysis session to see what kind of value people could get from the communication of remote context. It's interesting to look back at those values and see how the concept could provide these values. I believe this concept can provide people with the ambiance of the remote context through the represented colors and light intensity of the remote location. Also extremely dynamic situations would do well on the system (e.g. parachute jumping). This concept can also be seen in a broader context. The rise of virtual communities and sharing websites like Hyves, Twitter, YouTube etc. indicates that people are interested in other people and that people are willing to share a part of their life with other people, even complete strangers. This is also supported by a study [1] at HP on Camera Phone Use. The biggest part of the number of photo's made with a mobile phone is to capture an experience. This concept may be the next step in this process by taking this interest out of the computer screen into the real world. In Virtually Living together [5] one of the guidelines that is suggested is: "the basic incentive for man of these activities is people's attraction to, and interest in, other people, rather than the aesthetic or entertaining value of the media". So naturally people are interested in other people.

6.2 The remote user

The remote user has to be equipped with either a dedicated separate wearable device or a personal communicator (mobile phone), which may also be proficient as they aet more advanced with features like cameras and GPS. It could be a similar device as used in the Sensecam [7] study. Based on the available sensor information and the privacy level the projected image is generated by the system. When there is no visual information available (because of privacy restrictions or covered camera) the visual information can be gathered from a virtual camera inside a virtual world (like Google Earth) based on the positioning information from the remote user's sensors. At this moment Jun Hu and I are working on a submission of this project for a call for requirements with regard to MPEG-V. MPEG-V is a new, under development, standard for data communication between virtual worlds and virtual and physical worlds.

6.3 Privacy

The requirement of the remote user carrying a camera that records everything at all times may raise some privacy issues. But that does not mean that it won't be accepted in the future. More and more people are using their mobile phone to make pictures and videos and put them on the Internet. Also more and more surveillance cameras are put in the public domain. Maybe the mobile phone will come out of the jeans pocket and be carried somewhere else on the body open to gather visual information. People may even take the privacy issue for granted as suggested in Virtually Living Together [5]: the desire for privacy is not in accord with the desire to receive information.

Another scenario could be when you give the remote user control over what is recorded. But that would have consequences for the real-time nature of the concept.

6.4 Interpretation

This concept revolves around the projection of an abstracted version of a remote visual context. This implies that the provided information is less specific and more open to interpretation. During the exhibition I had some nice discussions about this topic. The ability of a person to interpret the projected visual context may be influenced by the knowledge the person has of the life of the remote person. For example: a couple has the system at home and the husband is on the road driving home from work. The visual context he's in will give a representation as displayed on the picture and demonstrated during the exhibition. Somebody who is not aware of the possible situation of the remote person, or may not be able to make sense of the projection of the remote context. However when the partner of the husband knows that around this time he's always on his way home, she may be able to interpret it correctly because of the knowledge she has of the rhythm of the husbands' day. She has a smaller frame of reference. When working with abstractions there's always some information loss and a lack of recognizability. It would be interesting to investigate the level of recognizability of the remote context through this prototype. A thorough study of this would require a bigger scope of remote contexts.Even better: a really working link between a user and a remote person. It would also requireusers to have access to the system for a longer period of time.

6.5 Learning over time.

Another interesting discussion topic during the exhibition was closely related to the previous one: Learning. I experienced that after having demonstrated the system for a few hours I became more skilled at recognizing the patterns in the different visual contexts. During the exhibition about 10 different recorded visual contexts were displayed through the system. For example a movie in a train where the poles flash by, the headlight of upcoming cars during an evening drive on the highway. I believe that although the projected image is abstract, recognizable patterns can be found. When the remote user moves through a certain visual context in a certain timely pattern (e.g. daily) after a while the receiving user may be able to derive information from this. For example concrete information on the location or situation of the remote user: the same kind of flashing lights moving by in a certain tempo represents he's in a car.

Earlier I described the balance between abstractness and concreteness of the representation of the remote context. This balance can be controlled by the configuration of the triangles. When the triangles are in a very compact setting the information density is high, however when the triangles are in a broader setting the information density is smaller and thus more abstract. It would be interesting to investigate the different configurations can have.

6.10 Design During the exhibition I've been asked several times if they are for sale. Apart from the processes behind the concept the design of the system was appreciated and could be used for more than the display of a remote context.

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6.6 Flow of movement.

This prototype provides a much better sense of movement than the ping-pong ball prototype. However there is room for change. There is one issue. Movement of the camera versus movement within the context. When the camera was not moving the movement of objects in the remote context was projected very nicely, for example leafs that were moved by the wind and light flashing by when driving into a tunnel inside a train. However when the camera starts to move it's very difficult to see these patterns. The projection moves more to a projection of the movement of the remote person inside the remote context. Which is not necessarily a bad thing but different than the communication of visual context.

6.7 Periphery

The system was meant to be a system that could give information through the periphery of the attention of people. However the amount of movement generated by the movement of the camera is guite big. The system will then attract the attention of the receiving user. That may be undesirable when working. It fits the description of Weiser and Brown [8] that Calm technology engages both the center and the periphery of our attention and in fact moves back and forth between the two. The system should not attract too much attention and cause constant distraction once you're used to it.

6.8 Smart Software

In this prototype a direct mapping is made between the pixels in the feed and the pixels in the triangles. It would be interesting to use software video analysis to filter out the characteristic visual impressions of an experience (e.g. moving objects, high contract objects) and project those onto scenery based on the present visual context. This could provide a cleaner presentation.

6.9 Configuration of triangles

6.11 Dynamic Range

One of the issues with this set of technologies is the limited range of cameras. The prototype with all the LEDs is capable of generating guite a high dynamic light range. Most cameras do not have this big light measurement range. They use their shutter time and aperture to get the projected image within the sensing range. The result is that the overall lighting of an indoor scene is almost the same as the overall lighting of an outdoor scene. This problem can be partially solved by gathering Meta data on the amount of ambient light during the shoot. The system will then be able to express the differences in global lighting.

6.12 Conclusion

Just like every Iteration throughout this project this Iteration also leaves quite a few leads to move on with. Another Iteration of this project could be added and be more focused on, for example, the just mentioned opportunities.

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7.1 Reflection on Literature.

Paper research - A brief look back

Home Radio: Extending the Home Experience beyond the Physical Boundaries[17] At the start of this project Marco Rozendaal has been involved with this project. it's interesting to see that in this project I've tried to give people a sense of another remote context while in the Home Radio project it's the other way around: people away from home get a home experience. It would be interesting to see what happens when both systems are present. Would they influence each other?

Virtually Living Together, A Design Framework for New Communication Media [9] The Virtually Living Together project explored a new design framework for new communication media. The method they use to test and categorize their prototypes and then test them in the field is very interesting and may be of use in a research follow-up of this project or a similar project.

More Than Meets the Eye: An Exploratory Study of Context Photography[6] In this research topic the authors use motion inside the visual context and project that into a still image from the same visual context. That actually is quite interesting compared to my concept. The big difference is the level of abstraction. In this study the software displays a slightly distorted image. It's still possible to derive detailed information from the picture. In my concept the detailed information is abstracted out. The kind of processes they use to detect the contextual movements could be a contribution to my prototype. It would refer to the opportunity: Smart Software described in the previous chapter.

7.2 Reflection Iteration III

Iteration III was very much based on the foundations that were built by iteration I and II. The balance in this third iteration was more towards the details of the final concept. The challenges I was confronted with were of a different kind than the ones in the first iterations. In the first iterations the challenges involved the understanding of notions and connections; finding direction. In the third iteration the problems were more of a concrete nature like my specific design and technology activities. That's also the moment the project starts to live and get up to a higher speed.

I'm happy with the final result of this iteration.Like the other iterations this iteration had lead to even more questions and opportunities that can be investigated in a possible future iterations. My primary goal in this project was to open opportunities, not directly to solve problems.

7.3 Reflection 2-3-7 Design process

This was the first time that I've used this design approach. I liked it. It worked well because of the explorative nature of this project. For me there were two main advantages. The first one is the time pressure. We were supposed to complete the iteration with a full design cycle. This put some pressure already early on in the project. The second advantage is the iterative process. Every iterative cycle was started with the results from the preceding one. This made it possible to continually reflect on and "fix" any problems during that iteration. This reduced the chance of building the project on faulty reasoning. The ability to start over after one iteration also gives the freedom to experiment. That's a chance I used during Iteration I and II.

Eventually we did not do an entire design cycle every iteration. On the beginning of the project the emphasis was on the beginning of the cycle (research) while in the final iteration the emphasis was on the prototype, the demonstrator of the final concept. When looking back this process has given me one problem. The first and second iteration take 2 and 3 weeks to complete. The user research that can be done in these iterations is fairly limited because the rest of the design cycle has to be done as well. It's not really possible to change a lot on the concept after the Interim. Therefore the concept presented during the interim is based on user research done during the rather short first two iterations. Perhaps the division of weeks should be revised to 1-4-7. This may give the possibility to do more extensive user research in the second iteration.

7.4 Reflection Working together with Ivo Stuyfzand

The beginning of the project was done together. This mainly was the research part as we were both looking for grip. We've had some very juicy discussion on our different interpretations of the project. This was a very valuable process because it enabled me to get things straight.

Early on in the second iteration we started to get different preferences on how to continue this project. Our coaches also suggested that for assessment purposes it would be better if we split; so we did. The prototypes of the second Iteration and the complete third Iteration was done separately.

Although Ivo and I had split we still had a lot of contact about the project; we had the same roots.

The "break-up" had given another advantage. We got in some healthy competition. When doing the same project of coursel wanted to do at least just as good, or, even better. Eventually Ivo and I kept challenging each other in this project, which was beneficial for the quality of both our work.

It is interesting to see how Ivo's final work differs from mine. Ivo already early on in the process focused on the interaction; actively exploring remote contexts. I focused on the translation and perception of remote contexts. The final result are two concepts with the same roots with both a different touch.

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7.5 Reflection Project

This project has been a bumpy road. The explorative nature of the project posed a risk. I was not at all familiar with the research topics involved with this project. Therefore I first had to burn quite some time to only get acquainted with the subject. The teamwork was very important for me in this process also the 2-3-7 week method has given me some freedom to experiment.

By doing this project I took a risk but also the freedom, and personally, I believe it has paid off. I've surprised myself with my final deliverable and the final opportunities for further development. It almost feels like the project is finally really starting. Perhaps, if I make it though this assessment of course, I will move on with this project as a M1.2 project.

The process could've been a bit more smooth. Especially the user side of the design process could've had some more attention despite it was not my goal to work on that extensively. The opportunities within this project were somewhere else. Nevertheless I would like to do a project next semester that allows for a more structured way of user involvement. More on this in Global Semester Reflection.

Eventually I'm happy with the project. The reactions during the exhibition were really positive. The project was finalized with set of leads that could be exploited in a follow-up of the project. I believe that's also what an explorative project is about. In a sense I got more questions now than when I started, but they are more concrete. In the end I've got the feeling I only found the tip of the iceberg, there is a lot more to discover.



I've explored the tip of the iceberg, there is much more to explore $_{\rm http://www.starstore.com/acatalog/iceberg-poster.jpg}$



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8. Modules

- DB101 Passion for Design DBB01 Visions on Ambient Intelligence
- DBB03 Qualitative Research Methodologies
- DB503 Quality Complaints in Consumer Products
- DB204 Autonomous Behavior
- DB403 Design Culture
- DB307 Foundations of Tangible Interaction

8.1 DB101-Passion for Design

Introduction

In this module we got the assignment to rebuild a caravan in a way it would express the vision of the faculty. The caravan would then go to the furniture fair in Milano.

On the right you can find my reflection on this module



leader.

Passion ID here.

Final Result

Reflection

Teamwork

This module was not only interesting because of the design assignment (you don't "pimp" a caravan every day) but also because of the big team. Working in groups of 2-6 people is not that new to me however working in a group of 20 people is a lot different. I'll point out some of the most remarking group developments. Since I was one of the few people that had experience with Max/MSP I've become responsible for the software part of the system. This evolved in a role where I coordinated the people working on the software and hardware and the implications it had for the other parts (e.g. interior) of the job. I liked this role although it was quite taxing. Already early in the process an estimation had to be made what would be possible to realize in the limited amount of time. There were a lot of available man hours but to effectively make use of them required careful planning of all the tasks. The whole thing went very smooth except for one part which eventually had big consequences for the rest and thus completion of the system. One of the parts (the table in the middle) was finished almost 12 hours overdue. This made it impossible to build and test the electronics & software inside the caravan in time. I went back on Sunday morning to finish at least the hardware part of the system so that the software could be tested and fine-tuned in Milano. I've worked in close collaboration with Martijn ten Bhomer and Thomas de Wolf. This turned out to be very valuable because they have been able to complete the system in Milano. To prevent this I maybe should've had a closer & tighter look at the progress of the "table" but I didn't want to get in Martijn Jansen's way with my involvement because he was the team

Although all team-members were Industrial Design (ers/students) working as a big team revealed the differences between us. One of the differences is where we find our passion for Design in. Passion for what we're doing, what drives us. It was very interesting to see how some people took the lead while some were a bit waiting. How some people preferred to work on the graphics/interior or technology. Because of the high pressure and thus the required efficiency we all had to do something we were someway proficient in. The hard work of everybody in their part revealed the different areas in which my colleague students can find passion for design in. I went for the technology, and I also believe that is a passion and one of the main reasons why I study

From what I've heard from the people that went to Milano, the Caravan was a success. Because the plug-into-the-table-and-connect-the-sensors system did not work it's questionable if the message we wanted to communicate came across. But either way I believe we've been able to put something exciting in the centre of Milano.

8.2 DBB01-Visions on Ambient Intelligence

Introduction

In this module the discussions on our vision on Ambient Intelligence was central. I really enjoyed the joint discussions. Although a discussion with 16 people at once can be difficult. By challenging each other during the discussions a more elaborate mental model of the subject is built.

Part of the module was to write a pamphlet. We were free to choose our own topic. The pamphlet I wrote is printed on the right. It's based on my experience during my internship at Oce [13]. After the pamphlets were written we had to rate 5 other pamphlets written by fellow students. In the end my pamphlet was rated as one of the top 3 in the class by my fellow students and Berry Eggen.

Parallel Pamphlet and Messenger Project.

While I was writing this reflection I realized that the design made in de Messenger project perfectly fits the process described in the pamphlet. In the project I've designed an interface for a system that senses it's context. There is an invisible connection between the two parts of the system. What exactly happens with the data is not visible. I could design it in such a way a third party gets a stream of the image as well. Therefore the users of the system have trust the system. This is an especially relevant issue for the remote user. This should be considered when designing the remote device. But one way or another it's up to the integrity of the designer because the perception of the operation of a device can be different from the actual operation.

as magic.

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Designing Ambient Intelligence: A balance between Black and White Magic.

by Bram Knaapen s040487 b.knaapen@student.tue.nl

Let's first take a glimpse back in history. Before the rise of science people attributed events like diseases, spontaneous recoveries and negative weather events to magic and higher powers. This was based on a lack of understanding of the processes behind it. As science progressed people started to understand these(natural) processes and how they could or could not be controlled. This knowledge and understanding gave people the ability to estimate the behavior of nature and anticipate on it by using technology(modifications of nature) but this took away some of the magic.

At this moment magic can still be found in products and services that use technology in a innovative way, a way it's not been experienced before. B&O has a radio which automatically slides open its doors and starts playing when you move your hand in front of the radio. It's like the radio has been enchanted. Also electronic devices capable of knowing where you are like navigational devices appear magic to some people as well.

Science fiction author & physicist Arthur C. Clarke once said:" Any sufficiently advanced technology is indistinguishable from magic". In reaction, Benford said: "any technology distinguishable from magic is insufficiently advanced".

I believe that Ambient Intelligence (AmI) has got a property that will accelerate the implementation of magical experiences into our world and will add a whole new chapter to the discussion on the comparison between technology and magic. But do we want to have magic in our AmI systems, can it be trusted?

Ambient Intelligence will split the application of technology into two parts: the upper world technology and the underworld technology. In the upper world, technology is used as the interface for the ambient intelligent system and is fully integrated into the environment. This is the part that is visible to and perceivable by people and interacts with them. In the underworld, computational technology and information sharing technology is located. This part is neither visible to nor perceivable by the user This distinction between the two worlds will make it difficult for people to fully understand the underlying processes and principles of the system and will bring them back to the situation in history sketched before: events happen (through the interface in the upper world) but how it works cannot be derived since the underworld technology is not visible. This distinction can make AmI systems to be perceived by its users

Designers are the ones that are going to create these systems. You could say that designers are the magicians of the future and ambient intelligence will be their potion. Implementing magic can be positive. It can give the user a thrilling, more natural and honest interaction. Secondly the user is not bothered with the complexity of the system. However the downside is that this obscurity for the user on the underlying

processes also gives the freedom to the designer to implement whatever he wants in the underworld technology since the user will not be aware of it. And because Ambient Intelligent systems can become very interwoven into our daily lives this can lead to controversial results.

Ambient Intelligence systems rely on information. Without information an AmI system cannot function. This information can be gathered by its interfaces, these can be sensors but also network interfaces with other ambient systems. Knowledge is Power; the kind of rich information AmI systems can gathering can be very valuable for companies and governments. Since designers will design these systems and therefore also the information flow, designers have got a big responsibility on what to do with this information. The system could be designed in such a way the user perceives the system as positive, White Magic, while it may actually also be negative, Black Magic: a second agenda of the designer in which the information secretly is relayed to a buyer. By allowing the positive magical user experience we have to take a decrease of transparency for granted. So eventually the question if you are willing to share information with an AmI system is closely related to the integrity of the designer. As more and more devices get connected to the internet AmI is suggested as an extension of the internet. Internet has developed into a system that has got no central control, it cannot be turned off and is not entirely controlled by anybody. So eventually it's up to the designers of AmI to find the positive balance between White and Black Magic and to find out if the benefits of a magical user experience and trust can be incorporated into AmI together.

8.3 DBBo3-Qualitative Research Methods

Introduction

The module was split into two parts. In the first part we were asked (in teams of 2 students) to pick a research method and make a poster that could be shared with fellow students. In the second part we were asked to do a qualitative research study in groups of 4-5 people. The poster is displayed on the right

Reflection

Although it was not the nicest module I've done it was a very valuable one. Qualitative research can be of great use during design. I've also used it during the Messenger Project. One of the most difficult things I found the reliability of the study. In qualitative research there always is a step of interpretation involved which can be subjective. Therefore Qualitative Research is perfect for opportunity creation, for example by using Technology Probes. In the Messenger Project qualitative research is also used as an opportunity generator. Through this module I've been reached a series of methods. According to future projects I can apply one of the methods.

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Technology Probes

Bram Knaapen Ivo Stuyfzand

Description

Technology probes are simple, flexible, adaptable technologies deployed into the user's environment over a period of time. A successful technology probe is open-ended and should enable the user to inspire and shape the technologies that are developed. Researchers expect the user to adapt to the new technology but also adapt it in creative ways, for their own purpose to create value. By watching how the target group integrates a certain technology into their daily lives, by capturing data about the interactions and by conducting ethnographic interviews, the probes will spark new ideas.

Well-designed technology probes balance three interdisciplinary goals: social science goal - collecting data about the use of the technology in a real-world setting while assuming that the probes will change user behavior

engineering goal - field testing the technology and to make sure all the main technological problems are solved for the probes to

an the main technological problems are solved for the problems to serve their purpose. **design goal** - inspiring users (and designers) to think of new kinds of technology and to encourage users to reflect on their everyday activities in different ways like cultural probes do, as introduced by Gaver and Dunne [4].

As part of the European Union-funded interLiving project [3] introduced technology into U.S., French and Swedish family no with the goal to design and understand the impact of new technologies that support communication and coordination technologies that support communication and coordination among diverse, distributed, multi-generational families. They introduced the MessageProbe; a simple application that enables members of a distributed family to communicate using digital Post-It notes in a zoomable space, and the VideoProbe; a simple method of sharing impromptu images among family members method of sharing impromptu images among family members between and within households is important but difficult. The econd conclusion that became clear after the deployment was that families want to have fun together, even at a distance.

Step by Step Guide

1. Selection of an interesting probe intervention. This is a situation in which technology can have an effect on people's behavior due to the technological intervention. Essential is that there has to be room for interpretation by the people that are going to use it.

2. Design of the Probe.

There are two important elements in this stage. The design of the probe itself as it's presented and interacts with the user (design goal and engineering goal) and the way it gathers information (social science goal) on the way users use it.

The main purpose of a Technology Probe is to gain insight into how people integrate a certain technology into their daily life in order to find new interesting opportunities. A lot of information about this can be gathered by the probe itself by recording the interactions people have with it. This can be extended with additional observation techniques like video-recording. It depends on the situation the probe is placed in whether this is acceptable of not. The kind of data that is recorded has to be carefully designed to make it useful in a later stage. When designing the probe itself it's important to keep in mind that A Technology Probe is not an ordinary prototype. This means that a Technology Probe should have room for interpretation. The people that use it should be able to put the technology to use for their own purposes, hopefully in a creative way. Because these probes are deployed at/with the user for quite some time they need to be fully-functional and error-free. That is the only way it can merge into the daily life of the user.

3. Deploy in real setting.

The Probe is deployed at the location it's support to get high traffic. Essential is the error-free operation of the probes. During the deployment there is a least researcher involvement as possible since the goal is to let the technology merge into the daily-life of the participants.

4. Discuss.

After the deployment ethnographic interviews can be conducted as well as analysis of the data gathered by the probe.

Technology probes are not ordinary prototypes, but tools to help determine which kinds of technologies would be interesting to design in the future.

Functionality: In terms of functionality technology probes should be as simple as possible, usually with a single main purpose and limited easily accessible functions

limited easily accessible functions. Flexibility: Users should be encouraged to reinterpret the probes and use them in unexpected ways. Therefore probes are more open-ended and less focused.

open-ended and less focused. Usability: During the use period the usability of the probe does not change. Unlike a prototype in HCI the goal is not to make an optimal usable prototype but to provoke the user to engage with the technology in a different way. Logging: Probes gather data that can be visualized and discussed between the researchers and the participants. In prototypes recording data is not a primary goal. Phase: Probes are intended to be introduced early in the design process as a tool for challenging pre-existing ideas and influencing future design. Prototypes appear later in the design process and are improved iteratively, rather than thrown away.

Cultural Probes, introduced by Gaver and Dunne [4], are meant to inspire users to reflect on their everyday activities in different way. These probes are collections of evocative tasks meant to elicit inspirational responses from people—not comprehensive information about them, but fragmentary clues about their lives mormation about them, but fragmentary clues about their lives and thoughts. [4] Suggested the approach was valuable in inspiring design ideas for technologies that could enrich people's lives in new and pleasurable ways.

Probing Technology with Technology Probes [2]. In this method the technology probes are really used as probes instead of a trigger as is the case with our main method. With this method technology is use as a probe for embedded data gathering. An example can be found in [2] Here advanced looging features were build into the probe to in [2]. Here advanced logging features were build into the probe to discover the way people engage with the technology.

Light-weight technology probes [1]. In this method lightweight probes are made that sacrifice some of the realism in favor of ease probes are made that sacrifice some of the realism in favor of ease of deployment and speed of information gathering. In this method a test takes hours instead of days or even months. It's conducted by supervision of a technician that can repair any problems instantly. The main advantage is quick feedback. The disadvantage is that the technology doesn't merge. For a first-impression it can be a useful method.

8.4 DB503-Quality Complaints in Consumer Products

devices.

Personal Reflection

project.

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Unfortunately nothing visual has come out of this module. It was merely a report.

Introduction

I've always been interested in business processes and I'm very happy that the education revolving around this topic is starting to get shape in this course. I'm especially interested in the business processes revolving around the implementation of new technologies. I choose this module to contribute to that interest.

In general the module is about SRPs (Soft Reliability Problem), problems not caused by a hardware defect. This is a growing problem within the domain of increasingly intelligent

I found the topic introduced by this module very interesting. This module also showed me that despite the product is aimed at a specific user group it may also be used by others. This can cause SRPs which can become a considerable cost for a future client. Being able to put products into context is essential for an Industrial Designer.

In the weekends I work at Paradigit, a computer shop, the lecture on SRPs was one big recognition. More than 50% of the problems people contact the Help desk at Paradigit for is because of a SRP. So I already had some experience with SRPs. Therefore it was very nice to get the theory behind it. I really would like to develop further in this domain. The second part of the module consisted out of a statistical analysis. A long time ago I did an assignment on statistical analysis but it was kind of rusty. It proved to me that statistical analysis is something I really have to look in to on time during my research

Introduction

Autonomous Behavior was a very hand-on module. First two lectures and immediately the building of a robot with the only requirement it had to present autonomous behavior.

Reflection

It was very nice to get a hands-on module from the start. Building a robot from scratch is not something I do very often. Building a robot is a very nice way of exploring the basics of autonomous behavior. Especially the difference between the teams.

I'm happy with the final result of our team. It's not the most original idea but it allowed us to experiment with the different properties and algorithms that could be used to make the robot behave. And that's what eventually it was about. I do find it a pity that it wasn't more original but as you pointed out, that's not what the module is about. Eventually the result achieved with the explorative approached, by using a more generic body, turned out the be very interesting and learn-full.

We've had quite a few setbacks during the development. H-bridges (to make the motors turn forward and backward) broke down 5 times, eventually we modified the circuit to make it more tough. Our first suspension and motors were way underpowered. But we've managed to fix that. It once again proved to me the usefulness of prototyping. Just building it and seeing what happens. And in this module it's twice as fun because this time it's not about efficiency. So a modification of an algorithm may result in very inefficient but very interesting and funny behavior.

In my team I've been mainly responsible for the Arduino coding and helping with the electronics. I believe the "nicest" behavior was found with the devices that were looking for a balance but came close but not entirely there and thus had to move again to compensate that, which eventually never ends. Next time I need to design something with behavior I will also look at other concepts of generating behavior, like Autonomous behavior





Introduction

In this module we were asked to read and present chapters out of the books Objects of Desire: Design and Society Since 1750 (Paperback) by Adrian Forty and In the Bubble; Design in a complex world by John Thackara

Described is the reflection I wrote on the insights gained by reading the chapters and attending the presentations of the other students. On the left page you can see the result of the second part of the module. In this part we were asked to design an object that would perfectly fit into the Rietveld-Schoder house we had visited a few weeks before the

The Rietveld-Schroderhuis was all about active living. The house could be adjusted in many ways so that it would fit your personal needs of that time. For example they could re-arrange the rooms by movable walls through the upper level of the house. I saw an opportunity there. In a book I had found a picture of a very stuffed bookshelf. This has brought me to the idea of introducing a system of holes, poles and planks which enabled the inhabitants of the house to mount bookshelves, tables or chairs to the movable walls.

Reflection

Reflection on the two pieces of literature read. Literature read together with Ivo Stuyfzand:

1. Objects of Desire: Design and Society Since 1750 (Paperback) by Adrian Forty

Chapter 5. The Home & Chapter 7. Hygiene and Cleanliness

2. In the Bubble; Designing in a complex world by John Thackara Chapter 3. Mobility & Chapter 4. Locality

The book Objects of Desire sometimes was a bit hard to follow but nevertheless has been great to read from. Mainly because of the rich historic perspective it describes. It sketched the social context and how (in our case) it was of influence on the way people use and experience the home along with the objects that make the home a home. Stories were told about the point of views people used to have that appeared almost unreal to me. Therefore it was very good to be taken out of the current world and get a view on how it was like back then. It made me think about our present society and how it defers from the norms, values and beliefs back then. It's also worth to think about how people will look at our time when they read the next Objects of Design in like 100 years. Perhaps they will raise their eyebrows when they read about Ambient Intelligence and Global Warming. How will those people react when they see a "tell-sell/teleshopping" or "goedkoper lenen" commercial? Not really something I would be proud of. However it's going to be interesting to see if some of my fellow students can make it to the level to appear in the Objects of Desire because of a groundbreaking design.

What I found particularly interesting in this book is the concrete examples it gave. In The Home chapter the road the sewing machine had to make before it had conquered its place in the home is discussed. It was very interesting to see how a business opportunity was spotted, the society was manipulated (advertising) and the product modified to fit into the specific social context. The contrary happened with the example in the Hygiene and Cleanliness chapter; the example of the train carriages. The values in society changed and left the rich people in the dark with their luxurious but "dirty" first-class

The book In The Bubble by John Thackara was guite a switch for me. Not only does he write differently than Adrian Forty, the book is about the present and the future instead of about the past. I found the way John Thackara writes very provocative and that's also what makes it fun to read but also discuss about. Where the statements in Object of Desire are carefully supported with examples In the Bubble tries to shock by overloading with examples and doom scenarios. As I understood from the people that presented the last chapter of the book his goal was indeed getting people to start thinking about it, making them aware of the "hidden" dangers. For me it worked! The main topic in the book is sustainability and the solutions appear very socialistic. Personally I don't think that all his suggestions are viable or desirable. Nevertheless a lot of the smaller initiatives he suggest can really contribute. I agree with Thackara that the real durable solutions will arise with a change in norms, values and beliefs within a society. And In the Bubble is written to enable this change. But it's a difficult process and when looking at history it's not always a very logic or honest process. The contribution of commerce described in Objects of Desire may be considered not honest.

I've experienced that every once in a while being taken into a different time or perspective can make me aware of the social context of current time. This is not only good as a designer but also as a person. There is not only one truth but there are many and it's always relative to the context. A little side-note may be that the literature read only the aspect of time was considered (past and future) but I believe societal difference also exist in current time between different cultures e.g. different countries/parts of the world.

At the beginning of the module questions about aesthetics were raised. After this module I believe that the perception of aesthetical quality also depends on the social context it's placed in. I've seen that in different times different aspects are considered of value. Something that was perceived as beautiful (high aesthetic value) (e.g. first class carriage) could've been perceived as dirty (negative aesthetic value) after a change of values. I also believe that aesthetic value is always relative to "the rest of the world", all the other things a person has experienced before. I believe technology is a great tool for designers when aiming for aesthetical value. Technology enables interaction between man and machine. This interaction adds another dimension to the way designers can embed aesthetical quality into their designs.

8.7 DB307-Foundations of Tangible Interaction

Insights gained and reflections on the concept of tangible interaction.

By attending one day of the TEI conference and the presentations of Kees Overbeeke and Jean-Bernard Martens I've come to see that there is not one truth on Tangible Interaction. Tangible Interaction still is an emerging research domain and the different people have different perspectives on Tangible Interaction. Where I believe Kees Overbeeke sees Tangible Interaction as a way to give people products that are able to interact with people on a more "true", natural, rich way. Jean-Bernard Martens sees tangible Interaction as way to give people products that are able to interact in a more transparent, understandable and thus less cognition stressing way. I believe both have very credible reasons why Tangible Interaction is worth pursuing. I do not have a preference for either two. I believe both perspectives can be implemented at different places within my future projects.

I presented the following statement after the group discussion: The application of tangible interaction will lead to the decentralization of interaction with digital and intelligent systems.

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Introduction

This was one of the most learnful modules this semester. I had heard of tangible interaction before and here and there made some designs but a real foundation was missing. This module filled that gap. We were offered the opportunity to visit the TEI 2008 conference; a very nice experience.

On the right you can find the most important insights gained during this module.

On the bottom right you can see a poster of our Tangible concept. The aim was to come up with a simple, straight forward concept. Because we already had seen so many table-top systems we didn't want to come up with that. This only partically worked out. The design was pretty shallow. Nevertheless I believe I learned a lot during this module.

The most important explanation of Tangible Interaction for me was in the paper of Ishii [6]. I came to see that TUI are not only about tactility & intuitiveness but that it is about the representation and control of a virtual/digital element into a physical element in the physical world. In that sense the weight of the interaction is in the physical world instead of in the virtual. This enables the user to interact with the system through an interface that is more natural by utilizing its physical manipulation skills that are much more refined than what is currently addressed when interacting with e.g. a personal computer.

One of the difficulties we've encountered in our group discussion was the balance between representatively and universality of the physical representations of digital information. We came to the conclusion that it's not possible to get all the functionality of (e.g.) a personal computer into the physical world because it requires a very big amount of representations. If the representations get more universal and thus can be used for multiple functions it will decrease the ability to understand. It may result in one object that controls all the information in the system, like a cursor. I believe the best way to deal with this challenge is to go back to the "value adding" essence of the device and see if it can be redesigned by using tangible interaction. For example with the use of mobile phones. I believe I should not try to map the entire system of a mobile phone into its tangible equivalent but I should try to design for the essence of a telephone: personal communication with another person and present it to the user at the proper location.

Through the application of Tangible Interaction, elements from the digital world are represented by elements in the physical world. Common personal computers offer these functions in a virtual world, created inside a physical device. It's neither possible nor desirable to map all the functionalities of a personal computer to a physical representation. Therefore application of tangible interaction will lead to scattering of

these functions. Tangible systems in common also enable to introduce this functionality in the context it is most desirable, instead of bound to a personal computer and its physical location.

Before I started this module I had heard a lot of Tangible Interaction. It almost seemed as a holy grail. A new type of design with merely advantages. Now I've seen that it also has disadvantages and it depends on the situation if and how it can be applied. Nevertheless it's a great additional tool that in some cases can be very useful. For example I was very impressed by the effectiveness of a few tabletop systems like URP[5].

I believe the biggest challenge now is to develop systems that use Tangible Interaction and bring them to the level of market introduction. In a sense I believe that as soon as the value gets justified by the price people will buy it. I believe Tangible interaction can add value to a product in terms of understandability. Stephan Wensveen asked us: "Is Tangible Interaction only for elderly?". I don't believe it's only for elderly but I do believe that it can contribute a lot there. Elderly people have difficulties with the freedom of the virtual space inside a computer. When enabling them to use the systems through the physical world they also ready know Tangible interaction can add value.

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9. Global Semester Reflection

I onjoyed my first semester in the Master. The tempo is considerably higher and I needed. some time to get used to that, But it actually feels apod. Having marely highly motivated and talented people around is very inspiring and mativating. This can also be seen from the results displayed at the interim and final exhibitions. I took a chance and freedom by doing this project. My goal was to challenge and surprise myself, it worked. But not without problems and difficulties. Fortunately I must say. By dealing with these problems and difficulties live learned more on how to deal with the quicks of design. I believe that in this project I've mainly developed in the areas of Design and Technology. The final prototype is the best proof of that. Besides that going through the process of an explorative project with the 2.3.7 week method was one of the major learning events. From the started this project has been introduced as a side-track of Richard Appleby's research. After doing this project I now see this project in the scope of many other projects. It's not just me and my project anymore. I believe this is also evident from the opportunities in which this project can be further developed. Daing this project has been a great experience but five dome to see that it's not the kind of project ! would like to keep on doing. Therefore new time I would like to do a bit less. abstract project In this project live applied LED technology. I've use this in some of my previous projects(#3)[14] as well. Laiso see chances in other technology fields and I would like to develop myself further as a special st in the integration and exploitation of promising technologies. This means that I would like to be involved with design on a bit higher. level, like I really enjoyed the discussions in the Visions on Ambient Intelligence module. The comphlet I wrate was selected as one of the best 3 of the class. The module Quality Complaints in Consumer Products has yet again attracted my attention to the Business Group Therefore I believe a project like the Roadinap for Wearable Sensors by Adidas may be the kind of project I would like to do next semester. I believe this would enable me to further develop in the domains of User and Business. The modules provided some of the theoretical background I had been looking for. Sometimes it's nice to have somebody explain the basics of a certain field. Having theoretical background makes it a lot easier to anticipate how to use, extend and apply that knowledge in my designs. 'You don't know what you don't know" is applicable in this case. If I don't know that it's there it's very difficult to search for it. In that respect it's also important to keep in constant contact with various people who can give different. angled comments

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