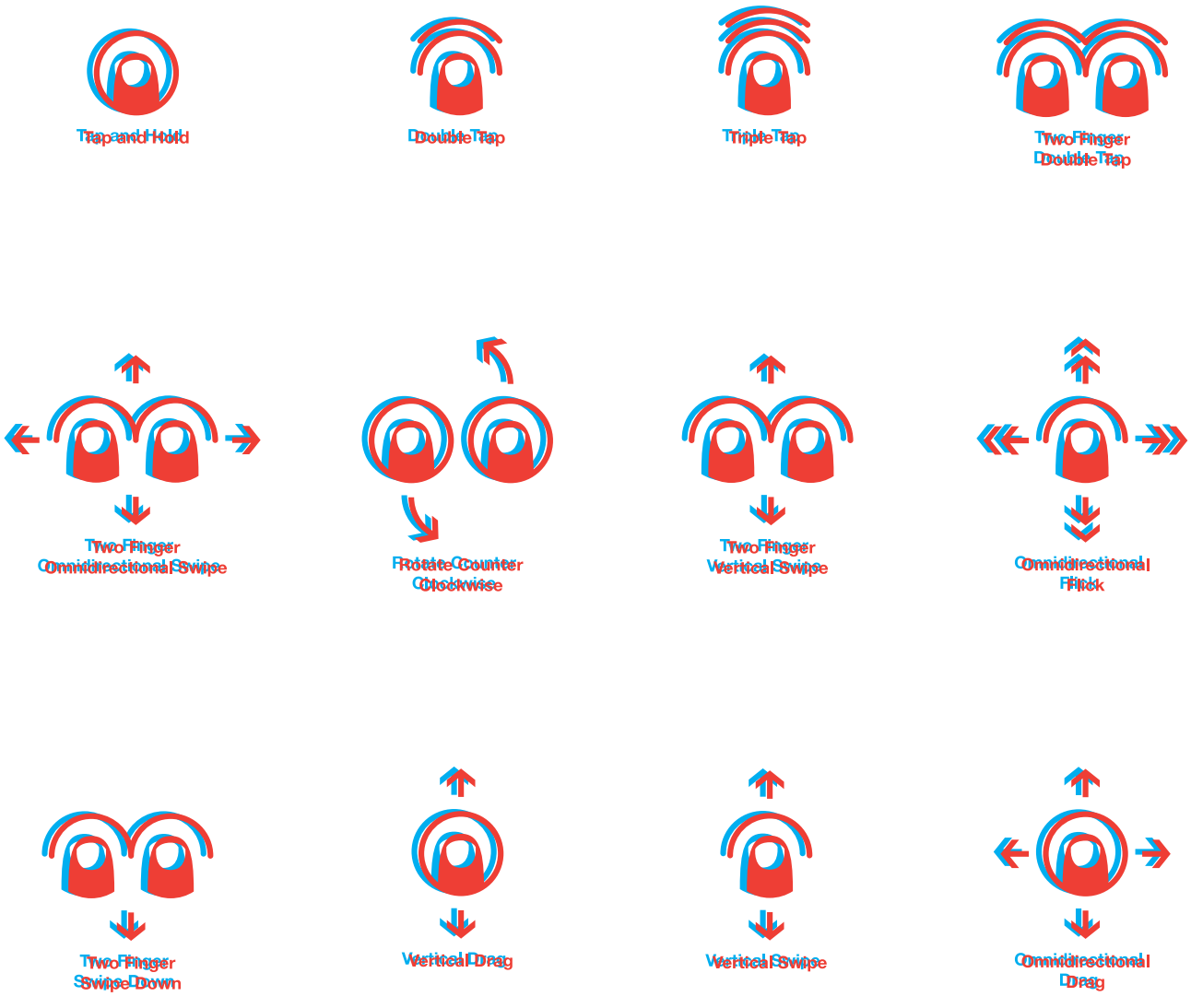
# SIDeR'12 Intertwine & Play

22-23 March, Göteborg, Sweden




# Proceedings of SIDeR'12

## Scandinavian Student Interaction Design Research Conference 2012

Edited by Eva Eriksson & Ruxandra Teodoru

CHALMERS UNIVERSITY OF TECHNOLOGY | UNIVERSITY OF GOTHENBURG

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# Introduction

The Interaction Design division of the Department of Applied Information Technology at the Chalmers University of Technology is pleased to host the 8th Student Interaction Design Research conference (SIDeR ’12) in Gotheburg, Sweden. The conference was inaugurated in 2005 in Sønderborg, Denmark, as a means of enabling interaction design students to participate in and contribute to research in the emerging discipline of interaction design. A number of prestigious universities have since been hosts to the event. SIDeR offers students the opportunity to bring forth research they have carried out throughout design projects as well as share reflections on design theory through the medium of an academic paper. Throughout the two days of the event, students will be able to meet with colleagues from other universities, share views on the design practice and build a valuable network in the field of interaction design.

The conference theme for the 8th SIDER conference is *Intertwine and Play*. Intertwining traditional services with new media forms and engaging play is the core challenge for future interaction design. In all parts of the work of an interaction designer, from gathering requirements, to performing methods and creating products, it is important to take respect to what is already there, from organizational and theoretical level to spatial and practice level. At the same time, by playing and experimenting with traditions, and intertwine them with new media and new technology, interaction designers will be able to inspire and visualize new perspectives of the future.

We are proud to support the effort by organizing this conference for the second time in Gothenburg. It is a great forum for students to meet and discuss their work ideas and approaches, and of course to network and make great new contacts. This year present X number of papers from eight different schools in four countries. In these contributions we find curiosity and creativity, as well as a strong will to change and improve. This is the work of the next generation of interaction designers, and regardless if you choose to continue an academic career or choose to work in the industry after graduation, you will define and strengthen interaction design for the future.

A warm welcome to SIDeR 2012!

**Division of Interaction Design**
Department of Applied IT
Chalmers University of Technology

# Organizing committee

At last, someone had to do it and this brave and enthusiastic bunch was the one.

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We would like to kindly thank all the nice people that have taken time to be part of the reviewing process of SIDeR'12 papers.

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# Table of Contents

# Table of Contents

# Table of Contents

# The living experience

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## ABSTRACT

There is a growing interest to consider a sensual perspective in embodied experiences in unused urban areas, contributing to connect specific spaces with citizens. Some spaces in urban metropolis are gaining new identities along the years according to the habits of society although other areas became gradually unused and lost their meaning to citizens. How people can feel more at ease in these urban environments and how to find a balance between notions of modern comfort and the urgent need for social responsibility in design practice.
This paper examines an approach to a sensual experience through an explorative prototype as a way of study the embodiment between citizens and target users in a specific area in Malmö city, Sweden.
The study project is a result of the "Embodied interaction" module exploring the public space in Rosengård, in Malmö. The intention of the concept is to provide users a place to be in as well as to feel the place is alive with their presence. *Processing* and *Microsoft Kinect* were used to explore embodied interaction with users. Aesthetics and interaction will be approached as a relevant role to this public area, creating an engaging experience, affecting users as well as citizens to visit, interact with and be in the place.

## Keywords

Interaction, participatory design, embodiment, emotions, playfulness, aesthetics.

## 1. INTRODUCTION

Urban areas are in a constant evolution [1]; in addition some urban spaces gradually become unused for the citizens. Urban areas which made sense in the past no longer do now. This is part of the process called evolution of the cities.
This paper explores, the *Aesthetics of Interaction* as a way to minimize [2] the lack of embodiment between citizens and unused urban areas, providing a better functionality to these urban spaces. This project researches how users can be stimulated in addition be more connected to the space. During the project each step was planned and discussed putting the user as the center of the project.
First, the paper describes the framework and the context of the project, presenting the guidelines.
Second, the paper presents the concept in details, regarding the qualitative research we made, during the design process, to get insights and after analyze it to provide usefulness in a social context in addiction to test playfulness, embodiment and affects/emotions from users through the prototype experience.
Third, is also described how the study was observed during the design process including the user test prototype. The project will be analyzed according to *Aesthetics of Interaction* perspective. This part will substantiate the discussion; how *Aesthetics of Interaction* can contribute to minimize the lack of embodiment between users/citizens to this space in the city (taking in consideration the social context).
Finally, is also described what was expected to find in with this project, following possible further developments.

## 2. THE LIVING AREA

### 2.1 Background

The aim of the present study is an exploration of a sensual experience in the public space in Rosengård (figure 1), in the sense to create a better connection between the target users and citizens to the activity area, since the space doesn't have this feature.
Firstly, we planed the project, defined a timeline to orientate what and how we intended to focus. We defined our plan with guidelines [2] and tasks to our group. Secondly, we made a qualitative research. We established contacts and observed the field camp; we visited the central area of Rosengård, nearby the area of the study project, to have a broad perspective. We also went to Rosengård's library, at the central area, plus to Yalla Trappan. We took this opportunity to interview stakeholders from the Municipality of Malmö, from the development manager at the Education Unit in Rosengård, from Rosengård Folkets Hus as well as the Radio-RGRA in Rosengård. At the same time, we looked to some sources of inspirations and information on the Internet. We also had two workshops; one with girls between 16 to 24 years old at Rosengård Folkets Hus plus another at Radio-RGRA in Rosengård with boys also around that age, to complement some research. Thirdly, we gather all the information and documents to initiate the analysis [2].
Most of people, who live in this part of the city, are emigrants and refugees from Serbia, Bosnia Herzegovina, the Middle East and Somalia. The areas of apartments in this part of the city are extremely small therefore lots of people live in these small/crowded apartments.
The activity space in Rosengård can gain embodiment and meaning to this target user. It's also a viable solution to Malmo Municipality since it can be an activity area with spontaneous events to the city, controlled by citizens and the municipality.

**Figure 1. The activity area in Rosengård – the unused space**

## 2.2 The living process

A group of possibilities was written down during the brainstorms plus visually generated in the ideation sessions, based on stakeholders needs to better define our visions. The *Problem/Solution* [2] method was used in our brainstorms. Each member came up with 3 ideas in the first ideation to give a contribution to the project. All of the team members were students of interaction design, from the IDM program at Malmö University in Sweden, from different backgrounds such as industrial design, new media, communication design and computer science. It was chosen a member who has the ability to coordinate and orientate the session as well as to register the ideas in a white board while one of the team members was presenting his/her suggestions and visual ideas. A matrix was made according to similarities. During next ideation sessions the most considerable ideas were selected to narrow down plus to start to define our concept. The three most relevant ideas were chosen to create one concept. We used an evolutionary ideation session [2] to improve and unify our concept. In order to have time to test a study prototype of our experience, we decided to focus in one part of the big concept. We revised, refined the concept and called *The Living area*. The tasks were divided according to respective backgrounds of each team member. Three students were more focus on research process, all of the team members participated in brainstorm and ideation sessions, one of the team members was more dedicated on the prototype and technical support. We focused on the aim we intended since the beginning, which was to let the users think they play an important role in keeping the place alive. Qualities such as social responsibility, playability, coziness, safety, spontaneity were selected to be relevant to stakeholders and to affect users be embodied to this place. An area where girls are welcome, feel comfort, privacy with a dynamic atmosphere. They can talk, dance, sing, make music as well as many other activities. These activities were mentioned by some of the stakeholders during the qualitative research (Eva Petrov, Beata and girls).

The concept was created. It consists of a digital part and a physical part. The digital consists of a website where girls can book the area for themselves plus decide what activity to play, connected to one of the most fluent social network existed in the Internet (*facebook*). In the physical area will be meeting spaces for their activities. A projection of lights and a shadow will be in this area to present the mood of the area based on users' interactions and in their activities (physical and virtual). The mood is personified by a shadow; a playful creature, similar to human body, which reflects the mood of the activity area, according to long term (sum up of the amount of users; per season, time of the day as well as the activity events provided from the website and the mood of the users in the physical space) and instant term (facial users' expressions, the movement and pace of the users as well as the body in real space and time). The shadow creature changes according to the meaning that people are providing to physical and virtual space in long term (reflected in the size and face of the shadow) and instant term (transmitted in the movements and pace of the shadow).

The prototype is viewed to our project as an early user test, as an explorative study in playfulness plus as a tool to add knowledge to our study. We decided to focus on the instant physical input of the shadow, to test the playfulness and the embodiment of our experience.

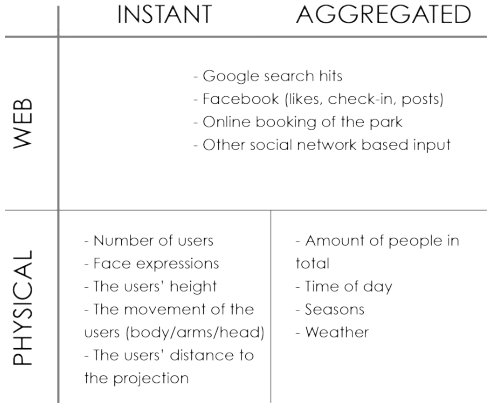


**Figure 2. Inputs into physical/web plus instant/aggregated**

## 2.3 The living experience

We made the user test prototype during Christmas market in Rosengård, with the users' target; some girls between 16 to 24 years old, some people from Malmö Municipality as well as some parents who were there. Processing software and *Microsoft Kinect* were used in the prototype to explore the playfulness and the embodiment. The feedback obtained from the users, during the test prototype session, confirmed some of the important features incorporated in the concept of the living area.

Firstly people were curious looking at the blank wall. They read the concept and after they started to interact with the wall. The welcome face of the shadow appeared on the wall and led users to make a smile. They started to move their bodies and realized the shadow was doing the same gestures with a happy smile (figure 3).

Secondly, people started to laugh and felt stimulated to interact with the shadow as an extension of their bodies. Sometimes people stopped, to see what the shadow was doing and the happy face of the shadow turned into an unhappy face. We observed they were emotionally attached to this creature and they continued to dance and play with the shadow (figure 4). They were through a playable and a sensual experience.

There were four girls, who looked to their friends and laugh while were performing the user test.

The prototype in this paper is viewed as part of an explorative study [3] as a way of doing research.

**Figure 3. One of the users interacting with the shadow**

**Figure 4. One of the girls playing and dancing**

## 3. DISCUSSION

The feedback during the qualitative analysis and during the user test prototype, demonstrated that *the living area* could be used to cover the lack of embodiment between target users and this public area in Rosengård.

This area is fulfilled with useful spare time activities for girls without forget the playfulness, concerning the ages, gender as well as their socio-cultural features. This experience affect users in a positive level, since it has social responsibility and can generate a sensual relation between the space and user.

*Aesthetics of Interaction* encourages users to explore and assess the relationship between them and space more deeply as well as to easier integrate this experience into their daily lifes. *Aesthetics of Interaction* is about all aspects of an artifact; not only how it looks but also how users behave, interact and feel. [4] There are four main features to achieve *Aesthetics of Interaction* [4]; 1 - Has practical use next to intrinsic value; the *Living area* is a participatory design study for a specific area in Rosengard, in Malmo city, giving possibilities to satisfy needs and desires of target users. The redesign of this area with this experience let target users to connect their daily lifes to this area as well as to feel affect and embodiment with the space, 2 - Has social and ethical dimensions; our concept depended from socio-cultural factors and historical background of the users living nearby this space. We reflected about the behaviors and analysis obtained from the feedback provided from the stakeholders, how we intended to invite people to interact with our user test prototype. An embodied experience, connecting girls and other users to this space of the city. Social responsibility, playability, safety, spontaneity and coziness, provide a sensual experience and minimize he lack of embodiment and affection between space and users, 3 - Has satisfying dynamic form; users were attached to the shadow as an extension to their bodies. Dynamic behaviors were observed during the testing prototype. The welcome shadow invited the girls to participate. This project promoted curiosity, engagement and imagination to users in the exploration of this interactive system, 4 - Involving the whole human being; according to the last feature users engaged with mind and body during our test prototype. The sensual stimulation from the user influenced the shadow and the shadow, in turn, influenced the sensual stimulation of the user. A space may suggest itself experiences as well as narratives. [4]

In *Aesthetics of Interaction* perspective we projected an embodied sensual experience, where coziness provides familiarity to this space. The users need to interact with this area, maintaining it alive in a good condition. This living urban area is intrinsically connected with users and citizens, as a symbiosis relationship. During the design process and user test prototype, the concept generated/affects emotions, because this area gives possibilities to solve their needs and desires with function and useful suggestions. In addition, it brings pleasure in a visual context.

The contribution to the events of the space or simply being there to talk and interact with the space, stimulate girls and other users to be a part of this area. This contributes for the maintenance of this urban space as a collective experience (girls, parents, Malmö Municipality, citizens, young people) and minimizes the lack of embodiment connecting citizens to this activity space.

## 4. CONCLUSION

I believe that I reasoned how the aesthetic experience through interaction relies on addressing mind and body [6], as well as it is rooted in the socio-cultural context of users and citizens. Moreover, *Aesthetics of Interaction* goes beyond the ideas of functionality, providing atmospheres full of meaning, emotions and embodiment.

In order to examine the potential use of *Aesthetics of Interaction* in our study project, the four main features were addressed in this paper. *The Living area* presents a possibility to reinvent unused urban areas in the cities, humanizing the space with sensual interactions, without forget the context of the space. Interaction design needs to be sensitive to beauty [7] and ethics to create and provide better atmospheres to people in a positive as well as in an intelligent perspective, letting users engage totally with mind and body. These specific urban spaces can be more responsive to people's needs to let them deeply embodied with the place through a sensual experience. When the action defines meaning to citizens these spaces turns into memorable experiences. [8]

I think *Aesthetics of Interaction* can highly contribute for a better future in this specific urban areas of the cities.

There are some parts of *the living area* that were studied theoretically and would be interesting to develop further some test prototypes in future, in the digital part (in long and instant term), as well as in the physical part of the project, to know how the shadow concept should be developed in the future. Different types of shadows linked to sound could also be a viable test.

Another reflection was made theoretically in how the shadow would be in ten years in addiction how users should contribute to the shadow in five or ten years, since it is a collective experience.

As an initial prototype we didn't have the opportunity to test the interactivity with more than one people with the shadow. Probably this detail affected the outcome of the testing. Although it was extremely relevant to evaluate the emotions and behaviors from the target users in an individual level.

However, as I mentioned above, I believe *Aesthetics of Interaction* is a benefit when designing embodied experiences. This perspective can be an advantage to participatory design as well as to promote curiosity, engagement and imagination in the exploration of an interactive system [9].

The feedback from stakeholders matches this statement along the design concept and during the study prototype, confirming *Aesthetics of Interaction* connects specific spaces of the city which have a lack of embodiment between citizens and the city.

## 5. ACKNOWLEDGMENTS

My thanks to all members of my team project and to stakeholders who contributed for knowledge to the project and made this study possible and solid. My thanks to Beata from Rosengård Folkets Hus who provided space for the workshop with girls group as well as Johanna Eriksson from Radio-RGRA in Rosengård, who provided space for the workshop with boys group. I also would like to thank to Mahmoud Keshavarz for the given support in my initiative as well as to our tutor Per-Anders.

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# Speak your mind
## Designing for participation in public space

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## ABSTRACT

Public places are one domain for dialogue and participation. This paper discusses how participatory design methods apply to designing for marginalized groups in society. As students we carried out this design project with a case from the city of Malmö and The EU initiative PERIPHÈRIA, with the aim to create an interactive concept for a soon to be built public activity area in the Rosengård district, Malmö, Sweden. Public places have historically been associated with men, and in Rosengård public after school activities such as football practice is dominated by boys. Therefore, we wanted to empower young girls to participate and express their minds. This paper discusses the outcome of using participatory design game and a prototype as communication tools, between designers and participants. Within the field of participatory design we argue that to be able to advocate the perspective of marginalized groups, designers need to consider their roles in a greater infrastructure in a Living Lab of stakeholders and be reflexive about your representation of the groups you are designing for.

## KEYWORDS

Participatory design, Design games, Place-specific computing, Empowerment

## INTRODUCTION

One main goal in a participatory design agenda is to empower marginalized groups (Björgvinsson et al, 2010, p.3). Participatory design has its roots in designing for workplaces, together with the skills and knowledge with which people carry out their workday in a specific local setting. In this paper we explored how these design methods can be applied for interactive concept development in a public place, to empower young women in a peripheral neighbourhood. First, the paper will situate the case together with a brief description of our design concept. Second, it describes the outcome of participatory design game and the testing of a prototype. Third, the paper discusses the meaning of interacting with a microphone and recording your own voice. Finally, it addresses the role of being a designer within an infrastructure of a Living Lab, conceptualizing and representing a peripheral neighbourhood and its inhabitants.

## THE SPEAK YOUR MIND PROJECT

We developed this project as students at Malmö University in Interaction Design Master's programme. The purpose was to explore the field of embodied interaction and participatory design, with a case as a part of a sustainable urban development project situated in Rosengård, Malmö, in collaboration between the EU PERIPHÈRIA Project (1) and the City of Malmö. The PERIPHÈRIA project, concentrating on smart cities, focuses in Malmö specifically on "The Living Neighbourhood". Our brief was to design an interactive, place-specific concept in "The Activity Area" for young people, which is going to be built in the heart of the Rosengård district. Generally speaking, "Place—Specific Computing is not about designing for place, but becomes part of the continuous construction and reconstruction of place, supporting established social practices but also adding to the potential to shift meanings and interactions so that places can develop in new directions." According to Jörn Messeter, "Place-specific Computing is about designing *in* place." (2000, P.39)

From a place-specific perspective, we struggled with conceptualizing this "activity area", situated in Rosengård. Participatory design has its roots in designing for workplaces as the Utopia project (Ehn 1988, in Björgvinsson et al, 2010) – but how to design for a public place in a neighbourhood with 22.000 inhabitants where the majority of the inhabitants have a foreign background (2)? Björgvinsson et al described the socio-material conditions for young people in this neighbourhood as migration between the periphery and the center of Malmö and Swedish society, which in return leaves them marginalized and with no opportunity to express themselves. (2010, p.3) Public places has historically been associated and dominated by men (Caine & Sluga 2000). Currently, many of the after-school activities for young people in Rosengård are dominated by boys and for different reasons there is a problem to attract girls. Therefore, we were asked to consider the equality aspects and design to include and foster the participation of young girls at this activity area.

## THE CONCEPT

From documentation of previous workshops, we learned that young women in Rosengård had asked for a place to have coffee and socialize. We had the initial idea to make a voice triggered coffee-maker, that would start to make coffee for friends having a conversation around it. The ritual of drinking coffee with friends creates a certain social setting. Therefore, this idea later became embedded in our concept, since we wanted to create something that would stimulate young girls and boys to go to the activity area. In its final stage, the "Speak your mind" concept included the ability to record your own message on a topic, get coffee in return, listen to a new perspective on the topic - a recording done by another user. We were considering several possibilities of connecting the system to a local radio station or to other coffeemakers in the office of local politicians.

## FROM GAME TO PROTOTYPE

To explore how to create dialogue in public space with a participatory design approach, we created a participatory design oriented game (figure 1) to gain a deeper knowledge base for our project. We chose to make a game, hoping it could be a method for participants and designers to imagine what could make sense in this context. Since we also wanted to explore embodied interaction we wanted to get a glimpse of what kinds of interactions like signing or dancing that could be motivating and fostering for young women to participate. The main aim of the game was to let the participants create scenarios about how they would use our concept in the activity area. It had to be played by two or more players and after the scenario was generated, they would have had to reenact it. Since this activity area is going to be public, we tried to meet both girls and boys in the age 16-24 in Malmö, so we did a series of spontaneous workshops at RGRA (a grassroots hip-hop and radio-studio), Rosengård library, Media Gymnasiet and a cafe.

Eva Brandt argues, that scenario oriented design games have inspiration from "Forum Theater" and "The magic if" techniques, where the players would actively recreate the scenarios, which in turn would create a discussion around the different possible changes in them (2010, p.59). After testing the game, we found out that this also requires the "ideal" participants - ones that are invested in the design process. With little time to gain the participants trust, we realized that putting them in the role of actors and requiring them to play out the scenario was impossible. Also, we learned that in our quest to find what made sense to young women (and to young men) we had left the design decisions solely to the participants. From the perspective of wanting to design for dialogue in a public place, we observed how the game became a tool to simply start a conversation between us as designers and young women and young men in Malmö.

Patterns, that emerged while testing the game, informed our decisions further in our design process. Our first prototype was a box with a handheld microphone (figure 2). We wanted to test the threshold and the motivation to speak your mind in a public place. Additionally, we thought that microphone was one of the key physical properties of the prototype and the machine would detect two participants to collaborate with each other somehow while having a "conversation" about "the future". A timer would fill up, and they would get a "new perspective" as a gift in the form of an origami.


**Figure 1 The game included cards split into five categories and a game board with five corresponding questions.**


**Figure 2. The first prototype, environment at workshop and origami.**

## PERFORMANCE AND EMPOWERMENT

During the testing of the prototype, we observed the figuration of two young women having a conversation together using the microphone. Interacting with a microphone can potentially be an empowering experience, especially if you know that you are able to share your message with others. In our prototype we only had one microphone and the conversation between the young women turned into more of an interview. But maybe two microphones


**Figure 3. A scenario, describing the use of the final prototype.**

can be more equal than discussion on empowering. Being heard can be empowering, but it can also be intimidating. For instance, a microphone can make people self-aware and worried where the content will end up. Our perspective in long term is to keep the system alive in one spot with a variety of topics by giving local youth a chance to improve the habit of expressing and spreading their ideas.

Hansen and Kozel hoped that taking part in their project "Placebo Sleeves" could be an intervention, that could influence the participants experience of their daily life (2007, p.212). Likewise, we hope that after girls experienced having control of their own voices, they would be aware of the value of their perspectives during their daily life.

# DISCUSSION

With an ethnographic approach, it is problematic to think about this neighbourhood as a homogeneous sphere. With Messeters (2009) notion of place it might also include the intentions of the stakeholders within the infrastructure of the Living Lab, urban planners working with development in the district, the politicians supporting with funding, scholars with special areas if interest, and even our intentions as design students. We as students became a part of this conceptual "place" as actors trying to understand it and design for its future. Therefore, we also need to consider our roles as designers and our position in this infrastructure. In many ways we were as much influenced by other stakeholders as our concern about how to empower young women in Rosengård.

What influenced our process was the main goal of the City of Malmö to attract young women to come to the activity area in the first place. From the PERIPHÈRIA projects point of view, we were encouraged to add the agenda of creating a channel for young women to empower them to speak their mind. To "Speak your mind" in a public place, has strong political implications, a desire that vaguely has been articulated by young women in Rosengård, as well as it has been articulated by representatives from the city of Malmö.

Truth be told, we had problems with getting access to young women in Rosengård. To be able to make any design decisions we were still trying to find something that could be considered "true" in this context. Ultimately, when making these workshops on the spot, we were limited when making deeper interpretations of the patterns that we saw. The motivations and the issues that concern "them" were still hard to decipher. Compared to ethnographic fieldwork, the game did not give us material to make a thick description (Dourish 2004, p.59). At this point the risk of creating stereotypes from your target group appeared, to make it fit your concept, when we had a small sample representing the whole. In our case we tried to be aware of this by talking about "girls" or "young women" and needs in common, but also phrase is as "girls that like coffee" or "girls that wish to get a new perspective". Still, this is on the level of representation, a stereotype could also be embedded in the system, by focusing on the needs and the desires to interact, fostering and hindering certain ways to interact and motivations to interact before others.

# CONCLUSION

This design process has taken a participatory approach with a place-centric perspective. We wanted to design a system to allow young women to speak their mind this public activity area, and

design a system that hopefully would include and foster a channel for young women to express themselves in the Rosengård district. In this process, participation, conversation and dialogue have gotten closely intertwined; in workshops, in the public place, in the neighbourhood and as a key interaction in the concept. A few conversations on the street cannot truly be considered participatory design. In order to implement this, these participations as dialogues need to be continued, to further inform us how to create a channel for young women to express themselves. As interaction design students, it is difficult to predict the long term effects your design would have on a social structure. And even a resourceful infrastructure of a Living Lab, it is a risk to reproduce the already existing conditions and social structure in this place.

# ACKNOWLEDGEMENT

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# END-NOTES/FOOTNOTES

[1.] ***Read more about PERIPHERIA - Networked Smart Peripheral Cities for Sustainable*** *Lifestyles* http://www.peripheria.eu/about-peripheria/

[2.] ***Statistics from City of Malmö***

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# Jetpack Project

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## ABSTRACT

This paper is based an artefact, named Jetpack, which took the form of an interactive game where the user takes control of a manned jetpack in a 3D environment. The goal was to create a interactive artefact that would utilise the possibility of depth present on a 3D cinema screen, and to examine whether or not the added depth would result in a more immersive interactive experience for the user.

To better evaluate if the added depth indeed enhanced the user experience, a series of Opportunistic Evaluations where held to get a better understanding of the immersive properties of the 3D screen.

## INTRODUCTION

The Jetpack project was created as the exam project in a course named 3D interaction, taken at the University of Aarhus. The rules for the exam where that the resulting project had to include interactive use of a 3D cinema screen, and that the finished project had to be presented in front of the class and demonstrated the to the examiners. As part of the course we had to design, build and test a prototype, as well as write a report about the design process and the user tests, to prove that our design used the 3D properties of the cinema screen, and that these properties actually helped enhance the interactive experience of the final artefact.

To this end, the immersion of the user was designed to focus around the game itself and not the Jetpack, as it was to function as a tool for interaction, thereby creating a perceptual illusion of nonmediation as defined by Lombard and Ditton (Ijsselsteijn, 2001). If the users felt that the Jetpack was cumbersome or unintuitive, then it would have taken away part their focus from the game.

The project was created by three students working together to create the Jetpack project over a two month period. The game engine Unity was used to create the game, since this engine made it possible to receive information from multiple sources at the same time. This was used to receive user input via the constructed jetpack backpack.

We will now take a look at the goal of the original design process that resulted in the Jetpack idea. Afterwards the final design of the artefact will be presented and explained in detail. Then we take a look at how users actually interacted with the artefact. Lastly a short discussion about how we explored the Jetpack´s properties, will help create a better understanding of the artefact as a whole.

## GOAL

The goal of the design process was to create an Interactive 3D experience for the user, where the interaction between body and 3D environment created to opportunity to enjoy the game itself without disrupting the immersion.

Designing the Jetpack textural, visual and interactive properties, also meant working with the theory of Tangible User Interfaces, to better insure the desired Connotations and Denotations in the users (Fishkin, 2004). Lastly the Jetpack game was planned out to be easy to learn yet hard to master, and took its inspiration from classical arcade games such as Donkey Kong. To have any chance of achieving this, our game would have to live up to several rules that are prevalent in classical Arcade games. Therefore these rules had to be examined and understood.

### Hypothesis

The Jetpack Project was created originally created as an exam project, where the main rule for the exam was that the resulting project had to in some way use the possibilities of a 3D cinema screen. As a group we chose to take the assumption that we could create a more immersive experience for the user, by using the depth perspective of the 3D cinema screen, to create a video game that used a first person perspective, and the body of the user for navigation. Here the 3D cinema screen functions as a “Window-on-the-world” monitor based display, as defined by Paul Milgram (Milgram, 1994). Having the user use both their body as the controller, and giving them a first-person perspective, we thought would create a better immersive experience for the user, then if we had given the user a avatar in the game

To figure out if the finished project lived up to these expectations, we therefor hard to test the resulting game with and without the use of an avatar for the player, as well as see if we could create an interesting interaction experience that would support our game idea, and not work against the immersion we where trying to create.

## FINAL DESIGN

The final design took the form of the Jetpack game, were a user wearing the jetpack backpack, uses it to interact with the game running on the 3D cinema screen. The user stands approximately

three meters in front of the cinema screen, while wearing passive 3D glasses, to get the full 3D experience.

**Figure 1: User testing the Jetpack game.**

The game would start when the user pressed down on the two buttons placed on each handle protruding from the jetpack. This would activate the motor of the virtual jetpack in the game, and let the user navigate the game environment by tilting to a certain side while activating the jetpack. The user would then fly in the direction they themselves where pointing. This lets users change direction while flying, by simply tilting to a different side. Likewise breaking requires the user to lean backwards to exert force in the opposite direction. By letting the user control their movements inside the game with their own body movements, the interaction with the game became more intuitive then simply presenting them with a keyboard or joystick setup. This did however mean that the jetpack backpack itself had to be designed to help give users a intuitive understanding of some of the backpacks interactive possibilities.

## 1 The Jetpack

The Jetpack is constructed primarily out of wood sheets, venting pipes and plastic jugs, which were constructed and painted to conceal the internal electronic components, as a well as complete the illusion of the jetpack for the sake of the users immersion (Greenfield, 2006).

**Figure 2: The finished jetpack after painting.**

When designing the jetpack backpack, we as designers had the opportunity to shape the artefact in such a way, that the user would have a natural understanding of some of the properties of the artefact (Kirkpatrick, 2009). Because of this, choices had to be made about the materials, the look, as well as the weight of the finished artefact, to ensure user understanding of the possibilities of the finished jetpack backpack (Rogers, Muller, 2005).

The jetpack was therefore constructed to create the illusion of being made of metal. This was achieved by using a technique of painting called dry brushing to create a worn metal look, as well as thick glue, painted to look like welding, to reinforce the idea of a metal item. These small details ensure that the overall look of the Jetpack backpack itself, helps reinforce the illusion of the real world properties of this joystick.

The internal components consist of a wireless mouse for button pressing input, as well as a Nintento Wii Remote that functions as a gyroscope, and makes it possible to receive information about how much the jetpack is tilting to a certain side.

The two rods protruding from the jetpack both have a red arcade button on the end, that the user must press simultaneously to activate the jets on the jetpack inside the game. This way both of the users hands are engaged as well as serving as a form of a dead man´s switch in regards to the rules of the virtual world. Keeping the users hands engaged while playing the game, was done to better insure that the user would use this part of her body as well, thereby trying to create a sort of full body immersion in regards to the actual interaction. By giving the user as much relevant interaction and information about the game world as possible, it was hypothesised that the user would achieve a better immersion (Jennett, 2009). In the paper "*Investigating Computer Game Immersion and the Component Real World Dissociation*" the authors argued that players would experience a higher level of immersion while playing a good game, as opposed to a bad game. A good game being loosely defined as a being able to give the user interesting and relevant feedback to the actual interaction. Therefore keeping the users entire body engaged, in a relevant fashion, would help create a more immersive experience.

When combined these inputs from the users, enables her to interact with the Jetpack game, while wearing the jetpack, by tilting themselves, back, forth or sideways, while pressing the two buttons that activates the jetpack motor in the game. This allows the users to navigate the 3D world of the Jetpack game, while maintaining their immersion in the game thought the input device in the form of the jetpack. The wireless mouse and the Wii Remote that make out the internal components here lets the jetpack send information to the computer running the game in Unity.

## 2 The Game

Choosing classic arcade games and the documentary *The King of Kong* as our main sources of inspiration , we arrived at the idea of creating a modern arcade game, based on the concept that a game should be simple to learn, yet hard to master (Halskov, 2010).

The game itself is based on the idea of putting the user into the harness of a jetpack, which then lets the user traverse a virtual 3D world, using her own body and its tilt as the main form of interaction.

**Figure 3: Shows paint detail and the fake welding.**

One of the early decisions about the game that was taken by the group, was about whether or not the user should have a avatar to represent her in the virtual world, or if the 3D screen that the project was based on, would achieve a better level of immersion if the user felt that she was inside of the game. The group decided not to include a avatar for the user after a series of concept tests, that where held early in the process, made it clear that a better immersion in the game could be achieved by letting the user feel that she was inside of the game and looking out though her own eyes. This did however mean that some of the movement precision of a normal 3D platformer was given up in an attempt to create a more immersive experience. An example of a game that mixes the idea of using both a partly hidden avatar, and not having an avatar at all, is the game Mirrors Edge, where the user has to traverse levels at a breakneck speed, while enjoying a first person perspective. Here the avatar is party hidden, and only the limbs are shown during the levels, thereby creating the illusion of the avatars limbs, being the users limbs inside the game.

The Jetpack game consists of three different levels each build on a slight variation of the overall jetpack theme. To traverse a level, the user must collect fuel for the jetpack while navigating the level and reaching the goal which is placed at the end of each level. Players are awarded a score on completing a level based on the time spend as well as the amount of fuel picked up. The fuel consumption and traversing of the game world make out part of the rules that enable the game to take place, since a game without rules could be considered pointless, or a sandbox game, where users create their own rules (Salen, Zimmerman, 2004). The rules where planed out to be relatively simple, if you run out of fuel or fall down then you die and must start over. To help users learn the rules of game, the first platform that a user can land on in the first level, is equipped with fuel, so that the user is shown the rules of the game gradually (Salen, Zimmerman, 2005).

The main difference between the three levels lies in the different difficulties presented by the individual level designs. The progression in difficulty allows for a manageable learning curve for the users.

## USER TESTING

To evaluate whether or not the design choices regarding materials and game design had been successful, a series of Opportunistic Evaluations were held to get a better understanding of how actual users interacted with the finished artefact, and if the addition of the 3D screen´s depth actually did give users a more immersive experience (Rogers, 2011). To this purpose users were both observed and later questioned about their experiences.

First the users were asked to test the finished game using the jetpack backpack, but without the aid of the screen´s 3D capabilities. They tested the three different levels of the game and had a chance to talk about what they thought about it. Afterwards users were again asked to try the game, this time using a 3D version of the game that required the user to wear passive 3D glasses. Lastly the users were interviewed about the different versions of the game to find out if the addition of the 3D depth had had an impact on their game play experience. These interviews were held to see how users reacted to the different versions of the game, and to better understand how the different versions of the game, as well as different forms of interaction, either improved or removed game immersion based on the earlier hypothesis.

The users where observed, during the test, to better evaluate their interaction and experience, while at the same time allowing us to better understand their point of view during the interview afterwards. Initially most users chose to test how the jetpack behaved as a controller by activating the jetpack in small controlled bursts. This way they could see how much fuel was consumed during flight, as well as get a feeling for how jetpack manoeuvred. The users that didn't choose to test the jetpack slowly, often ended up pressing and holding the thrust buttons compressed, resulting in the jetpack taking off and remaining airborne until they ran out of fuel.

After the initial trial run, the users chose to gently try and manurer towards the first available fuel source, and once there they repeated the procedure, thereby trying to navigate the level from one visible fuel source to the next. Some users chose to stick to this form of navigation throughout their interactions with the game, while a select few decided to experiment and try to find a more strait path towards the finish line. One user decided to try and see if he could reach the finish line without picking up any fuel at all. This user seemed to have noticed that the longer the activation buttons remained compressed, the more speed would be generated. This was due to the way the jetpack had been programmed to add force to the players avatar, without ever reaching a maximum setting. Here the user had found a different way to play the game, but not necessarily one that broke the game. The reason for this was that this new approach to the game might not have been planed from a design standpoint, but it did prove to be extremely hard to pull off for the users. After the initial user had tried the idea a few times, a few of the others wanted to give this new approach a try as well, but in the end only one of the users was able to actually reach the goal. Interestingly enough it was the same user that initially had the idea. This could mean that this user was more determined to make it work, or that this user was simply more

used to playing video games, and therefore had a better understanding of the rules and limitations of the Jetpack game.

## DISCUSSION

The users agreed that the game was more immersive when using 3D to enhance the depth experience, as well as giving the users a better understanding of how far they had to fly to reach a certain point.

Most users didn't complete all the levels but everyone agreed that the game seemed "fair" as far as their interaction and movements were concerned. One user managed to gain enough proficiency at the game, to try and complete one of the levels picking up as little fuel as possible.

During the interviews it became apparent that the users didn't focus on the Jetpack itself once they had it on, and after just a few tries most of them didn't even consider their interaction though it. They simply played the game.

## RESULTS

The addition of the 3D depth allowed the users to traverse the games levels more precisely, however they agreed that the game would also functioned without the added depth, just not let the user navigate as precisely. Therefore the addition of the added 3D depth, using the 3D cinema screen resulted in a better experience for the users, since they felt that it improved their control in the game. Likewise the interaction though the use of the jetpack, made the game experience more immersive for the users, since they felt that they where controlling the jetpack directly thought their movements.

## RELATED WORK

When working with the therm *immersion*, in regards to game design, it can be a good idea to take a closer look at Emily Brown and Paul Cairns article "*A grounded investigation of game immersion*", to get a better understanding of the definitions of *immersion* as a therm, as well as getting insight into how the users of games can experience immersion in different ways.

When designing a game where some form of input device is required then Graeme Kirkpatrick´s work in *Controller, Hand, Screen: Aesthetic Form in the Computer Game,* focuses on the user interaction though different types of controllers, and specificity how and what the design of a controller can contribute to the experience of a given game.

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# Introducing Magical Experiences in UX

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## ABSTRACT
Lately there has been an increased interest in the area of magic and its applicability in various fields. In HCI, it has been argued that the practice of magic is filled with knowledge that is applicable to user experience design.

Based on conjuring theory, a conceptual framework comprised of a distinction between internal and external magical experiences is suggested as a potential design parameter in user experience design. The framework is evaluated through an exploratory study identifying what constitutes the experiences. We find that the magical experiences have different qualities in the following constituents: control, communication, interaction, timeframe, timing and decryption interest. The purpose of the framework is to inspire user experience designers in developing designs that focus on hedonic qualities rather than pragmatic functions.

## Keywords
Magical experience, user experience design, UX, Conceptual framework

## 1. INTRODUCTION
In the past few years, the interest in what constitutes a user experience has been growing. Recent discussions within user experience (UX) and design aesthetics suggest that in addition to the pragmatic qualities of a system, the user experience encompasses the subjective experience of the system, which creates emotions like joy, pride, and excitement [13, 3, 4].

Marc Hassenzahl [4], introduces the concept of do-goals and be-goals in his discussion on how people perceive interactive designs. Do-goals refer to the pragmatic quality aspects of a product, such as the usability and utility that enables the user to do a task, and be-goals refer to the fulfillment of basic human needs, such as "being competent", "stimulated", "special" etc. This turns the focus of user experiences to the Self, and what is considered meaningful for the individual [4]. The central idea is that humans wish to achieve be-goals, and that this wish, is what drives experiences with products.

Consequently, products can have a perceived ability to support the achievement of be-goals. Hassenzahl calls this "hedonic quality" [4], and describes it as containing strong potentials for pleasurable experiences [3]. In this article, we propose magical experiences as a possible hedonic quality that can support the achievement of be-goals.

Magic is a 5000-year-old tradition that is based on evoking experiences within the spectator. This evocation of experiences, whether it pertain to "being stimulated", "entertained" or the achievement of other be-goals, makes it an interesting area of study for UX.

Furthermore, what constitutes today's magic is filled with knowledge, within e.g. psychology and cognition, which is directly applicable to addressing the user experience. This has been argued by Kuhn et al. [7], who suggests that it could be possible for the interaction designer to guide the user's attention similar to how a conjurer (magician) would when performing his trick, thus improving the interaction with a system. Still, adding magical qualities to designs is nothing new. In 1993, Bruce Tognazinni [14], an interface designer, published an article on how he uses the teachings of conjurers in his work and called out to other designers within human computer interaction (HCI) to start doing the same. In spite of this awareness, no one has provided a conceptual framework for how this might be done.

Therefore, the question is: What constitutes magical experiences and how could they be addressed in UX design?

To answer this question, we must first define what magic is comprised of.

## 2. DEFINITION OF MAGIC
The common definition of the experience of magic is that it produces "a sense of wonder in the spectator" ([7], p. 350). This wonder comes from the trick, or the effect, which is the correct professional term. This is the spectator's actual experience of magic [7].
There are many methods that can be used to produce the same effect: E.g. to make something vanish (effect), the spectator's attention may be misdirected (method), while the conjurer performs one of numerous sleights of hand (method) ([9], p. 874).
Based on the book Sleights of mind [8], which reveals the methods of several magic effects, and the underlying cognitive principles that make the effects possible, we define magic as being constructed of three layers.

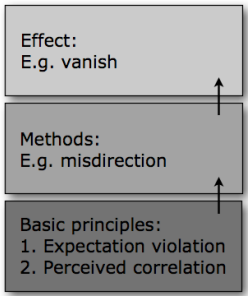


**Figure 1. The three layers magic is comprised of**

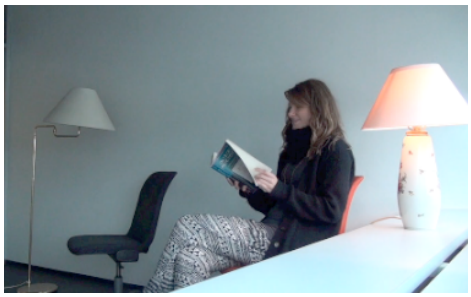

**Figure 2. The experiment setup**

All magic methods and effects are based on at least two basic principles, which produce the "sense of wonder".
(1) Expectation violation - that something happens, which violates your expectations ([8], p. 159), and (2) Perceived correlation - that two events, which have no proven connection to each other, are perceived to have a connection ([8] p. 193). This deals with cause-effect relationships, and an everyday example could be that if you touch your computer and it shuts down, you think you caused it even though you did not ([12], p. 11).

The literature published within the field of HCI takes point of departure on the levels of effects and methods. This research has either focused on how various methods and effects can be exposed using technology, e.g. gaze tracking [6], or employed in the design process [14]. Hepworth [5] has investigated on the level of basic principles and used them in design experiments. However, these were derived from a brainstorm on what constitutes a magical experience at B&O, not conjuring theory.

We believe that to develop a conceptual framework for addressing magical experiences in UX design, we must take point of departure in the basic principles of conjuring theory.

## 2.1 The conceptual framework

Based on the two principles, we propose that magical experiences can occur in two ways, thus creating two definitions:
(1) The *external* magical experience (EME), which originates in the environment, and stems from a violation of your expectations of what will/can happen, and the (2) *internal* magical experience (IME), which originates from yourself, and stems from experiencing a perceived correlation between your action and the response of the environment.

# 3. EVALUATION

To evaluate whether this framework could be used to address magical experiences through the use of technology, the framework was applied in an initial experiment. This experiment was set up to explore the interaction with the system (do-goal); afterwards the experience of magic and what/how that made the participants feel (be-goal) was discovered through an interview.
The experiment consisted of two lights, two chairs and some books.
Eight people participated, all students/teachers at the IT University of Copenhagen.

Each participant had to turn on the light in four ways: The traditional way (flipping the switch on the light), the IME (using a "magical" action), the EME (light reacts to picking up a book), and a combination of EME and IME (first light is lit by picking up a book, the participant was then told that they 'would rather sit in the other chair' and had to turn off the first light and turn on the second light with "magical" actions). In this way the experiment was similar to how a conjurer works: there are different methods (ways of interacting) that achieve the same effect (light on/off).
Using the Wizard of Oz technique [1], two different technologies were mimicked through controlling the lights with remotes from another room. The IME was tested through mimicking a gesture based interaction system [2], because gestures stem from the individual and potentially could create "perceived correlation". We did not want to limit the possible "magical" interactions, therefore the participants could make any action, they found "magical" to turn on the light.
The EME was tested through mimicking a context aware system [10], because such a system originates in the environment and potentially could create "expectation violation".

Before participating, the participants knew that the experiment was about magic and user experiences. They were asked do to the tasks, making this experiment more based on do-goals than be-goals, therefore the findings in section 4 present only an initial exploration into this field.
Next, the applicability of the framework should be tested in an explorative use-situation, because the meaning of using it will be discovered when a UX design is appropriated through use [13].

# 4. FINDINGS

Particularly control and communication arose as the constituents of the magical experience. The quality in the IME lay in the perceived control over the system (light) and the answer to the user's desire (turning on/off light), through direct interaction (e.g. pulling, snapping fingers, and Star Wars mind-trick gestures). In the EME, the quality came from the "intelligence" of the system; it's ability to understand what the user needed based on the context, and respond without the need for control or communication, making the interaction indirect.
The perceived longevity of the IME was described as potentially remaining magical a little longer than the EME, simply because of the need for an interaction. Once the expectation violation is gone, the external magical effect may have been somewhat decoded; this is why magicians never repeat a trick ([8], p. 192). The timing was also relevant: The IME needed quick feedback; the magical effect was gone if the light did not turn on at once. The timing in the EME was perceived as associated with either the book or the

**Table 1. Constituents and qualities of the magical experiences[1]**

| | Constituents of the magical experience | The participants' perceived experiences | |
|---|---|---|---|
| | | Internal Magical Experience (IME) | External Magical Experience (EME) |
| Why is it perceived as magical? | Control | Sense of control | No control needed |
| | Communication | Answer to "magical" communication | No communication needed |
| How is it perceived as magical? | Interaction (perceived as) | Intuitive gesture<br>System understands user's desire<br>(Direct Interaction) | Intuitive system<br>System understands user's need<br>(In-direct Interaction) |
| How long will it be perceived as magical? | Timeframe | Longer<br>It remains an experienced interaction | Shorter<br>You forget it/get used to it |
| | Timing | Quick feedback<br>Remains magical as long as the timing is prompt | Disjointed feedback<br>Remains magical as long as the timing does not give away method (sensors) |
| | Decryption interest | Important factor | Important factor |

chair. This disjointed feedback could potentially improve the magical experience by making it harder to figure out.
The participant's individual decryption interest in the figuring out the "magic" was an important factor in relation to UX that needs further research, attempting to decode the experience creates a risk of removing aspects of the "magic". However, even after thinking they had decoded the system, the participants still perceived the experience as having magical qualities.

All participants agreed that it was a positive experience. They used words like "cool, nice, easy", and even "right", explaining that it did not seem "artificial". These findings indicate that using magical experiences in UX contains pleasurable aspects; we therefore argue that these experiences relate to Hassenzahl's concept of hedonic qualities [3].

## 5. MAGICAL EXPERIENCES AND BE-GOALS

Based on our findings, we can conclude that it is indeed possible for designers to use the framework to address the "magical experiences" users can have when they are using technology: Mimicking already developed technologies within a context the participants were familiar with, we were able to evoke different experiences, which were perceived as magical, and identify the above-mentioned implications.
Each participant had their own experience of the experiments, which depended on the person's frame of reference, as well as what the word "magic" meant to them. This is similar to one of the most important teachings of conjuring theory: that the most interesting effects are those that are made meaningful to the spectator in that individual's current context. So if, for instance, you say you are hungry and the conjurer produces a sandwich from thin air, this is perceived as more relevant than if you were full ([11], p. 6). In other words, it is essential to consider how the user's subjective state of mind and current situation affects their receptivity towards the magical experience.
Consequently, we suggest that addressing magical experiences in designs must be done only when it is meaningful for the user.
Relating this to Hassenzahl's argument [4], we make the following two suggestions:
(1) That IME and EME will probably not be relevant when designing for do-goals only, as it is possible that the magical experience will be perceived as interference. Therefore this framework should be used in situations where the user is prepared to explore be-goals that involve expectation violation or perceived correlation. (2) That magical experiences are subjective, and therefore people do not necessarily share the same be-goals [3], hence, it is possible that magical experiences in UX will appeal to people with different be-goals.

## 6. CONCLUSION

In this article an initial conceptual framework addressing magical experiences in UX has been presented, evaluated and discussed. This framework is based on basic principles in conjuring theory as recognized by us, and proposes two definitions of how magical experiences occur: the internal and external magical experience.
These definitions, and the implications of applying them, were tested and some basic constituents of magical experiences were recognized. These were: control, communication, interaction, timeframe, timing and decryption interest. The findings concluded that the two magical experiences were perceived by the participants to have different qualities in each of these constituents.

The study proved that the sense of wonder that defines magic could be addressed and evoked in UX design, where technologies are used to apply the framework.
The purpose of this framework is to inspire UX designers in the development of designs, which focus on addressing the basic human needs that add a hedonic quality to the user experience

[1] The combination experiment has been left out of the table due to the participants only focusing on and describing the internal magical experience in the experiment.

design, and therefore goes beyond the pragmatic function. We propose that magical experiences are such a hedonic quality, because they can provide a pleasurable feeling when interacting with a design.
Our argument is not that all UX designers should use this framework and design for magical experiences; we are merely suggesting that designers pursuing the hedonic qualities of UX can use this framework as an inspiration.

## 7. FUTURE PERSPECTIVES

This study has scratched the surface of using magic in UX, but further studies are relevant:
Implementation of systems using the conceptual framework in actual use-situation, serving different functions, e.g. controlling curtains, the TV, etc. and in different contexts where the evolvement of the experiences over time can be studied, e.g. everyday context vs. contexts where it is only experienced once or twice, like in a hotel. In continuation of this, the longevity of the magical experiences and the aspect of irritation and decryption interest in various situations should be studied, as well as the socio-cultural aspect of using these systems in front of others.
Additionally, an interesting study could be the aspects concerning the inconsistency in visibility and mapping (as identified by Norman [12]), in the designs.
Finally, researching the magical interaction could be an interesting study. E.g. how essential is timing to the effect? Why are the gestures perceived as magical? Are there other modalities that could be magical?

## 8. ACKNOWLEDGMENTS

We would like to thank Thomas Pederson for introducing magic as a possible study and providing useful comments on the paper and magic in UX, and professional conjurer Jens Bjørn Andersen, for helping us understand the mind and practice of a conjurer.

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# Inspiring Coffee Breaks: exploring new ways and times to reuse old footage.

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## ABSTRACT
During the development of their projects, design researchers often gather large amounts of video material from interviews, user research, workshops and more, that usually is archived after the project is complete. In this paper we present a brief review of a two week project intended to explore the potential of re-using old research footage. It consisted of a big screen, placed in the common kitchen of the research environment, showing material from old research, sometimes associated with small activities. We will present how, based on our study, old footage can be reused creatively and how it seems to encourage students' and researchers' engagement in 3 main directions: *creativity production, immediate conversation*, and *long term reflection. We noticed that the* factors that affected these outcomes can be grouped under four main conditions: the event-ambient mode of the installation, the relevance of the content for the researchers, the ambiguity of information, and the presence of activities. T

## Categories and Subject Descriptors

## General Terms
Design, Experimentation, Theory.

## Keywords
User research, communication, inspiration, video, ethnography.

## 1. INTRODUCTION
During the development of their projects, design researchers often gather large amounts of video material from interviews, user research, workshops and more. The value of this material is widely recognized because of its richness, and various research methods have been developed to exploit its potential while making it easy to use during the design process [1] [2]. However, the drawback of this richness is represented by its bulkiness, which makes video a difficult tool to work with for very practical reasons. Video material requires time to browse and analyze, memory space on computers to store it, and its richness requires designers to make sharp prioritizations of what to use depending on the project they are working on. This will potentially leave out parts of the material that might be useful from other perspectives and under other conditions. So far, little research has focussed attention on what happens to all the hours of video footage as soon as the project ends. We assume that in most cases the footage is archived and forgotten, and the same bulkiness that made it difficult to use in the first place, makes it even more difficult to access it later on. This happens even if the video footage could have value for other research projects and could provide inspiration for further investigation. Research has been focused on the development of software that allow ease of access and browsing while in 'project-mode'. One of the few examples that addresses the issue of reusing video is the "sweeper" digital archive software system, which uses material from the repository of a particular institution and facilitates inspiration by comparing current and previous material based on tags related to common "musts" and "desirables" characteristics [4]. Tagging, however, always presumes that the tagger can appreciate any perspectives on the material that may later become of interest. In our work we wanted to explore how random selections of old research footage may facilitate its re-use. Rather than think of video browsing as a conscious activity, we wanted to draw inspiration from public art and its use of video installation to proffer a more casual and episodic experience. In the case of art, there is no deliberate search for any content, as with a search engine. The meaning of what is seen is to a large extent defined by chance [7]: the ephemeral interactions of subjects and their perspectives, spaces and content of what is screened are the elements that define the character of an art installation, making it therefore more or less meaningful. Starting from this point of view, we have developed a series of experiments that explore how seemingly randomly screened videos and activities can facilitate the re-use and re-invention of old research footage. Results encourage us to think about it as a source for reflection, creative production and discussion triggers in a research context.

## 2. COFFEE BREAKS WITH VIDEO
Before presenting our results, we will clarify the series of choices that we made regarding the location and the content of the experiments. The installation consisted on a series of videos projected on a surface or on computer screens placed in a research environment's common kitchen. The kitchen is open to staff, researchers and graduate students of departments related to Design and Business. People that use the kitchen vary both in their background and in their interests, and the openness of the space attracts also guests and members of other research groups occasionally. Patterns of use of the kitchen vary from quick in-and-outs to take a cup of coffee from the machine, via informal meetings to longer chats encouraged by the presence of a high table with stools. The large video screen was back-projected on a glass wall of the room (figure 1) and later smaller computer screens were added on top of the coffee machine and at the entrance of the kitchen. The study was shaped as a series of 11 experiments in which we "played" with the content of the videos, proposed simple activities, or arranged "video galleries" in the space of the kitchen.

**Fig. 1. The projection on the wall of the shared kitchen.**

We adopted a reflexive approach in which the results of each experiment would influence and shape the following ones. Our video material consisted of both raw footage and edited videos, mostly belonging to the department archive and developed during the past 3 years with the exception of two videos, part of ongoing projects. Contents ranged from footage of ethnographic fieldwork of demining practices in Africa, to studio workshops and presentations. We had two reasons for picking a space like the kitchen for screening old research videos. First, placing the screen in the kitchen would allow an engagement with old footage without interfering with the actual work of researchers, allowing participants to keep focused on their own projects. At the same time it would permit a casual interaction with the screen, given the transitional and dynamic character of the kitchen. Second, the kitchen represents a social, less institutional place, where different people might interact informally, exchange ideas and possibly engage in conversations. In their 2008 study Waring and Bishop [9] highlight how "water cooler moments"– places and times for breaks during the work routine - could become a place for knowledge sharing and where different perspectives are compared in relaxed interactions. In our case, the intention was to exploit informal moments, like the coffee break, to encourage people to take a look at work that has been done previously within the research group, with the hope of triggering new ways to relate with old material.

## 3. DATA COLLECTION & ANALYSIS

Data for the analysis of the experiments were collected through participant observation, semi-structured interviews and written field notes. Initial plans considered the use of a video camera which could record what would happen in the kitchen during the screening time, or video recording of the conversations by one of the authors. However, we noticed from the beginning that, given the small space of the kitchen, the latter option of a continuous presence of a researcher with the camera was disruptive. For the purpose of analysis we named each experiment to highlight the way in which participants seemed to engage with the videos. We used Schatzman's *Dimensional Analysis* [5], a method based on Grounded Theory, as a means to find explanations of *the type of "engagement" that the participants developed with the installation and its content*. By organizing and reorganizing the experiment outcomes against various categorizations, we managed to identify three dimensions that seem to roughly describe participants' engagements with the video displays: *Immediate conversation, creative production, and reflective observation*. We tried to use these dimensions as ideal outcomes of the reuse of video, which could define a withing to place the various results of the experiments. As shown in Figure 2, we positioned each experiment in this space according to the degree in which they encouraged interactions with the installation or between participants. It is important to stress that these are to be considered only abstractions, based on observations of expeiments in a short period of time. While different experiments placed closer or further from each of them, no experiment explicitly represented one of these ideas. However, we consider it interesting and fruitful to define this map, in order to make sense of what happened, based on what reusing old material could foster in participants.


**Fig. 2. The experiments are positioned to indicate which type of engagement they encourage.**

## 4. IMMEDIATE CONVERSATION

*Immediate conversation* covers the situations in which the videos provided the trigger for a conversation between the people present in the room. Many of the experiments encouraged conversations, more or less connected to the content screened at that moment. Two examples are represented by the cases that we called *Project Showcase* and *Video Tiles*. *Project Showcase* was an experiment in which the screen showed footage from a workshop organized by researchers and a graduate students working in an ongoing project on supportive technology for arthritis patients. The video showed how patients try out a the prototype of a robotic hand by performing daily activities (i.e opening a jar of jam, or handling scissors). The screening of the video encouraged lively conversations. *"I knew that [the student] was working on a project about arthritis but I hadn't seen anything about what they were doing"*, said a participant. The liveliest conversations happened when the student involved in the project was present in the kitchen. Comments and critiques on the prototype were raised always in a playful way. At the same time, the student involved explained some of the choices made during the project. The discussion for a short period changed into a playful brainstorming session where ideas or comments were expressed freely. *"It's really nice to have some feedback"* the student involved in the project stated in the end of the day, *"because there were things that I wasn't convinced about either."* *Video Tiles* screened four different videos simultaneously. The videos stemmed from very different projects produced within the previous two years. The videos were looped for continuous presentation, but had different lengths (from one to twenty minutes). This installation developed a relaxed and less involved conversation. People would silently get attracted by the screen, and the exchange of opinions were limited to brief comments on what was happening in particular clips. "*I think that in this way it is better.*" stated a participant *"When you see just one video at a time sometimes it might not be really interesting for you. In this case I can have a choice and look at what's more interesting for me".* Compared to the Project Showcase conversations, these ones seemed generally less intense and focused, since most of the participants concentrated on different bits of the screening, according to their main interest.

### 4.1 The influence of relatedness and focus

Based on our observations – and comparing them to other experiments within our study - we found that two factors seem to influence the immediacy of conversation triggered by the installation.

The first one, and somehow obvious, is how much participants can relate to a video and its content. They may recognize the theme of the project, prototypes shown, or the people in the video, or the ones who have made the recordings. Having familiarity even with a little aspect of the video fuels interest and participants are more likely to provide feedback in relation to it. This is evident in the showcase experiment, where people felt confident to comment more extensively. When the relatedness to the content is lower, the conversation is likely to be more general. In another experiment, the *Video Library*, the screening shown footage a de-mining project in Africa, with which none of the participants were very familiar. This video generated great interest and general comments, but as it wasn't possible to relate to the content, it resulted in participants spending more time on trying to "understand" the images, rather than build on it. *Focus* is the other factor that played a role. As shown in the *Video Tiles* experiment, a screen playing several videos together, especially if not related, seemd to be perceived as an "ambient" kind of screening. People's attention was fragmented leading to a more passive engagement with the material. Conversations stay on a comparative level, without going too much into detail.

# 5. CREATIVE PRODUCTION

A second ideal dimension of participants' engagement with the video material is what we called *creative production.* This covers a type of engagement that encourages participants to build on each other's work and generate novel ideas by physically producing new material in form of sketches or notes. We have to make clear that we tried, during the experiments, to deliberately provoke this attitude. A series of experiments attempted to encourage participants to develop a critical stance towards the footage. We tried to ask participants to either comment on the videos, answer specific questions, or draw on cards the aspects that they considered most important of what they were seeing.

*Video Appreciation* was an experiment screening videos of people interacting with everyday tools. We posed the question "What do you see here?" and provided empty cards which showed three sections: title, sketch, description. We asked the participants to sketch their impressions and answer the question, or to take a card for themselves and write on it whatever they considered interesting for their own project. People used the cards to write notes with varying detail, some were quite descriptive, others rather reflective. Some people, for example, noted aspects relating to the movements and techniques that people used to open/use cans of marmalade or kitchen tools. (figure 3, right image). *Prototype Gallery* showed a very short loop of two prototypes in use. Based on the idea that ambiguity can be a valuable quality in design[3] we experimented by trying and give no contextual information, making it difficult for participants to understand what the prototypes were about. In an activity we asked participants to sketch on cards imagining, "What could these objects become?". Participants reacted quite differently to this case depending on their backgrounds. For most of them, the activity appeared frustrating because of the lack of information about the time or effort required to accomplish it. Other participants, on the other hand, seemed fascinated by the videos, and imagined ways to "reuse" the prototypes for their project purposes. One of them, for example, working on an application for a game connected to a social network, volunteered *"maybe this could be reused as an easy login system"* (figure 3, left image). A member of the administration staff said: *"It's inspiring, I don't know what it is about but I've been thinking about it the whole day"*.

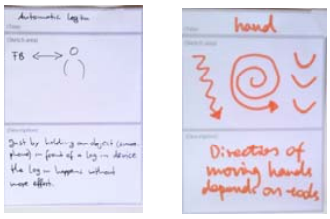


**Fig. 3. Two images from the activities proposed. On the left a creative redesign. On the right a reflection on the interactions with tools shown in a video.**

## 5.1 The influence of ambiguity and activities

Again, we noticed how the possibility to relate to the content seems to have influenced the way in which ambiguous messages were interpreted. *Ambiguity* seemed an encouragement for participants that had already had familiarity with prototyping, brainstorming, and creative work, but discouraged people who couldn't find a connection between their particular interests/knowledge and the videos. A second and more important factor, however, is that with all our experiments, creative production happened only if we explicitly asked participants to produce, and even then not always so. Participation, despite its interesting results, was really low. We respect the statement of one participant who noted *"I am just coming here to get a coffee, I have some work to do, so I'm thinking about other things"*. Performing activities was seen as a time consuming task that clashes with the idea of break. However, despite not having received satisfying results in terms of participation, these experiments seemed to generate individual reflections with several of the participants.

# 6. REFLECTIVE OBSERVATION

The third dimension of our ideal engagement map is the *reflective observation*. We noticed that reactions were different depending on the screening time and number of people present in the kitchen. We saw quite a bit of solitary engagement with the videos, characterized by silent observation and no immediate reactions neither in conversation nor production. *Instructional Video* is a case in point. The installation was composed of 3 screens placed in different parts of the kitchen. These showed for the entire day a video about the the different stages of prototype development, together with the explanation of one of the projects that is currently being developed in the research group. The video generated immediate interest especially with students, who saw many links with their own work and their field of study. *"It's interesting to see how people do things"* was one reaction. Others stated *"It's nice to see what is going on"*.

**Fig. 4. Videos were presented in different spots. The location of the screen on the coffee machine attracted more silent observation, during waiting time.**

## 6.1 Screening mode and pervasiveness

In *Public Screens and the Transformation of Public Space* [6] MaQuire et al. make a distinction between the use of public screens in "event mode", which they define as "crowd pullers", and "ambient mode", where the audience is more transient and distracted. We borrowed these two terms to distinguish an "ambient mode" (in which we left the videos run for long periods

of time, without any particular task prompt) from an "event mode" (in which 20 minutes long screenings with accompanying tasks would run in the most busy moments of the day). We found these shifts between a more diffuse and a concentrated screening mode to be influential of the way in which people engaged with material. As we noticed, if the screen was projecting for longer spans of time, conversation tended to be less intense, while the amount of "observation time" increased. In these cases, people tended to observe most of the videos while alone, in their trajectories between one desk or another, or quickly passing by to get a cup of coffee. Ambient mode facilitated the interaction with the screen on a more "individual" perspective. An event mode version, on the contrary, would consider the screening of new videos in the moments where the kitchen was likely to be used by more people in their work breaks. This allowed the creation of "shared surprise", and therefore facilitated immediate conversations and exchange of feedback and opinions.

## 7. LOW OR HIGH IMPACT?

In her reflections on public screen installations in Birmingham, Kelly Taylor [8] provokingly asks "*Can big screens be accepted as a low impact medium?"* The question is obviously related to the idea of using far bigger screens in urban environments where people tend not to stop, but to just pass by and give a quick glance to the displays. Let's take this question to reflect on our installation. In fact, even if the field of intervention is substantially different from the urban environment, where spaces and movements are much wider and unpredictable, we tend to agree that our screens can be considered low impact. In our observations, the screen seemed to subtly work towards a reflexive-provoking and inspirational goal and not be suitable for immediate outcomes or creation. A participant stressed how she found the installation provided for an "inspiring coffee break" that generated many discussions between the staff, and in general, most of the participants considered the installation interesting or inspiring, both because they would get to know each others' work, and because they would discover material that they weren't aware of. From the perspectives of the people involved in the creation of the content screened in the installation, the reactions have been very positive. Researchers saw the screen as an opportunity to gather feedback, or to ask questions and opinions of colleagues regarding their work, or what it suggested to participants.

## 8. CONCLUSIONS

In this paper we have presented a brief review of a series of video screening experiments run in a period of two weeks to explore possible ways of engaging people with old research footage. Our experiments seems to suggest that there is possibility to reuse old material, and that people tend to engage with the installation and each others in different ways. We tried to map three ideal dimensions of engagement and understand which factors affect them. Results encourage us to think that using informal moments and breaks would be a good direction to let people engage with old footage.This feeling is reinforced by the fact that activities proposed encountered really little success. However, we are aware that our considerations are to be based on a series of experiments developed in a very short span of time. This might mean that the behaviours observed might not be considered as a strong base to get to any conclusions. We also recognize that these same behaviours might have been strongly affected by the element of novelty that a screen in a common kitchen might represent, and also by the different degrees of knowledge of the participants regarding the content (i.e. Students did know very little about some videos, and might have been more enthusiastic because of this). Though this means that our material doesn't allow us to make any statement, we think that more attention on how the different factors affect the responses from participants might help us developing effective ways to let people engage with old footage. In particular, we would direct our interest towards two main directions: a first one that encourages a more social engagement with the material, in which more or less relatedness of the content to participant's interest might affects the quality of conversations and feedback provided. A second approach, encouraging a more reflective practice, on the contrary, could stimulate additional exploration on the "ambient" screening mode, where a more diffuse and silent screening might support individual practices and reflection in the background, or could be addressed to a wider audience to provide information.

## 9. ACKNOWLEDGMENTS

We would like to thank all the researchers and graduate students in the SPIRE Centre for participating in the project and and professor Jacob Buur for helpful supervision and feedback.

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# Past-Practice Challenges Trigger Today-Sustainable Ideas

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**ABSTRACT**
In this paper a new approach of creative sustainable design from the past is proposed and introduced. The approach is based on the social practice theory, Vision in Product Design methods (ViP)[1] and techniques like culture probe and interview. The paper closes with a pilot done by the author to test the approach and further discussion.

**Keywords**
Sustainable design, Social practice, past, ViP, Cultural probes

## 1. INTRODUCTION

Increasing dependent on energy import and the effect of climate change has given rise to present-day concern about energy saving. In Europe,der household account for around 25 percent of the total direct resources consumption of society.[2] Although many new efficiency energy consuming products are currently being designed and introduced, household electricity consumption in Netherlands for instance, has still increased by 24 percent in the past 20 years.[3] It shows incremental modification in current product that cannot change people's use habits, nor feasible ways of achieving the goal of energy saving, thus in the field of sustainable design, real radical innovation is required.

A way to innovate is by looking backward the past. How can we learn from our ancestors when such energy-consuming techniques not exist? How can we learn from the ways our ancestors organized daily life in the past? But we cannot simply go back or copy their approaches, thus a sensible bridge is needed to connect those insights to today's context. This thus gives rise to the following question: What methods can we use to create the right path?

The paper explore in a way that use the concept from ViP method3 and social practice method, as well as using culture probe as a tool to intervene into people's daily life in order to explore the possible creative solutions under this topic,

In order to test the approach, a pilot study was done by the author in a specific daily practice: preserving food at home. As the refrigerator is widely used by people to preserve food at home, it consumes the second-largest volume of electricity in most homes. Refrigeration and freezing are two of the most common forms of food preservation used today[4], as indicated on the other side, products also shape people's daily practice and behavior.

Using this intervention to generate concepts proved to be inspirational and useful, some interesting finding will be therefore discussed of the end of the paper.

## 2. HOW IS SUSTAINABLE DESIGN RELATE TO SOCIAL PRACTICE THEORY

Sustainability is such a broad concept that one can find many approaches or principles in design discipline that serve this goal. Such as low-impact materials application, energy efficiency design, durability design and reuse and recycle design.[5]

In social practice theory, daily life is viewed as a set of approaches of socially shared practices or routines while varieties of products are used.[6] This means that product is an aspect that designers can use to influence people. Kuijer and Jong defined three levels of innovation in this respect: Technical innovation, Use behavior innovation.[7] Designers can influence practice with new products, thus changing practices and people's resource consumption. From this point of view, give designer greater space to learn from the past.

## 3. THE REASON OF CHOOSING VIP METHOD

But how can designer assess and choose potential insights from the past practice? In ViP method, a sensible way is provided to us [1] (figure 1).

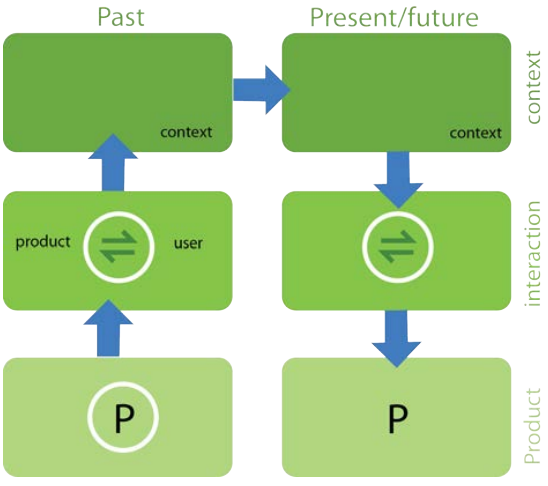


**Figure 1.Model of the ViP approach**

There are three levels of product descriptions: product as concrete form; product as a relation of people; product as a part of larger context. In order to get concrete ideas, designers "destructure" (down to up) from the past and present, and "design" (up to down) for the future. [8] With the ViP method four context factors help to organized the relationship of past and present/future, which can be defined as state; principle; development and trends. The relations between the four kinds of factors can be described as follow:

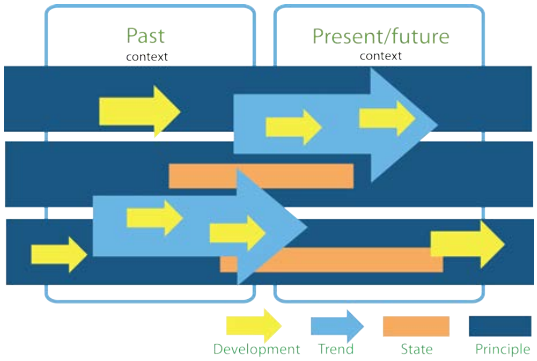


**Figure 2. The four context factors of ViP**

Principles are the underlying rules, either universal or personal but they are supposed to be unchanged over the course of the time; while states remain the same during the visible future but do not have to be stable over time. Developments concern some observable movement in the environment around, and some developments can be regarded as trends and those are usually related to people. It is true that every designer must have had been conscious while designing. But in ViP by listing those factors designers can better visualize and organize their thoughts and by choosing the factors designers can better control the results. For instance, if a designer chooses the factors that seem irrelevant, it is harder to get product out naturally but gives more chances to develop out of box ideas. The set of factors chosen by designers is the starting points for the design.

Using the method of ViP, designer can evaluate the past practices. How is the practice meet the principle, and how is it conflict with the trends? What kind of development can be track back to explain the change of practice and how is the state we can relate be the same? By considering those factors, gives designer a clue to intervene his insights into people's daily life.

## 4. CHALLENGE! USE CULTURE-PROBES TO INTERVENE IN PEOPLE'S DAILY LIFE

Culture probes is considered a helpful tool for people to reflect on their daily routine. According to our topic aims to study such daily life practice, such a familiar environment of people—it is essential to provoke inspirational responses of people thus break the dilemma that designer will easily being constrained to design from the needs that people tell them, rather than identify latent ideas. Moreover, not only needs, it is also essential to know about people's beliefs and desires, their aesthetic preferences and cultural concerns.[9]

When design of the culture probes, the insights from initial work are taken into account. For the aim of sustainable design, the culture probes must be able to encourage critical reflect of how current products and practices shape the social conditions and people's experiences[10]. It will be discussed in detail of the pilot study.

## 5. EXPLORE POSSIBLE SOLUTIONS

The approaches is using social practice theory and ViP method as a basis, and translate the insights into culture probes and further use it as a tool to intervene in people's daily life, thus trigger further insights. The approach is generally described into 3 steps:

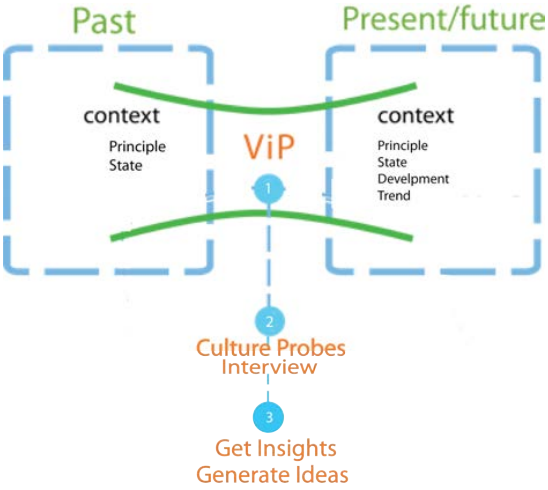


**Figure 3. Model of the approach**

### *5.1 Step one: Get insights from the past*

By identify the principles, states, developments and trends, one can find the products of the past that reveal the ways of how our ancestors deal with the same problems of today. Thus designers get an overall feeling of the past context. Then designers try to find reasonable links of the factors.

The goal of this step is to find several interesting past practices that regard to have the potential of today.

### *5.2 Step two: Intervene in people's daily life*

In this step, 4-5 people will then be chosen to use the culture probes free of charge in the way they want for a period of time. After designers have collected the culture probes, othersuch as a personal interview will be conducted for designers to get further insights.

### *5.3 Step three: Get insights and general ideas*

To get insights is to discover add-qualities with those factors. For instance, trends like people are more aware of time can be state as an add-quality like "increase time efficiency". Sometimes some trends are highly

related to high-consumption techniques and products of today that will be seemed as conflicted to sustainable practices from the past. Thus it's also useful to look at the principle and states. To see what latent/high level needs are revealed in those factors that might be cooperate or dominate for today in a more sustainable way.

After defining the add-qualities, it's then time for the designers to look back on the meaningful practice he has found. Possible solutions will be the combination of the practice with the added qualities. Using a Morphological chart to combine the Practice and qualities in a systematic way, each practice and quality does not necessarily have to have one to one correspondence. Designers then choose the most potential combinations as a starting point to general concepts and ideas.

## 5. PILOT

A pilot under the topic of preserve food at home is conducted to test the approach.

### *5.1 target group*

In this case, the culture probes as a booklet (figure 4) and was given to four participants due to the author personal network. There are two girls and two boys. Two of them from Taiwan; one of them from Columbia and one of them was from Mainland China. There are two designers, one mechanism engineer and one systematic engineer and all of them are master student now studying in TU Delft, three of them live on their own and one girl lives with her boyfriend.

### *5.2 The design of the Culture Probes*

The booklet was designed according to several guidelines conducted from previous studies as followed:

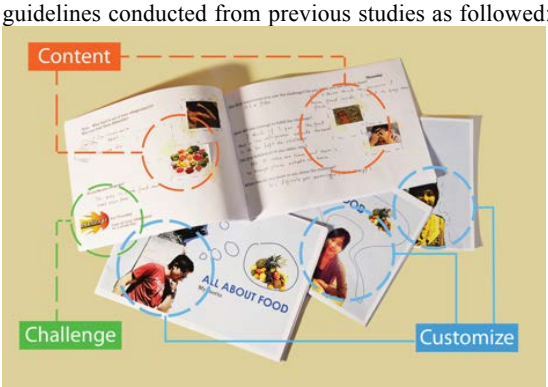


**Figure 4. Culture Probes**

***Guideline 1: Content co connect many aspects of everyday life***

People preserve food and the practice itself is related to many aspect of everyday life. The domain can be expand such as their cooking and eating behavior and those are all potential research areas. So it's important to cover more aspects rather than only focus on the food preservation. In that way it also makes the booklet more friendly and natural.

It is also worth mentioned that have some consistent topic with the booklet along time that help to reveal tiny changes of people's life.

***Guideline 2: Customized-Make it more attractive!***

In order to make the booklet more attractive, the front page was designed with each participant's photo so every participant got his/her own booklet.

By using different layouts can also makes the booklet funnier to do thus let the participant willing to play with it. Such as pictures will also contain richer information than words.

***Guideline 3: Challenge people!***

Some challenges were added to challenge people on some of the days. A little stick is pasted on the challenge that the participant has to peel off the stickers when the day comes. It's like a little "surprise". It does not matter so much if the participants cannot fulfill the challenges. The challenges aim to evoke participants'' responses, whether they can fulfill the challenge or not it will trigger them to reflect. There are two kinds of challenge in the booklet, one is to close your refrigerator for one whole day, another is prepared a three dishes meal for yourself at one time. I noticed all the participants failed at the first challenge, most importantly, they did not even think about doing it, one mentioned this challenge as a joke which gave me more thoughts about people's reliance of refrigerator today.

### *5.3 Give the booklet and arrange interview*

The participants are asked to do the booklet day by day. After that I did a few personal interviews. After all had finished, a small gift is given to each participant as appreciation.

### *5.4 Case Results*

From the previous finding, from the culture probe study and interview, developments, trends, states and principle are found and the add-qualities were defined based on them. The results was shown in the morphological as shown in figure 5:

| Past Practices | Add qualities | Resources of the qualities |
|---|---|---|
| **a. Reserve food in the winter (use environment)** | A. Reduce time pressure | Trend & State |
| **b. Put apple with potato** | B. The enjoyment of shopping | Trend &development & Principle |
| **c. Make jams** | C. Emotional evolved | Principle |

**Figure 5. The morphological chart of the pilot**

There are many combinations can be generated from the morphological chart, some combinations are really

triggered product ideas. One of the concepts is the combination of

***Past practice: a (Reserve food in the winter(use environment) ) +***

***Add Quality: B The enjoyment of shopping + C Emotional evolved***

Concept description: People like shopping experience. One reason is the display of food in the shops appears more attractive than the food storing in the refrigerator invisibly. In the past, people usually stored food outside of the house to make use of the low temperature. All of above indicated the new product idea could be using the nature environment to preserve food in winter thus reduces the energy consumption while displaying the food in a shopping shelter that gives people a shopping experience.


**Figure 6.Concept combine a&B,C**

Beside this, several combinations also find potential, such as the combination c (make jams)&A, C (emotional evolved), it has trigged the idea of simplifying the process of making jams and add joyful experience to it.

## 6. CONCLUSION

From the result we can see the approach indeed create a path to connect the past and present/future. It is also shown that because the approach considered the context of today, some ideas generate from it have the potential to replace the dominate practice today. By doing different combinations of past practices & add-qualities, it will trigger concept in a tangible way. By choosing the methods of context study and select factors, designer can also better control the process and drive to personal desirable results.

## 7. DISCUSSION

After the pilot, there are several findings relate to the approach:

Finding 1: The culture probe could be replaced to other forms of delivers, which is a more space for designers to explore.

Finding 2:The effect of the culture probes decrease when participants are more familiar with it. I get more insights from the participants who haven't done this kind of task before.

Finding 3:It is the combination of one practice with two or more add qualities that gives more potential concept. I assume this is because today's context is more complicated than the past.

Finding 4: It is hard to say by now whether the generated ideas will be accepted by the people, further test and assessment are expected to take in order to evaluate the proposal approach.

## 8. ACKNOWLEDGEMENT

I want to thank the four participants for sparing time to finish the research, my tutor Kuijer and editor from the Sider conference organization that gave me a lot of helpful insights.

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# Interaction Design Feedback and Feed Forward Framework: Making the Interaction Frogger Tangible

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## ABSTRACT

In this paper, we present a tangible version of the design framework Interaction Frogger [4]. First, all terms used in the framework are explained using examples. Then, we present how the framework can be used to analyze products, compare products and improve interaction in products using examples from a workshop. Finally, we discuss how the tangible framework can show new possibilities for (improving) design on a more concrete level.

## Keywords

Interaction Design, Feedback, Feed Forward, Tangibility, Framework

## 1. INTRODUCTION

To analyze human-product interaction, the Interaction Frogger (IF) was created by studying theory as well as design practice, "to analyze person-product interaction in terms of the couplings between the person's action and the product's function through the use of inherent and augmented information, i.e., feedback and feedforward."[4, p1] The framework itself is reduced to a theoretical application and graphical representation of human-product interaction and requires theoretical background knowledge before designers can start to use it, which adds difficulty to directly apply it to the design practice limiting its use to design research [3]. Our contribution to the Interaction Frogger is to provide a Tangible Interaction Frogger (TIF) which offers freedom of interaction to designers by making theory physical and social [1].

## 2. UNDERSTANDING THE FRAMEWORK

Analyzing interaction of human product interaction is an abstract process while the interaction itself is often non abstract. By making the IF tangible we attempt to present the information about interaction in a less abstract way.

### 2.1 Four Phases

As stated by Wensveen[4], in analyzing interaction we run through 4 states: Action, Inherent Information, Augmented Information and Functional information. The three kinds of information contain both feed forward and feedback. To understand how these four phases are related to each other we use the example of turning on a television using a remote control and the definitions by Wensveen [4: p.3-4].

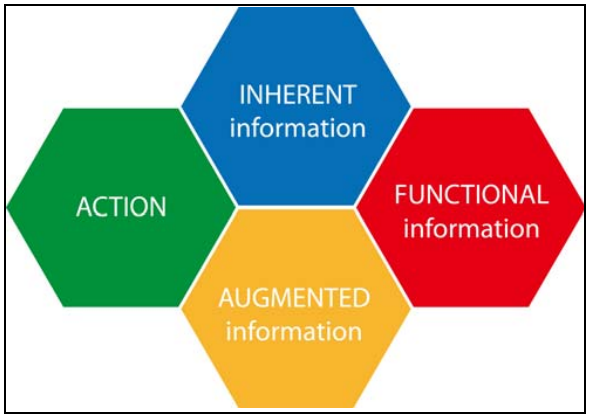


**Figure 1. Four states (Action, Inherent, Augmented, Function)**

The action in this example is pushing the button of the remote control.

*Inherent Feed Forward: The information that communicates what kind of action is possible and how the action can be carried out.*

*Inherent Feedback: The information returned from the action itself, in physical terms.*

Inherent feed forward is given by the button itself: the button looks like it can be pushed. (Instead of moved, turned, etc) While pushing the button, the button provides feedback, the user can actually feel the state of the button is changing, it is giving physical feedback to the user. (For example, while moving in front of a Kinect, the user does not get any physical feedback from the product confirming that the action is received).

*Augmented Feed Forward: The information received from an additional source about the action possibilities or the purpose of the action possibilities.*

*Augmented Feedback: The information received from an additional source once the action has been performed and not related to the action.*

**Figure 2. Remote control**

In the example the icon on the on/off button of the remote control is providing augmented feed forward, as well as the red color of the button (see figure 2); the icon and color tell the user's cognitive skills this button is probably for turning the television on and off. After pressing the button an indication LED on the television will light up, providing augmented feedback that the system received the user's action.

*Functional Feed Forward: The information about the general purpose of a product and its features.*

*Functional Feedback: The information received about the actual purpose of the action.*

The television is providing functional feed forward by the fact it has speakers and a screen that provide information about its visual and auditory functionality. After the action is performed the television gives functional feedback by showing an image on the screen and playing the corresponding sound. The user knows the function (s)he wants to achieve is accomplished.

Inherent and/or augmented information connect the action and functional information, like represented in figure 1.

## 2.2 Six Aspects

How action, inherent, augmented, functional information are coupled can be described using the six aspects of natural coupling. "There are six aspects taken from the physical world which describe characteristics of both the action and the reaction. A unification of action and reaction on each of these aspects makes the interaction intuitive" [6]. We represent them with symbols and make use of questions to describe their meaning; they will be explained by using the television and piano examples.

*Time: Does product's reaction and user action coincide in time?*

The action and the inherent information is coupled through time, the button is moving at the same moment the action is performed. However, the functional information (the television turns on) is received later on, there is a delay and thus there is not a coupling in time.

*Location: Does the reaction of the product and action of the user occur in the same location?*

The location of the action is coupled with the inherent information, the button itself is providing this information. However, it is not coupled to the functional information that comes from the television as the location is different, which is good in this example because that is why it is a remote control.

*Direction: Is the direction of the product's reaction the same as the user's action?*

The action is coupled in direction with the inherent information. While pressing the button, it moves in the same direction as the action is performed. As well, the button is spring-loaded which gives forced feedback in that direction.

*Dynamics: Are the dynamics of the reaction (position, speed, acceleration) coupled to the dynamics of the action?*

Dynamics can be explained by the example of playing a piano. The dynamics (the speed and acceleration) that is put in pressing the keys can be heard in the sound (functional information) from the piano.

*Modality: Are the sensory modalities of the product's reaction in harmony with the user's action? (Sound, light, etc) It refers to the richness of the feedback in relation to human senses.*

The action of playing a piano is coupled on modality as well: the user can hear the sound, see and feel that the keys are moving.

*Expression: Is the expression of the reaction a representation of the expression in the action?*

The expression that is put into the action performed by the user can be heard in the functional information (the melody) of the piano.

## 2.3 Representing the Six Aspects by Sliders

In the tangible model sliders represent the couplings between action, inherent information, augmented information and functional information. By using the sliders, users of the framework can grade the quality of the couplings and add meaning to it making the couplings more dynamic (See figure 3). Users of the TIF can go through the questions defined in the previous paragraph and draw the couplings.


**Figure 3. Couplings in the tangible framework**

# 3. USES OF THE FRAMEWORK

To test the TIF a workshop was set up with two interaction designers from Novo Nordisk [2], a PHD student of Syddansk Universitet and Stephan Wensveen himself. Two of the authors were facilitators while the others were present during the session. The workshop contained four activities, the first one 'understanding the framework', through a 20 minutes presentation in which the four elements, the six aspects and their possible coupling were introduced to our participants using the previously mentioned examples of a television and a melodica.

To make the participants familiar with the IF we run a sense-making activity in which two products were analyzed; a hammer

and an egg timer; in order to show the difference between mechanical and digital products. The facilitators guided them to analyze the hammer first, afterwards they were separated into two groups to analyze the timer and compared and discussed the results later on in an opened conversation.

After building understanding about the theory of the IF and how to apply it in the TIF, the participants analyzed one of the Novo Nordisk's insulin pens. During the analysis, we discovered how the participants acquired a deeper understanding of their product interaction.

The goal of the workshop was to discover if the TIF helps designers to understand the theory used to develop the Interaction Frogger and use the tangible version to analyze products.

From the results of the workshop we want to address three different directions of use for the TIF.

## 3.1 Analyze Products

Once a certain level of understanding of the framework has been reached, designers can use the TIF to analyze products, they do that by moving the sliders of those aspects that are coupled to show the connections.

In the workshop the participants were given the task to analyze a product from their own company, they draw the couplings by moving the aspect sliders of the four elements, starting from action and going through inherent and/or augmented information to functional information. They did not only show the couplings but the quality of them as well. So they discussed about the quality of interaction in their products. By doing this they discovered why certain interactions with their products are good: it was because there is coupling on many aspects between inherent and augmented information (see figure 4); the user can hardly distinguish whether the feedback is inherent or augmented which makes the feedback rich.

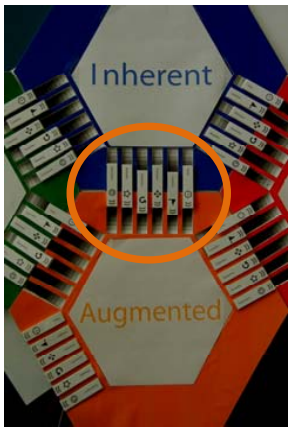


**Figure 4. Strong coupling between inherent and augmented information**

### 3.1.1 Choosing Different Paths

An important aspect of filling out the framework is as well freedom of interaction.[5] In the workshop, the participants started with the action that is performed and then go through functional information via inherent and/or augmented information. However, the TIF allows designers as well to start by defining the functional, inherent or augmented information at first and then look how it is coupled to the other aspects (see figure 5), thus helping them to change the focus of the analysis and allowing for new perspectives. When the analysis is made starting from the action the existing interaction with the product leads the path, in contrast when the analysis starts from the functional information, it leads to different insights closely related to the function of the product.

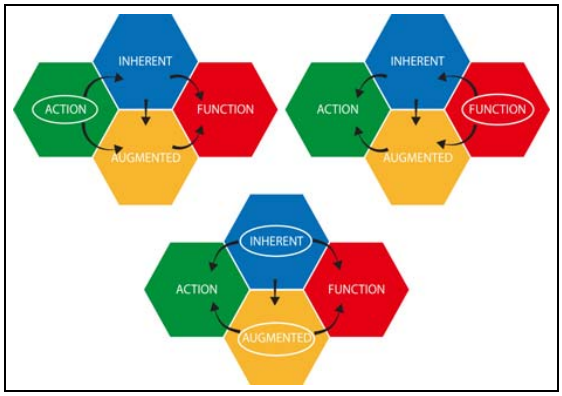


**Figure 5. Possible connections in the framework**

## 3.2 Combine Analyzes in a Tangible Way

The TIF can also be used to compare different products or the different analyses of the same product.

For example, in the workshop 2 groups analyzed an egg timer, both groups draw their own framework. While comparing both analyses, participants saw similarities as well as differences (see figure 6).

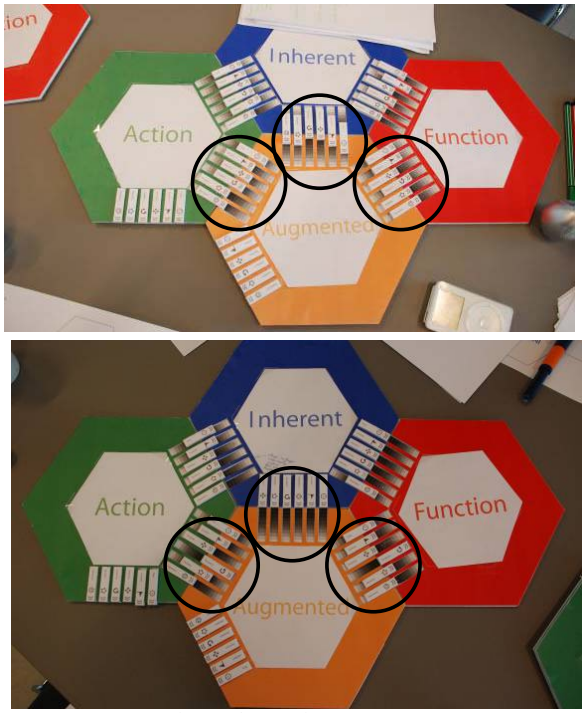


**Figure 6. Egg timer analyses**

While discussing the results the participants realized that they were not always talking about 'the same aspects'. For example, a good coupling between action and inherent information on the aspect of location could mean the inherent feedback on location is

really good or the inherent feed forward on location is really good. Ideally the slider is a representation of both, but while moving the sliders and discussing within design teams, participants realized that some of them focus more on feedback while others focus more on feed forward.

The value of comparing multiple analyses is on the one hand to get a better understanding of the terms used within the framework and on the other hand to build common ground within the design team. They can for example ask themselves questions like: What do we mean with feedback and feed forward within human-product interaction in our products, what is most important? Which of the six coupling aspects are important for the individual members and which ones are important for everyone? Do we, in providing feedback and feed forward, want to focus on inherent, augmented or functional information or a combination of those?

### 3.3 Possibilities for New Designs

Finally, the tangible framework can also be used to come up with improvements for a design or opportunities for a new design.

For example, when the participants were analyzing the egg timer, they noticed that the inherent information is not strongly coupled to the functional information, meaning that the physical state of the product does not provide the user with any information about the function, setting a time, (see figure 7).

**Figure 7. Egg timer**

Because the framework shows this missing coupling, the design team can now discuss on if they want to fill in this coupling and if so on which aspects they want to make this coupling stronger. Overall, the framework helps designers at first to take a look at their products like they did not do before, and also show them new design possibilities. It is however to the design team if they want to use this possibilities or not and judge if these possibilities are improvements for their products.

## 4. CONCLUSION

By making the Interaction Frogger tangible we noticed that designers can quickly start to use the TIF and get to understand the four elements and six aspects of natural coupling of the IF while exploring the possibilities of the Tangible Interaction Frogger. By doing this we connect design theory used in the academic world to a practical design tool that can be used by designers in as well the academic world as in the industry.[3]

## 5. FUTURE

TIF allows analyzing quality of interaction. The position of the sliders says however something about the quality of the coupling and not about the quality of design, it is an observation, not a justification. Can we modify the framework in such a way couplings can say something about the quality of design? This is of course difficult since ‘good’ and ‘bad’ design is hard to define, although the framework seems to give opportunities for that purpose as well.

Part of our future considerations regarding the development of the tangible framework address the need of the framework of being a tool that can be used to rate the quality of the interaction with a product instead of the quality of the aspects of coupling. In short, making it more concrete and therefore easier to use within companies to assess the interaction of their products.

## 6. ACKNOWLEDGMENTS

Our thanks to Stephan Wensveen for supporting us throughout this project, even while we were critical about your research. We also want to thank Miguel Bruns Alonso for his inspirational advice and Peter Urban and Christopher Monnier for their valuable input during our workshop.

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# Tangible Interaction: Arduino Watch

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## ABSTRACT

Our concept is of an interactive home where the contact with surfaces enables the user to control devices. The input device, a wristwatch with built in gyrometer and accelerometer can read movements in six degrees of freedom. By pattern recognition the movement made by by the user's hand are read as signals and sent to an Arduino board. The Arduino board then sends out commands to different devices chosen by the user. Small vibrations in the wristband give the user haptic feedback to enhance the interactions with the device.

## Keywords

Arduino Controller, Universal Controller, Interaction Gesture, Six Degrees of Freedom

## 1. INTRODUCTION

The goal of this research is to build a controller that simplifies and enriches the user's experience when interacting with electronic devices. This is done by pattern recognition within a wristwatch, interpreted by an Arduino and executed by the device chosen. By implementing this technology in an everyday token which the user always carries with him/her we hope to make interaction more natural and intuitive.

## 2. BACKGROUND

The way people interact with electronic devices has changed drastically from being almost none at all, through the industrialization and where we are today. With having technology so cheap and easy accessible a new understanding has come to grow. This understanding is based on the everyday handling of devices, causing them feels like a natural part of the environment.
Often this natural way of interaction is lost though. The devices way of taking commands can bring people to behave in the most extraordinary ways; screaming at a voice recognition device while being down town, pressing two red buttons and one yellow while aiming at a 45 degrees angle at the multi controllable TV and so on. This is something we wanted to tackle when given the chance to work with tangible interactions. We wanted a system which felt natural for the user while not being in the way and blending in with the users' natural environment as much as possible.

## 3. CONCEPT

While working on this project our concept was to make the user's everyday life more simple and fun. The goal was not to give the user another tool to keep track of, but rather to use an already frequently used tool - the wristwatch- and make it more useful as a tool for controlling devices. This decision was partly based on Ishii's and Ullmer's thoughts about seamless interaction[1] enabling the user to control input by using intuitive hand movements. It was also a part of our bigger concept, of an interactive environment that interpret the different surfaces and textures the user interact with and executes commands according to these.

## 4. REALIZATION

### 4.1 User Scenarios

Before we begun working on the actual design, a set of user scenarios were designed to show the concept of having a wireless controller to make everyday life simple and fun.

1. Sara comes home from a day at work. She points at the hallway lamp and it lights up. She turns her wrist to dim the light as it is hurting her eyes. She walks by the living room on her way to the kitchen. When passing the stereo she turns it on by directing her hand at it. Simultaneously as dropping her bag and getting the newspaper she switches radio channel by flicking her hand sideways. When tuning in to the channel with right kind of music she turns up the volume by twisting her wrist. When finally sitting down with the paper she increases the brightness by indicating her hand at the kitchen lamp and twists her wrist.
2. Peter is parking his car in a very narrow parking space. By getting out of the car when it is correctly positioned he is able to control the cars forwards movement by indicating his hand forward. When it has its final placement he locks it by turning his wrist and "withdrawing the key".
3. Markus is entering school and heading towards the elevator. He aims his finger towards the doors he wants to go. By the time he reaches the elevator, it is already there waiting with open doors to take him to the floor he wants to go.

### 4.2 Research and Design

In the beginning of the project we used a bottom-up model, brainstorming to see different aspects and limitations of the different elements we could control. A long list of projects was produced of which we discussed the ones possible to make, the affordances and haptic feedback possible.

After we decided on what kind of different digital devices we wanted to control, a user study on the natural movement patterns was performed. The device we decided to control was a lamp and a music player, therefore different movement patterns of

controlling physical lamp and music player were studied and tested.

The user study was carried out on some of the Interaction Design and Technology student at Chalmers University, answering the question: how would you prefer to control the lamp and music player if not having a physical interface? The result showed a tendency of people having different way of controlling these devices mostly due to variation in design of the devices. The movement pattern we did find in common for many users were in dimming the lamp and changing the volume of the music player. A majority of the users' preferred to dim the lamp and change the volume by holding the knob and twisting their wrist, since this movement is quite symbolic for dimming the lamp and change the volume of music player on a physical device.

Therefore the decision was made to build a device that involves the movement pattern of the user twisting his/her wrist. After some discussion, we agreed to make an Arduino wrist watch (A-watch) that could use the same movement patterns as a wireless lamp dimmer and tuning button.

The design of A-watch was motivated by the possibility of being a part of a bigger concept while still being tangible with clear affordances. A general idea about the importance of the size of the A-Watch was encouraged by the various user tests. The watch should be easy to carry in daily life since the user shouldn´t feel hindered they do not want to hindered when tuning their music and handling devices.

## 4.3 User test

When finishing the major design parts of the product we did another user test, to discover things that might have been missed out. The prototype of A-watch was handed to users and the users were asked to control the lamp and music player, firstly without given any instructions and simply letting them play around with the A-watch and the devices to be controlled. Then the users were given specific instruction how each component works and asked to perform the task again. The performance of both attempts were recorded, and afterwards the users suggestions of improvement were also collected.

The second user test gave very valuable feedback and contributed to the makings of the final prototype. Unlike what we initially thought the task of just controlling the devices turned out to be more complex and a bigger part of the interaction than we expected. Such interactions as activating the control command, haptic feedback improvement and change the sensitivity of the movement pattern showed to be more complex than expected.

## 4.4 Final prototype and functionalities

After analyzing the feedback from users, we improved the design according to the suggestions from users and the issues discovered during the user test.

The watch is able to distinguish different motions of the wrist and translate these into functions in devices. Users can start to command the lamp and the music player by pointing towards the device. This interaction is metaphor of "You will now listen to my command". What actually happens is the gyro meter inside the A-watch activates the laser pointer, and while the laser pointer hit the receiver on the lamp or the music player, user has x seconds to adjust the brightness or turn up and down the volume of the music.
When the device is starting to or is done with receiving your command, the lamp and music player tuner will blink twice to demonstrate the beginning or end of listening to your command, and the A-watch will preform a long vibration as feedback. This blink is metaphor of "Receiving your command" and the vibration is telling the user that the device "is performing your command". The mechanisms behind these feedbacks are the LDR sensor detects the laser light, and it triggers the LED light placed on the lamp the music player tuner. At the same time, the lamp dimmer or music player tuner will send a message wirelessly to your watch, tells you it is ready to receive your command. As this message received the vibrator of A-watch start to vibrate.

Now the user can twist his/her wrist to change then brightness or the volume of the device as the way they prefer to interact with the physical prototype. The A-watch measures rotation in steps of about 15 degrees each, when a new step is reached the watch vibrates shortly. After a set amount of time the device will send a end signal to the watch, the watch will use a long vibrate to tell the user it is no longer in control of the watch. User can control the device again by pointing toward to the device they would like to control.

## 4.5 Components

**The A-Watch**

**Gyro** – (Yaw) measuring rotation around the x-axis .
**Accelerometer** – (Pitch and Roll) for measuring angles of wrist movement. A tri-axis accelerometer is used to measure the roll of the wrist. This enables the user to simulate the control the device with a twist of the wrist. (Horizontal rotation, twisting)
**Transceiver** – this let the user interact via radio with different devices.

**The Controllable Lamp and the Controllable Music Tuner**

**LDR** – acting as trigger for listening command.
**Transceiver** – sending and receiving command via radio.

# 5. EVALUATION

The system we have built works well and is scalable. This is truly a universal remote that can control most electronic devices in our vicinity. As the time limit of our project only allowed us to program the recognition of four movements into the watch, a sweep to the left or right and rotation of the wrist clock or - counterclockwise . With more time we could have programmed the watch to recognize many more movements and even advanced patterns. The drawbacks of our project is the need for a receiving device connected to what you want to control and the need for the device to be in line of sight. The later problem can be fixed by creating some other way of choosing which device to control, e.g. a button on the watch or a representation of that device in another room. Then by telling the watch witch device it should control a bit more refined communication protocols could allow the watch control over the device as long as it is in range of the wireless transciver.
- **The vibration feedback.** The haptic feedback with the vibrator worked well, It was very helpful when using the watch, and

helped to understand what movements it thought you were performing. However it had a learning curve. First time users felt like the watch was vibrating all the time. The users who tested the clock more than once showed a much higher skill level in distinguish the different kind of vibration and interpret there meaning. The different settings we used for the haptic feedback, the vibrations, were only the time the vibrator was active, differing from 75 to 200 milliseconds. More elaborate settings can be created using pulses or other kinds of time multiplexed feedback.

**-The users hand would often block the visible red laser, forcing the user to bend the hand to be able to use laser.** To avoid this laser could be put higher up on the watch to give the user full reach.

# 6. RELATED WORK

Our project is far from the first one attending the field of wristwatch integrated controls. One of the most common approaches is the multi button solution, which for example Casio uses in CMD40B-1T1[1]. This model enables the user to control a broad spectrum of devices by using a combination of buttons together with infrared light. This concept has much in common with ours by trying to enrich and make the users' everyday life more effective. The means of making this happened are opposite though. Casio CMD40B-1T gives the user more control by moving the interface from the devices to a watch. Our aim is to make the interaction seamless by replacing the traditional way of interacting with a tangible user interface and instead use movement patterns which we believe will be more intuitive.

A project using an accelerometer to control an independent unit is Qbots mobile robot23[2,3]. This project evaluates the possibilities of controlling a robot arm by moving an iPhone in different directions. The arm has 5 degrees of freedom and responds to the wrist/iPhone movements directly by doing the same kind of motion. It is similar to our project in the sense of executing commands by hand movements but also in the general aspect of controlling external devices by simple and intuitive movement patterns. The major difference between the A-Watch and Qbot is that the A-watch also reads the movement patterns as digital commands like play, fast forward and so on. This gives an extra element of difficulty since the watch not only reads the movement patterns but also makes these into digital commands who are not a natural part of the body language. For example if the user wants to us the A-watch to switches song on a music player it may be translated into swiftly sweeping your hand in left or right direction. In the Qbot this would make the robot arm swiftly turning its "body", a more natural and understandable movement.

In Human Performance in Six Degree of Freedom Input Control[4], Shumin has investigates human performance in relation to various dimensions of 6 degree of freedom (DOF) interfaces, including device resistance, transfer functions, muscles groups and joints, and input display formats. From that paper we have learned (1) The physical properties of a 6 DOF input device should provide rich feedback so that the user can easily feel her control actions proprioceptively and thus learn the task quickly. (2) To the extent possible, fine small muscle groups and joints should be included in the operation of input devices. (3) The transfer function used to interface a device with the computer should be compatible with the physical device. (4) The visual representation of the user's actions should be designed to allow immediate exteroceptive feedback and the application of semi-transparency serves this purpose well. These findings from Shumin are quite helpful to our project.

# 7. DISCUSSION

**Individual movement patterns** are harder to map than we thought. Since everyone has different movement patterns naturally this makes the mapping of what is universal quite hard and if not done correctly, unreliable. Before making controls that solely depend on this kinds of input thorough research have to be made so that the system allows certain margin of error.

**Feedback** is an area which can be developed further. As the watch itself is unimodal, the only feedback is the vibrations, it is somewhat limited in its ability to convey what action it preforms. The limited feedback is a bottleneck when it comes to program movements recognized by the watch. By only recognizing a few patterns and have different feedback for each preformed action it is easier to understand how the watch works. In this way the watch remains simple and intuitive to use. The feedback now is somewhat lacking and would benefit from another channel e.g. a LED on the watch. This would allow for more function to be programmed into the watch. The technology is not the limit. The limit instead lies with the users ability and willingness to learn what the technology can do.

**The mapping between movements and actions** is a complex task to solve. Todays interaction with technology consist mostly of pressing buttons, turning knobs, and in some cases moving sliders. Turning a knob is easily translated into turning your wrist. This is helpful in cases like changing the volume or changing the intensity of a lamp because this is normally how we interact with devices off that sort . As it comes to different kinds of action to be preformed e.g. on and off, play and pause, or open and close there is no clear and intuitive way of how that move would look. Recent technologies like the touch pad has made us more physical active when it comes to interaction, and maybe as drawing patterns to preform tasks becomes more familiar. These new patterns can be used in our kind of setup.

# 8. CONCLUSION

We had to re-evaluate our feedback model. Haptic feedback is very important in interfaces which otherwise lacks the graphical way of showing user where he/she is, but all feedback is not good feedback. Without thorough thought and implementation faulty feedback is worse than no feedback since it is both misleading and adding mental friction.

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# Researching Interaction Guidelines - Mapping Playful Quality to Design Interactive Products

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**ABSTRACT**
The interactions in IT supported activities in a Generation Y work context were studied and discussed, which general design guidelines have been revealed. However, further research about practical design guidelines hasn't been performed. This study aims to serve as supplement of this part based on previous research. By applying contextual interviews of mapping interaction quality and Aesthetic Experience, some phenomena of interaction in work context has been revealed. By using sensitizing toolkits, we extract participants' latent needs and expectation of future working types. In the end, practical design guidelines for designing playful interactions in work context are drawn. Designers could benefit from the result and utilize the guidelines, prototyping new interactive products. Meanwhile, researchers could apply or modify the sensitizing toolkits or sessions in order to come up with new insights for designing different interaction qualities.

**Keywords**
Aesthetics of Interaction, Generation Y, Interaction Quality, Design Guidelines.

## 1. INTRODUCTION

From reviewing the research of Wei Liu's [7], there is a discord between the home and work context when it comes to the interaction with IT supported activities. Wei Liu developed guidelines for designing interactive products for generation Y workers and identified six interaction qualities, understanding how these qualities happened in both work and home contexts [7]. However, design guidelines are always directions that lead the concept to a higher or an abstract level. There are no practical instructions of how these guidelines are implemented in reality. Moreover, how these interaction qualities are concretized into specific product qualities is still unknown. This research paper aims to map certain interaction qualities with Aesthetic Experience, finding how the behavior in certain interaction quality can be perceived, experienced and evaluated by people. In the end, practical design guidelines for designing interactive products in different activities are concluded in terms of playful interaction quality.

## 2. BACKGROUND KNOWLEDGE

### 2.1 Generation Y Interaction

With the rapid technology development among mid-1970s to early 2000s, people born during that interval grew up in a completely different environment which older generation never experienced before. They began to contact with various electronic devices that contains abundant of human-product interaction in the early age. In these days, Generation Y started to enter the job market and they found out that the interaction in work is not as rich as they experience at home. Wei Liu stated that we could understand the friction between work and home context by identifying six interaction qualities among Generation Y workers [7].

Six qualities: Instant, Collaborative, Playful, Expressive, Responsive, and Flexible

- *Instant: The interaction is experienced as immediate, spontaneous and on the spot.*
- *Playful: The interaction is experienced as engaging, enjoyable and challenging.*
- *Collaborative: The interaction is experienced as supportive, unifying and shared.*
- *Expressive: The interaction is experienced as open, free and animated.*
- *Responsive: The interaction is experienced as alert, quick and reactive.*
- *Flexible: The interaction is experienced as adaptable, accommodating and adjustable.*

In Wei Liu's research [7], he concluded some design guidelines, which could drive the development of future office work support:

- *Any content for interacting has to be playful, expressive, and responsive.*

• *Collaborative working requires an engaging (digital) platform for gathering and exchanging information.*

• *New mobile offerings should enhance instant and context-aware communications, resulting in flexible working conditions.*

### 2.2 Principle of Pragmatist Aesthetics

According to the research [9], Philip R. Ross and Stephan A. G. Wensveen's developed a general idea of aesthetics based on Pragmatist philosophy. In terms of designing interactive products, they translate the conception into a design approach, coming up with four design principles:

• **Practical use next to intrinsic value:** Aesthetic Interaction benefit not only from its' intrinsic value, but also the practical use. Norman [8] claimed the phrase "attractive things work better" to indicate the practical use of beauty in design. Therefore, the aesthetic interaction should be valuable in itself and also has practical use in daily life.

• **Social and ethical dimensions:** Although social and ethical value vary in individuals, societies and cultures, designers always have to take these aspects into account when designing interactive products because interactive products have both aesthetic and practical functions, strongly influencing people's values ad behaviors.

• **Satisfying dynamic form:** Since interactive product is different from static product, in terms of form, color and material, the form in interactive product should be opened, dynamic and coordinate to user's behavior.

• **Involving the whole human being:** In line with Hummels, Djajadiningrat, and Overbeeke's research [3], the involvement of whole human beings means the participation of four human skills: cognitive, perceptual-motor, emotional and social skills. Since the experience of beauty is not limited to intellectual contemplation of beauty [10], we could see that the Aesthetic Experience will be experienced in different levels within human skills, rather than restricting to one specific aspect.

### 3.3 Sensitizing tool kits

Conventional user study techniques only discover people's current situation and the understanding of past experience. In terms of eliciting people's fear, dream and potential needs, these techniques are quite limited [11]. Traditional user study methods focus on the analysis of the past and present status, providing concrete design guidelines for designers after analyzing. However, research from Bodker [1], Hekker and van Dijk [4] shows that the contextual information from generative sessions accommodates tacit knowledge and latent needs. This qualitative information could serve as insights for designing products exist in the future. Therefore, sensitizing tool kits is a suitable media for discovering people's potential needs in order to design for the future scenario.

According to Liu's interview toolkit [6], we adopt and modify some components in order to meet our research goal. Different IT supported activity cards are still kept the same, since we can discuss particular activity back and fourth, referring to previous research result [6]. To map Aesthetic Experience, we create four boards stand for different principles. Each boards has scale from 0 to 7 and consist of 2 context: work and home context. (see Figure 1)

## 3. MAPPING PLAYFUL INTERACTION QUALITY WITH AESTHETIC PRINCIPLE BY APPLYING SENSITIZING TOOL KITS

### 3.1 General idea

The aim of the session is to interview participants and use the sensitizing toolkits, asking them to compare and remind the playful experience of different IT supported activities both in home and work context.

### 3.2 Tool kits

There are four boards, 8 sets of 24 IT supported activity cards, blank cards, pens and post-its (see Figure 1). Each boards stands for a particular principle of Aesthetic Experience. From the result of Wei Liu's research, we adopt all IT supported activities and take them further in this session.

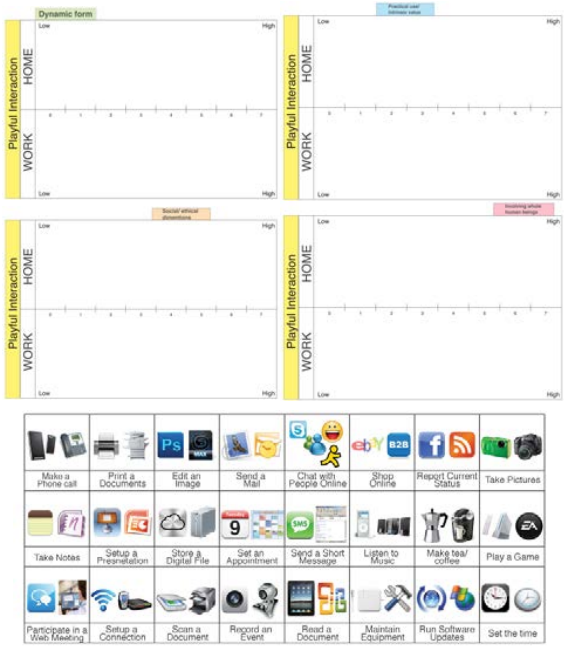


**Figure 1. The boards and activity cards**

### 3.3 Participants

In these two sessions, we choose two participants. See Figure 2. One (F.E.) was working in a design consultancy as a graphic/ web designer, having 5 years working experience. Another participant (H.W.) was working in a

design consultancy as a strategic designer, having 1 year working experience. Both participants' ages fall in the category of Generation Y and currently studying master program in Industrial Design Engineering Department in TU Delft.

**Figure 2. Two participants**

3.4 Procedure

Each session lasts 65 minutes and the sequence as follows

- Informing participants about the procedure of the session - 5 minutes
- Explain the topic and the task - 5 minutes
- Start utilizing the sensitizing toolkits - 30 minutes
- Discussion of the results - 20 minutes
- Close of the session - 5 minutes

4.5 Result

Two participants successfully completed the sessions and managed to provide experimenter the contextual information via using sensitizing toolkits. During the session, participants were active and willing to share their experience. The results are 4 sets of boards for each participant. See Figure 3 and Figure 4.

Qualitative analysis:

Since the raw data are quotes, transcripts and statements, qualitative analysis is an efficient way of refining these contextual information into meaningful level. The sensitizing toolkit serves as a mean to induce the participant's experience. During the session, experimenter and participants together made the transcript, which includes notes and statements. After the session, the interpretations were made by the experimenter who brings the data to knowledge level [2], finding patterns in order to discover target group's latent needs and tacit knowledge [5].

Participants F.E.

Participant F. E. emphasizes that various activities regarded as daily routines are associated with Playful Interaction in work context and highly valued in social aspect as well. Particularly, he mentioned that "setting up a presentation" is related to "Dynamic Form", "Social aspect" and "Practical/ Intrinsic values". However, participant FE experiences less in "Involving whole human beings" of every activities he claims that involving too much human perceptual skills will cause distraction either in home or work context.

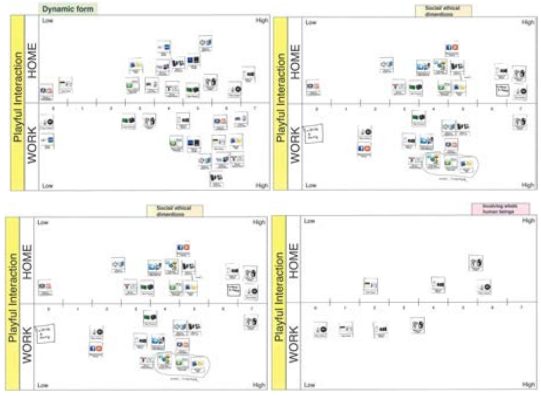


**Figure 3. Result from participant F.E.**

Participant H.W.

Participant H.W highlights the importance of functionality side in every activity, especially in communication tools. Participant appreciates the interactions that help workers increase the efficiency in working. Participant valued "Dynamic From", "Social aspect" and "Involving whole human beings" in "chatting with friends", looking forward new interaction which help the way of communicating with clients. However, The subject didn't put much emphasis on "Practical/ Intrinsic value" in work context because she considered that routine works need to be done efficiently and quickly. Sometimes these activities are provided by the company so participant regarded these activities be practical but not beneficial in intrinsic value.

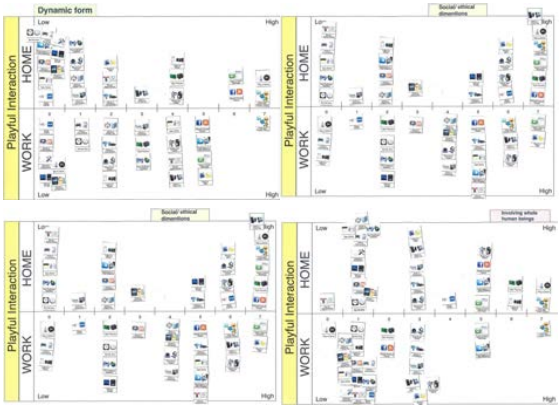


**Figure 4. Result from participant H.W.**

## 4. DISCUSSION

From the transcript and interpretation, the results indicate that "Dynamic Form" and "Social Dimension" are crucial principles of designing Playful Interaction in work context. Daily routine activities in usual work context could be redesigned as a more playful interaction that involves social

aspect and dynamic forms. For example, the communicative activities could be designed in a way that involve other workers and be "dynamic" according to users' behavior and emotions.

## 5. PRACTICAL DESIGN GUIDELINES

From the data in the contextual session, we conclude four practical design guidelines as follows:

• **The Dynamic Form in interactive products should support the communication activities in work context –** playful interaction greatly involves in "Dynamic Form" which shows the behavior of interactive products. This behavior should support users to express themselves in a more elaborated way other than text, sounds and images, especially under the condition of distant communication.

• **Interaction of social/ ethical dimension supports routine works –** the interaction in routine works should focus on the collaboration and the co-creation in the same task among workers, which increase not only the playful interaction but also the willingness of conducting routine works in the office.

• **The interaction of involving human sensor motor skills raise the playfulness in work context –** especially in the communication activities, the interaction involves various human sensor motor skills which increase the playfulness in work context. However, the mean should not be over emphasized due to the distraction of normal working flow in the office.

• **Interaction involving aesthetic value and practical use is relevant to activities for dealing with images –** for example, the interaction in "editing images", "setting up a presentation" or "taking pictures" has to be aesthetic to some extent since the results will be presented to clients or colleagues in the office.

## 6. CONCLUSION

Several literatures have been reviewed and two contextual interviews have been conducted with sensitizing tool kits. The literature reviews were focused on the Generation Y Interaction, Aesthetic Experience and Contextmapping Method. By mapping playful interaction qualities with four principles of Aesthetic Experience during the session, four design guidelines have been drawn. Though playful interaction is richer in home context rather than work context [6], the essence of playfulness still can be put into the work environment via utilizing "dynamic form" and "social aspects", which seals the interaction friction between home and work. On the other hand, involving the whole human sensor skills also raises the playfulness in various activities. However, the distraction from current tasks in work context should be avoided while applying several senses in the interactive activity. Aesthetic and practical value are crucial as well. However, these aspects raise attentions in certain activities, for example editing images.

According to the results from sensitizing sessions, two directions of future research have been notified, which could either focus on mapping different interaction qualities with four Aesthetic Principles, coming up with more practical design guidelines, or concentrate on how to prototype the interaction by using the design guidelines that presented in this paper. Both ways have the values in understanding the discord between work and home context and optimizing the working experience by introducing novel interaction.

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# Affective Prototyping – a Theoretical Proposal

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## ABSTRACT
Prototyping is an essential tool in the designer's repetoire, when it comes to making sure the concepts of your design fit the expectations and needs of your intended user. But it is a practical tool, created and used primarily to understand user experiences, explore design ideas or communicate design concepts [1]. Affect is a well-known and well-researched topic, when it comes to analyzing finalized designs and concepts, but using it in the design process, as a tool to be used as other design tools, is another matter completely. In this paper I will try to outline the possible benefits of introducing a new way of thinking about what prototyping should try and accomplish, and what it can do in specific design processes. I propose to use the prototyping method to create affective link between the user's experiences with the prototype and the final design product.

## Keywords
Affect, Interaction, Prototyping, Design Theory

## 1. INTRODUCTION
To overcome adverse reactions to your design, when presenting it, or delivering it to the intended recipients, is a difficult thing to do. It requires understanding of the user, his expectations, and knowledge of the degree to which your design lives up to these expectations. Each of these fields of understanding represents a potential problem in regards to your expected user's reactions. Having a design that does not live up to the expectations of your user's, is not in itself a problem. There are various ways of making sure the perspectives of your intended users are related and integrated into your design: by involving them, making them participate in workshops and thereby giving them a voice in the designing of the final product. In this paper I will outline the possibility for influencing user reception by creating an affective link between the user's relation to a chosen mode of interaction, and the final design product – using a theoretical method I like to call Affective Prototyping.

The scope of this paper is to explore the possibilities of including affective dimensions into a prototyping situation, on a theoretical level. In effect, this limits the paper to a theoretical review of current literature with a possible reflection on future practice with regards to the topics at hand. This is not seen as a weakness, but as a result of the basic need for strong theoretical considerations, before empirical studies can be carried out, in support.

In closing, the paper does propose some immediate steps, which if pursued, could support the argumentation of this paper strongly.

## 2. RELATED WORK
This paper focuses on the possible effects of the interaction between people and products, being more or less finalized. This position is covered and expanded upon in Forlizzi & Battarbee [2]. This paper shares that focus on the experience of that interaction, and specifically the emotional bond or link to a given product that a person can experience as part of, or result of a given interaction. In line with the content of their paper, this paper will focus on the interaction-centered models, and especially the emotional thread of experience, as presented by Wright [4].

One could argue that this paper takes another view to the term of expressive user-product interaction, as presented in Forlizzi & Battarbee [2], with the extension of the concept to include interaction where the user doesn't modify, change or personalize the product, but engages with, and creates a personal story about the product and interaction.

To expand on the concept of experience and the emotional consequences of experience in particular, this paper also draws heavily on the concept of Affect, as presented in Massumi [3]. In the article, Massumi presents the affective tonality of a situation as the basis for the resulting emotional attachment by the user to the situation and experience as a whole.

The amalgamation of both of these approaches, the experiential and affective, is put into play much earlier in the design process, as part of the prototyping phase. This is done, not to secure effectiveness of the design, or to improve the prototyping procedure as it stands, but to refocus it to another purpose – to make sure that the affective tonality, or emotional response to the design, is positive.

In effect, this is similar in focus and goal to the experience prototyping suggested and elaborated on by Buchenau & Suri [1]. That paper presents three design situations, that can been enhanced with the use of a differently focused prototyping method, and in this paper I expand upon one of these, the communication of design concepts.

## 3. AFFECTIVE INTERACTION
### 3.1 Affective Tonality
In Interactive art, affective tonality or mood is the binding power between the instances of action and reaction, which in turn constitute interaction [3]. It is the thing that gives the interaction,

with its otherwise fragmented nature, a wholeness and creates a situation, instead of a string of separate events. When interacting with an art installation, one is immersed in this wholeness, and the underlying mood colors the perception of the interaction, both positively and negatively, depending on the tonality and qualities of the interaction situation. This is similar to what can happen when interacting with other, more mundane interfaces. When presented with a novel interaction form, or a new version of a familiar product, we immerse ourselves in the interaction, and as a result, our affective relation to the interaction or product is shaped and possibly changed. This can be used in the design process, to shape the affective relation to a product, or to gauge the degree to which the current model of interaction generates an affective response. To create an affective tonality in a given situation is to make the person(s) involved react emotionally and give the situation an in-ness [3]. The division between affect and emotion, the reflectiveness, is central to this idea. The unreflected affective engagement becomes reflected emotional response in retrospect, and as described in Massumi and detailed later in this paper, it can color and reshape perceptions and experience. Instead of making the situation subject to reflection or analysis, the immediacy of it, and the immediacy of preceding and following moments is brought to the forefront and given voice. It is not the content of the situation, and as a result, it can be very hard to plan or presuppose, but as explained later, some things can be done to make a given affective tonality appear.

Affective tonality is central to creating a positive or negative reaction to the interaction, and to whether or not the agent in the interaction recalls it as pleasant or unpleasant. The tonality is a result of particular events in the situation, particular moments, and the immediate and unreflected response of the participant to those events. A good response, a feeling of accomplishment, security or power, can color or taint the following moments positively, and in effect also recolor or retaint the preceding moments similarly, whereas a bad response, a feeling of disappointment, anger or fear, can lead to a likewise negative coloring or recoloring of the preceding and following moments that make up the situation as a whole. [3] That makes eliciting the right, or wanted responses central to ensuring desired affective tonality, and emotional reaction to a given experience.

## 3.2 Models of Experience

To understand the emotional effects of prototyping we turn to Forlizzi & Battarbee [2], who present different models for experience, as encountered in interaction, focusing mainly on the interaction—centered model as presented in the paper. Since interaction with prototypes is qualitatively new, at least from the point of this paper, the interaction cannot easily be described as *fluent*. Likewise, since the focus of Affective prototyping is the emotional response to the interaction, rather than the cognitive solution to a given problem, or acquisition of knowledge, the interaction wouldn't be considered *cognitive*.

As a result, we focus on the *expressive* user-product interactions, which can form the basis for trying to prototype an affective user response to a given form of interaction, and as a result, create an emotional link between user and product.

To use their terminology, what I am suggesting the design team tries to create is not "experience" or "co-experience", but "an experience", which inspires an emotional change in the user. The main difference is in the scope of the interaction, and the resulting affective bonds, and their emotional repercussions. Specifically, we want the subjects to be able to express, with or without words, the effects of the interaction on their relation with the design. The changes in emotions in return changes the plans and intentions of the user, the organization of the procedures related to the plans and the evaluation of the outcome of the plans and procedures.

It is worth noting that changing the focus to a co-experience approach would make it possible to utilize even negative emotions to form positive shared experiences, as explained in Forlizzi & Battarbee, but for now, the focus remains on a single user, and a single interaction prototyping situation [2].

## 3.3 Prototyping Interaction

There are many reasons for involving the user in the design process. Not least of which is the possibility to test early stages of your design, before being resourcefully committed to a particular concrete design. This is not the only reason, as I have stated previously. The opportunity to make a likewise uncommitted test of a chosen form of interaction is another one, and even more so if your reasons for choosing that particular form of interaction are weighty and/or difficult to explain.

### *3.3.1 Experience Prototyping*

To use prototyping to relate design choices and communicate design concepts is a well-known and described practice [1]. While the purpose of Affective prototyping could also be described as understanding users responses to a concrete idea, or explore the possible effects of affective tonality on the overall reaction to interaction, its main focus is communicating design ideas, the third of three design activities mentioned by Buchenau & Suri. Using prototypes as means of communication is often limited to a logical or practical communication, and not geared towards changing opinion or emotional response to the content of the communication.

The point made in Buchenau & Suri is that prototyping can be used to let users form their own subjective understanding of the intended design, which I expand to include understanding of the emotional responses to the affective tonality present in the interaction with the prototype. This is done, not to better understand your design, but to make your intended users understand your thoughts and reasons for choosing that exact solution to the design. Thus, instead of being focused on simply communicating, the goal of Affective prototyping is to alter or change the attitude or emotional response to your prototype and by extension, your final design.

## 3.4 Affective Prototyping

When you have a chosen form of interaction, and would like to make sure that the interaction is well-received, one way to go about doing this is to make your users participate in an affective prototyping session. It does not differ from a normal prototyping session, in regards to methods and tools, but the object of the session is not to make a proof-of-concept, but to influence the user's relation to your chosen mode of interaction. I have mentioned the different uses of prototyping, as explained by Buchenau & Suri [1], and as previously stated, would like to present Affective Prototyping as a communicative tool, rather than a exploratory or understanding-seeking one.

### *3.4.1 Making an Affective Prototype*

It is hard to come up with a comprehensive list or description of how to go about making an affective prototype, for one very simple reason: The specifics of the setup of your prototyping session depends on your preliminary design and your users along

with any other design-specific limitations or requirements. This makes a predetermined list of things to communicate, along with the specifics of the possible affective tonality and emotional responses, nigh on impossible. Instead of trying to make a full list, I will try to outline some of the things that I think are important for an affective prototype, and the reasons for them being important.

#### *3.4.1.1 Positive Affective Tonality*

To make sure that your users feel that the interaction is pleasurable and would like to repeat it, the overall affective tonality should be geared towards positive affirmation and rewards. This seems quite logical, but as quickly noted in the coverage of models of experience by Forlizzi & Battarbee [2], there are also positive things to gain from experiencing initially negative interaction.

Repetition is the key here. Wanting to repeat the interaction, whether overtly or (as explained later) in a hidden form, adds to the user's acceptance of your overall design, including the chosen mode of interaction.

#### *3.4.1.2 Hidden Interaction*

The interaction, while central to your prototyping session, should not be overtly placed at the center of attention for the users. This could lead to reflection on the context and situation, rather than the immediacy of the interaction.

Making the interaction hidden is something that sets this form of prototyping apart from others, and one of the reasons why I would find it hard to categorize Affective Prototyping as either exploring or seeking understanding. In effect, what you are prototyping is not the design object, but the underlying, meta-layer of interaction, as envisioned by you, which is then ported onto another context completely. The exploration or understanding gathered from such prototyping could only relate to that specific situation, and as a result of the port, could not be directly used to explore or understand your actual design, other than the interaction..

#### *3.4.1.3 Gamification*

One way to make sure the interaction stays hidden, and keeps a positive affective tonality, is to use Gamification as a design guideline [3], when designing the prototype the users are going to interact with. This is to make sure that the possibilities of the users seeing the link between your prototyping context and the actual design context are as small as possible. While it is not forbidden to use similar or work-oriented contexts to prototype interactions intended for such situations, it is more likely that the users will be focused on the context, instead of the interaction. Keep in mind that the affective prototype and the final design product do not need to have anything in common, aside from the chosen form of interaction.

### *3.4.2 Considerations*

There are certain caveats when it comes to affective prototyping, primarily the necessity of the complex relationship between designer and user. The two parties involved in the prototyping process need to bring their respective knowledge and professional skills to the table, as well as an acceptance of the skills and knowledge of the other participants, and as a result, the relationship is both symmetrical and asymmetrical at the same time.

The symmetry comes from both parties bringing professional skills and knowledge of the design situation and design practice to the table, while the asymmetry comes from the differences in the present knowledge. The designer has meta-knowledge of the inner workings of the design process, that the user does not necessarily have, and the other way around – the cooperation requires acceptance and understanding of this asymmetry.

When talking about the relationship between, and relative input from, both designer and user, it is also relevant to point out that in one respect, they are very similar, and that is in their respective capacities for emotional response, and as a result of this, their ability to become affectively engaged in a given situation. This is vital in understanding the reasons for Affective Prototyping, and more weighty than respective professionalities in this regard.

Another consideration about the usefulness of Affective Prototyping is the setting in which it can effectively function. There has to be a known and limited user-group, to which the designer has a wide range of access and possibilities of involvement and communication. This more or less limits the method to be used in situations where a designer is contacted and required to solve a certain design-oriented problem – design by request.

## 4. CONCLUSION

In this paper, I have presented an idea of expanding the usefulness of experience prototyping, by changing the goal of prototyping from communication to creating "an experience" where the user gets a chance to create or change their emotional or affective bonds with the design object. This is to show that it is possible to make the user part of the group of design areas that a designer can actually design upon.

In order to bring some of these ideas to fruition, and actually support the theses put forth in this paper, I propose making a two-part study of observation and implementation.

Firstly, I would think there is a need to observe and record actual prototyping situations, and from the data collected, try to find instances of affective interaction, characterized by immersion in the interaction, or clear, emotional responses.

Secondly, I would propose considering and analyzing the data, and from there attempt to construct a model prototyping session, where the potential situations for affective interaction and emotional response are supported and brought to the fore.

From there, it would be easier to judge whether or not the affective relations are a resource to be used by the designers, in constructing design workshops, such as prototyping sessions, or not.

## 5. ACKNOWLEDGMENTS

My thanks go to Jonas Fritsch, who gave invaluable help during the writing process.

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# The ReflecTable: A digital reflective practicum

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## ABSTRACT
The ReflecTable is a novel approach to teaching design that combines a long tradition of playing games in participatory design with Donald Schön's concept of the reflective practicum. This is done by using a design game to teach students design by aiding reflection on the process of their own design projects. Based on design artefacts from a design project that the students are engaged in, the first part of the game takes them through a condensed design process. In the second part of the game, the players formulate a question about their process in the first part and use video clips from the first part to answer it. Judging from the nine experiments conducted so far, the ReflecTable could be a valuable supplement to traditional design teaching by helping students to get the most out of their design projects. Using learning-by-doing in the framework of a game, it succeeds in teaching important schönian points, e.g. the value of conversing with the materials of the design situation. Eventually, the ReflecTable will be an augmented table for supporting reflection individually and in student design teams.

## Keywords
Design education, reflective practicum, explorative design games, concept design games, research through design, interaction design

## 1. INTRODUCTION
Design is, according to Donald Schön [8], a reflective practice, where the practitioner's constant reflection-in-action is crucial to success. It is therefore best taught in practice and Schön envisions a *reflective practicum* as a way of bridging the gap between design practice and design theory. The reflective practicum is a *virtual world*, where design students can experiment with chosen aspects of real design practice. The ReflecTable powers Schön's vision up by using a design game to engage students in reflection on their own practice. The core game consists of taking groups of students through a condensed design process, recording it on video and letting the students work with the video afterwards. This supports *off-loop-reflection*, reflection on the direction of one's design practice [7], and helps the players generate insights on their own practice and get the most out of their design projects. Accordingly, the ReflecTable could be a valuable supplement to traditional design teaching and we envision the ReflecTable as a place where design students can come when they need to reflect upon and further their design process.

The ReflecTable consist of an augmented table and a design game that's played on the table. We've created a mock-up and tested the game several times, while the actual table has yet to be built.

## 2. RELATED WORK
The project builds on a long tradition of playing games in participatory design. For example Ehn & Sjögren [1] use design games to bridge the gap between designers and workers in some of the very first participatory design projects, Brandt & Messerter [3] use games to facilitate cooperation between different stakeholders – users, suppliers, designers – in design projects and Brandt [4] argues for exploratory design games as a powerful framework for organising collaboration between stakeholders. The examples demonstrate how design games can frame complex situations and make them less abstract. And by making design situations make sense for the participants, design games make participation possible. As Ehn & Sjögreen [1] notes, design is a *language game* – in Ludwig Wittgenstein's sense of the word – that changes the rules of other language games. Hence, design games are a way of opening the language game of design up for other participants – e.g. design students – by employing the familiar resemblance with ordinary games.

Another important inspiration for the game is the concept design games of Habraken et.al. [4], which has earlier been proposed as a supplement to traditional design teaching by Iversen & Buur [6]. Habraken et.al. use very abstract games as a way of pointing at important parts of design practice. The ReflecTable takes much of the abstraction out of the game play, but shares the goal of teaching the tacit dimension of practice.

A similar study of supporting design team training in the light of Schön's reflective practicum has been conducted by Iversen & Buur [7]. They, however, use video recordings from previous design projects to initiate reflections among design students.

I've previously contributed to an article [5] about the aesthetic qualities of using real artefacts as opposed to relying solely on digital representation. This is also a theme in the ReflecTable project as the ReflecTable use artefacts from the players' design projects.

The development of the ReflecTable design game is an example of research through design (see Zimmerman, Forlizzi & Evenson [9]), where the design process itself produces new insights.

Below, I will describe the design game that is the core of the ReflecTable setup.

## 3. THE REFLECTABLE DESIGN GAME

### 3.1 RULES AND ROUNDS
The players – a group of 3-4 design students – are asked to bring five things each from a design process they are currently engaged in. The things can be anything, as long as they are manageable on a table. In the experiments, however, people have brought pictures from field studies, vision statements, scenario descriptions and other design artefacts. Besides these objects, the game is played using post-its and pens (with a different colour for each player) on a writeable surface. The game is filmed using a camera mounted in the ceiling. The players are asked to push a button whenever

they feel something important or noteworthy has happened. This is marked in the video. A game facilitator takes the group through the rounds and helps the players if they get stuck.

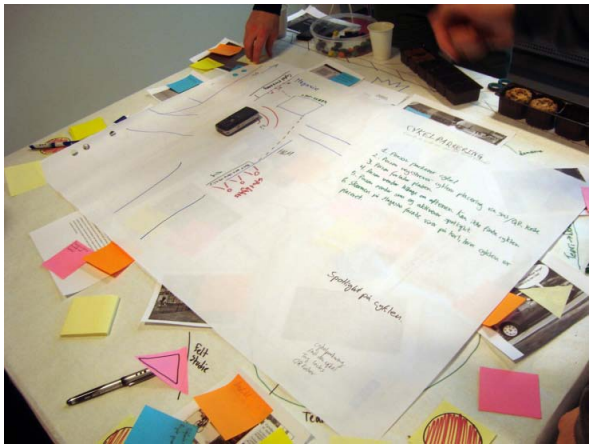

**Figure 1: Concept developed in the last round of part A. The pictures and post-its under the poster are from the first two rounds. The yellow post-it with a red circle is a button.**

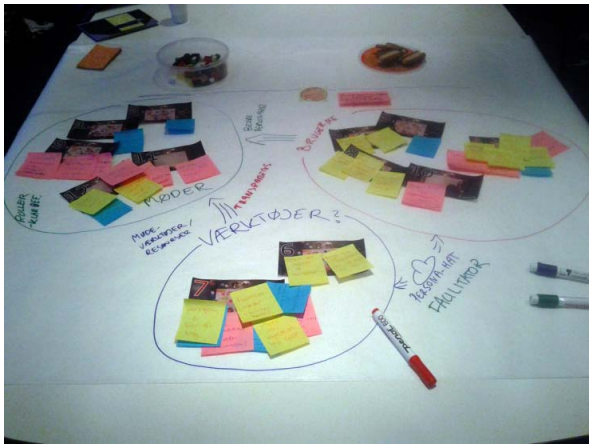


**Figure 2: Video clips, represented by still pictures, annotated, grouped and related to answer the group's question in part B of the game.**

The actual game consists of two parts. Part A consists of three rounds and takes the players through a condensed design process. In the first two rounds they explore the materials they've brought with them; in the last round they transcend their understanding of the domain by creating a new design. In part B, the players are asked to formulate and answer a question about their design process in part A. The answer is done by annotation, grouping and relating video clips from part A.

While part A is similar in the mock-up and on the actual table, part B differs quite a lot. In the final version, the players will use tablets for watching and manipulating video. I the mock-up, the players have used laptops for watching video and worked with printed still pictures from the video clips.

## 3.2 PLAYING THE GAME

We've played the game with six groups of players. The video from part A had to be manually edited for part B, which meant that the two parts of the game had to be played separately, a week or two apart. Half of the groups played both parts; the other half only played part A. After part B, we asked the groups to write post-its with what they felt the group had learned from the game, and conducted five minute individual semi-structured interviews.

**Table 1: Overview of the games**

| No. | Players | Parts played | Part A time | Button pushes | Part B time |
|---|---|---|---|---|---|
| 1 | 4 researchers | A | 1:13 h | - | - |
| 2 | 4 students | A+B | 1:36 h | 6 | 0:59 h |
| 3 | 4 students | A+B | 1:14 h | 8 | 0:56 h |
| 4 | 4 students | A | 1:04 h | 1 | - |
| 5 | 3 students | A | 0:56 h | 2 | - |
| 6 | 3 practitioners/ students | A+B | 1:30 h | 2 | 1:26 h |

The first game, played with a group of design researchers, was a very early test of the concept. The researchers were asked to bring things and ideas they found important for a design practice and help us design a ReflecTable. We didn't get much of a concept out of the game, but it confirmed that we were on to something useful.

Games 2-5 were played with groups of 1st semester interaction design students from Aarhus University. They were doing an obligatory design project and brought material from that project to part A.

The last game was played with a group with a "real life" project. One of the group members was a fulltime project leader with a background in computer science and comparative literature; the other two were interns, one from a multimedia design school, the other an interaction design student. This group was nearer the end of the project compared to the design students and used the game more as a way of evaluating their process. The game worked well in this capacity too, though the concept development in part A felt quite artificial since they were beyond that point in their project.

## 3.3 RESULTS

In evaluating the potential of the ReflecTable design game and assessing the learning gains for the participants in the games so far, we rely on our observations and the subjective responses from the players, expressed during the game and in five minute semi-structured interviews.

Even though it was never the intention, the game turned out to be a good team-building exercise. One of the players explicitly commented on the "teambuilding-effect" and all the groups who played part B reported things relating to their teamwork, e.g. "found out that our team works well under stress", "found common values". This effect is probably due to the fact that the game forced the players to make choices and prompted discussions about subjects that might otherwise have remained tacit.

In analysing the interviews, three schönian terms pop up most often: Repertoire, conversation with the material and learning by doing. On the most concrete level, the digital design students felt that playing the game expanded their design repertoire by showing them ways of conducting a workshop and generating ideas. One player put it like this:

*Facilitator: "What did you, on a personal level, gain by participating in this design game?"*

*Player (S): "I think it's clearer to me how a design process happens in practice, because we've been given a lot of theory on it, but not experienced other peoples' design process as we've seen yours now. At the same time it has obviously given us new tools and I think about things in a new way; maybe I push myself a little harder because I can see that it's beneficial for the process."*

Three of the players noted that they realised that working creatively with post-its – having a conversation with the material - in the design game produced better ideas than sitting around a table or in front of a computer. For one player, this insight helped her on a personal level, giving her more confidence as a designer:

*Facilitator: "What did you, on a personal level, gain by participating in this design game?"*

*Player (A): "Well, I guess I discovered that I'm better at thinking creatively when I'm doing something. I find a game like this, where you have post-its and some pens to draw lines, much better than just sitting and thinking about it. Sometimes I've been thinking 'am I even thinking creatively enough?' when I've been sitting by my computer to write a design proposal. And then you try something like this [game] and then you feel, that yes, you can do it."*

Lastly, four of the design students noted that the design game facilitated learning by doing and made the design theory more concrete.

It's important to note that the outcome of the game depends very much on the players. Some groups are better at working together in the way the game facilitates; some people are better at reflecting and articulating their reflections. The ReflecTable can't guarantee what the players gain from the game, but it can help the students to get the most out of their practice projects.

## 4. CONCLUSION AND FUTURE WORK

Before we began working on the ReflecTable, we knew that design is best learned in practice. We also knew that discussing video of practice supported off-loop reflection for designers, and that playing abstract design games could teach designers aspects of design. This knowledge comes together in the ReflecTable design game which takes the "sandbox" practice of the student design project, puts it into a game structure and uses video to provoke reflection on practice.

The preliminary results show that the ReflecTable design game succeeds in teaching aspects of reflective design practice to 1st semester interaction design students. It also works as a tool for strengthening the cooperation in the individual design groups. As such, we feel that the ReflecTable has some potential as a tool in design education.

The next step in the design process is prototyping ReflecTable design game on actual hardware. We imagine the final ReflecTable to be an augmented table with four buttons, a camera mounted in the ceiling and four tablet computers for watching and manipulating video (see figure 3). Additionally, we would like to make the technology accessible on low cost commodity hardware to enable a more widespread adoption in universities and schools.

## 5. ACKNOWLEDGMENTS

I'd like to thank professor Ole Sejer Iversen and the Culture Lab at Newcastle University for cooperating in designing the ReflecTable and UBST for funding the project. I'd also like to thank the people who have participated in the initial experiments with the ReflecTable.

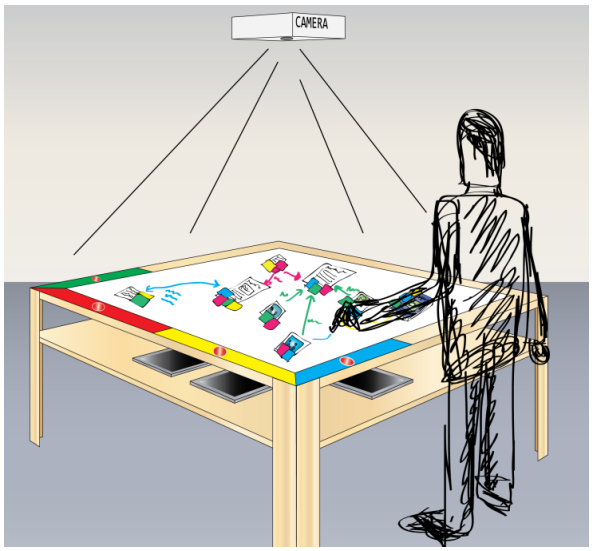


**Figure 3: A sketch of the final ReflecTable setup.**

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# Create Your Own Travel Map: Online Persuasion in Different Contexts

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## ABSTRACT
The persuasive technology is a newly risen concept applied in the area of human-human or human-computer interaction to change attitudes or behaviors of users. To date, most researches focused on improving computational technologies, falling short in considering the sociological perspective. As a complement to previous works, this paper introduces the concept of context to the domain of persuasive technology by conducting a survey (N=45) about the effect of persuasion in different contexts. The result shows that context does have influence on the persuasion and thus should be taken into account when designing the persuasive technologies.

## Keywords
Persuasion, persuasive technology, captology, context, Facebook application, Tripadvisor, travel

## 1. INTRODUCTION
During any interaction between people, persuasion plays an important role. People use the power of persuasion to make others accept their points of view in order to achieve certain objectives. For example, companies persuade customers to buy a certain product through placing an advertisement or environmental conservation institute persuade people to use shopping bags in supermarkets. Regarding interpersonal relations, the head of alumni association needs to persuade as many as alumni as possible into joining the reunion each year. As a result, a lot of persuasive strategies have been proposed, such as authority, flattery [7] or social norms [4], to enhance the effectiveness and efficiency of persuasion.

In recent years, the computing system has started influencing the domain of persuasion, in which persuasive technology is an emerging concept, first defined by Dr. B.J. Fogg as: "a computing system, device, or application intentionally designed to change a person's attitude or behavior in a predetermined way. [5]" He also introduced the term "Captology", which is the acronym for "Computer As Persuasive Technologies", to illustrate this area of study.

So far, persuasive technologies have been applied successfully in the domain of health promotion. A notable example is a product named Baby Think It Over, a computerized doll designed by a U.S. company (www.btio.com), which gives teenagers possibilities to be a caregiver of a simulated infant in order to reduce the teen pregnancy rates. Other examples are wellness interventions on online health communities or social media attempting to help the users lose weight, smoke less or reach other goals involving their health [8, 9, 11].

On the other hand, since persuasion involves people, in the academic area, it's essential to not only take technical viewpoints into account, but also bring sociological perspectives to researches. For instance, the reason why a person could be easily persuaded online might not only hinge on the online persuasive techniques, but also on the person's context, namely, the momentary surroundings of the users, including his/her impression (age, occupation, lifestyle), what s/he is doing (Is s/he busy), where s/he is, or other contextual aspects, such as how much s/he is interested in the target behavior [10]. All the reasons above could be an influence for the success of persuasion.

It's necessary to clarify that the term "context" used in this paper was based on the phenomenological position [1], which could be regarded as "the environment of the human-product interaction" [10], which considers contexts dynamic and relative to the content, including the users' social and cultural factors. As such, the meaning of the "context" here might be different from various meanings of contexts appearing in the newspaper, magazines or publications.

This paper aims at linking persuasive techniques with sociological knowledge by introducing the concept of context to the domain of persuasive technology, in which four hypotheses have been tested through an online questionnaire in order to gain insight in online persuasion in different contexts.

## 2. METHOD
The difference between this study and previous studies about persuasive technologies, which largely focused on the technical points of views, (e.g. how to improve programs persuasive techniques or how to implement online persuasive strategies), is that this study was conducted from users' perspectives.

The following four hypotheses were put forward according to personal intuition and past experience:

(i) How often people think they travel is in direct proportion to the willingness to use a digital application relating to travel.
(ii) How often people travel in reality is in direct proportion to the willingness to use a digital application relating to travel.
(iii) How many places people have been to is in direct proportion to the willingness to use a digital application relating to travel.
(iv) People now staying outside of hometown are more willing to use a digital application relating to travel.

The above four hypotheses are based on one common assumption: in different contexts, the effect of persuasion is different. In other words, the success rate of persuasion might lie in the user's context, rather than the persuasive techniques used.

The hypotheses were tested by an online questionnaire, designed to gather users' information and subjective opinions toward their past travel experience. In the end of the questionnaire, one Facebook application called Tripadvisor, was introduced to the respondents. The application allows users to create an interactive travel map to pin the countries, cities, towns, and suburbs they've visited. In addition, users can post the map on their wall, personal blog or website, or share with friends on Facebook. Meanwhile, they can also take a look at their friends' travel maps to see which of their friends has travelled the most (see Figure 1).


**Figure 1: The main interface of Tripadvisor application.**

The reasons why to choose this Facebook application as an example to support the study are as follows: First of all, Facebook is, so to speak, the most successful example of persuasive technology up to the present, with more than 800 million active users, of which 50% of them log on to Facebook in any given day [13]. Secondly, since Tripadvisor is popular on Facebook, which attracts 10000 daily active users and 220000 monthly active users [12], the participants had already been very exposed to this application through the networks on Facebook. Thirdly, this application has a clear attempt: persuade people to create their online travel map and share travel information. This leads to a boost in the possibility for users to use the service on Tripadvisor website, such as booking hotels or flights (www.tripadvisor.com). This is important because without an attempt, i.e., a planned effect, it is not persuasion but only a side effect of technology [6]

## 2.1 Participants

In total, 45 participants, who are all Facebook users, responded to the questionnaire, of which 16 are male and 29 people are female. The majority of them (42 out of 45) are at the age of 20~30.

## 2.2 Procedure

To test hypothesis (i), the respondents were asked to mark 1~7 points (disagree to agree) about their subjective opinion toward their past travel experience. The questions were "do you agree that you travel in your country very often?" and "do you agree that you travel abroad very often?"

To test hypothesis (ii), (iii) and (iv), the objective information about the respondents' past travel experience was gathered, which included "your current city and why are you there?", "how many countries (exclude your country) have you traveled to?", "how often do you travel in your current city?" and "how often do you travel abroad?". Apart from the first question, all the questions were matched with 5 items to represent different frequencies.

## 2.3 Measure

The effect of persuasion is measured by the linear dependence between four hypotheses and the willingness of the respondents to use the application. This is represented by the correlation coefficient calculated from the data gathered in the questionnaire.

# 3. FINDINGS

In Table 1, the results of the correlation coefficients(r) between different travel experience and the willingness to use the application has been calculated:

**Table 1: The correlation between different travel experiences and the willingness to use the Tripadvisor application**

| | S/he has used the Tripadvisor application in the past | S/he hasn't used the Tripadvisor application but considers to start using it |
|---|---|---|
| Agree that travel in your country very often | 0.2464 | 0.0131 |
| Agree that travel abroad very often | 0.5055 | -0.0517 |
| Frequency to travel in the current city | 0.1193 | -0.0019 |
| Frequency to travel abroad | 0.3029 | 0.2106 |
| How many countries have they been to | 0.2425 | -0.0504 |
| Current place (Outside of the country/hometown) | 0.4029 | -0.0615 |

**Hypothesis (i): How often people think they travel is in direct proportion to the willingness to use a digital application relating to travel.**

There's no significant correlation between the respondents' subjective perception of the frequency of traveling in the country and their willingness to use Tripadvisor application ($-0.3 < r=0.2464 < 0.3$). However, there's a weak positive correlation between the subjective perception of the frequency of traveling abroad and the willingness to use Tripadvisor application ($0.3 < r=0.5055 < 0.7$).

**Hypothesis (ii): How often people travel in reality is in direct proportion to the willingness to use a digital application relating to travel.**
There's no significant correlation between the frequency of traveling in current city and the willingness to use Tripadvisor application ($-0.3 < r=0.1193 < 0.3$). However, there's a weak positive correlation between the frequency of traveling abroad and the willingness to use Tripadvisor application ($0.3 < r=0.3029 < 0.7$).

**Hypothesis (iii): How many places people have been to is in direct proportion to the willingness to use a digital application relating to travel.**
There's no significant correlation between the number of countries people have been to and the willingness to use Tripadvisor application ($-0.3 < r=0.2425 < 0.3$).

**Hypothesis (iv): People now staying outside of hometown are more willing to use a digital application relating to travel.**
There is a weak positive correlation ($0.3 < r=0.4029 < 0.7$) between people stayed outside of the hometown and the willingness to use Tripadvisor application.

In addition, the numbers in the very right column in Table 1 suggests that if the respondents have never use Tripadvisor application, there's no perceivable correlation between different travel experiences and the willingness to use the application ($-0.3 < r < 0.3$).

In a nutshell, the result shows that Hypothesis (i), (ii) and (iv) are partly considered probable. Specifically, the willingness to use Tripadvisor application has something to do with the respondents' personal overseas experience. There are three main reasons why respondents are more willing to use the application. When they think they travel abroad a lot, when they actually travel abroad frequently and when they are currently staying outside of hometown. Furthermore, it's worth mentioning that the respondents' subjective perception outweighs the facts. In other words, the respondents are more willing to use the application when they think that they travel abroad frequently than when they travel abroad often in reality.

## 4. PERSUASION AND CONTEXT

Fogg's Behavior Model (See Figure 2) illustrates the reasons why a person could be persuaded into performing the target behavior, which could be divided into three categories, in which each category could be further broken into several subcomponents: (1) Sufficient motivation (pleasure/pain, hope/fear, acceptance/rejection); (2) Sufficient ability (time, money, physical effort, brain cycles, social deviance, non-routine); (3) Effective trigger (spark, facilitator, signal) [3].

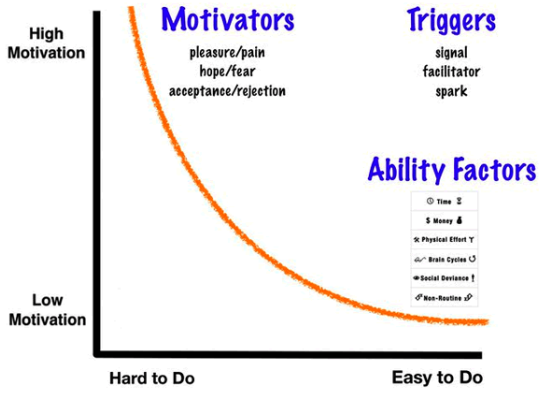


**Figure 2: The Fogg Behavior Model [2].**

In general, the model contains lots of psychological insights and could serve as a guideline for designers intending to change others' behavior. However, the concept of context is missing in this model, which leads to the ineffectiveness when applying this model in practice.

Take Tripadvisor application for example, it is likely that a prospective user has enough ability and has been sufficiently motivated and triggered, but s/he still couldn't be persuaded to use the application since s/he has limited overseas experience, which is the user's context that wasn't covered by Fogg's Behavior Model.

For Tripadvisor, in order to increase the number of users, the company should not necessarily focus on improving the function or interface of the application, but also take user's momentary surroundings into consideration, namely, the users' current location (if s/he is currently outside of hometown), if the users perceived themselves an active overseas traveler, and if the users travel abroad frequently. As mentioned before, these three factors were proved to have positive association with users' willingness to use the application.

Since context is outside of the process of persuasion and its scope ranges from the user to the place, time, social setting or culture [10], it contains a lot of uncertainties and is impossible to take every factor into account when designing. Nevertheless, it's very risky not to consider them at all. Therefore, before starting to examine what factors in the model are missing, it is advisable for designers to first learn the situations of the target group, the context, through some certain techniques, e.g. contextmapping.

## 5. CONCLUSION

The concept of context is indispensible when it comes to persuasive designs. This study shows that apart from the persuasive techniques of the product, the users' context sometimes could positively influence the effect of persuasion.

Although intuitive and understandable, the concept of context contains a wide scope and is easily neglected, especially in ostensibly technical projects. It's impractical for designers to consider all the aspects when designing, but the concept of

context should be kept in mind all the time to avoid fixation and preconception.

This study is just a beginning to introduce context to the domain of persuasive technologies. Needless to say, more future works are needed to measure the effect of persuasion in more complex context. Moreover, the research method shouldn't be limited in the traditional methods (i.e., observation, interview, questionnaire), but should apply new tools (i.e., the make tools) to acquire the explicit knowledge and users' latent needs [2].

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# Considering Context: Integrative Design of Graphical User Interfaces

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## ABSTRACT

This paper presents a method of working holistically with the design of a graphical interface by studying the physical environment and the social interaction that takes place within it. After an introduction that describes the case project and approach, a conceptual model that has been applied during the project is presented. It is shown how this framework assisted the designers throughout the project and affected the outcome. Thereafter the benefits of integrative design thinking and associated challenges are discussed. The conclusion reflects on the result of the case project, when the use of the method can be motivated and also points to changes in technology and society that may promote a more holistic approach in interface design.

## Keywords

Design, Methodology, Integrative, Holistic, Graphical User Interface, Police, Dispatch

## 1. INTRODUCTION

The total experience of a graphical user interface (GUI) is not limited to the screen - the environment and social situation in which the screen is situated is equally important. Cognitive powers are largely created by the environments in which these same powers are exercised, yet the impact of these environments is rarely studied[3]. Insights such as this, coming from social and cognitive science, should be taken into better consideration when thinking about interactive systems. Integrative or integrated design is a method used in the design of buildings that emphazises holistic thinking[10]. This paper describes a project where the designers studied interaction on multiple levels and tried to apply a system approach, similar to the thoughts behind integrative design, to a very information dense environment.

The project, ”Efficient information and resource visualization in a Police Communication Center”, was carried out in the first semester of the Interaction Design MA program at Umeå Institute of Design, Sweden, in corporation with the Umeå Police. It was completed over a five week period where the first three weeks were used for research and the last two for developing concepts.

From visits to the Command and Communication Center (Figure 1) it was evident that the work depends on collaboration between the dispatchers, to a large extent through the data system but also face-to-face, in the room. The group of which the author was a member formed out of a common interest in studying the interface (Figure 2) as one part in a cooperative environment. While the goal of this project was the redesign of the GUI, the belief was that a hard focus on the GUI would mean ignoring how dependent the efficiency of the interface is on its context.

**Figure 1. The Command and Communication Center in Umeå, Sweden**

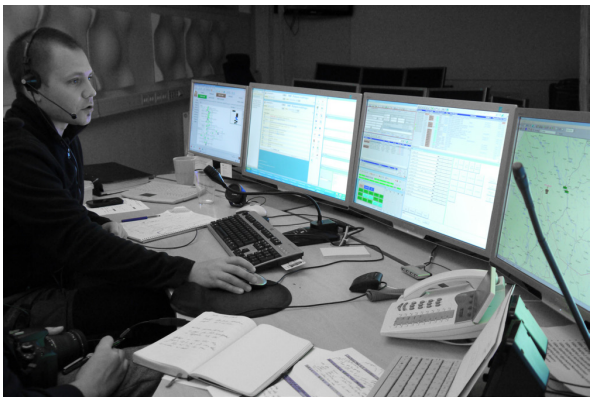

**Figure 2. Current work station and interface**

## 2. METHOD DESCRIPTION

The approach was to not see the screen as a sovereign unit but rather as one part in an information eco system encompassing people, artefacts and information. Important discussion topics throughout the project were:

- How can the room environment best support the information flow of the GUI and vice versa?
- What physical consequences does the current GUI have?
- How does the GUI affect inter-human interactions?

In order to better grasp the scope of the chosen problem area it was necessary to break it down and look at its components one by one. The representation shown in Figure 3 was created.

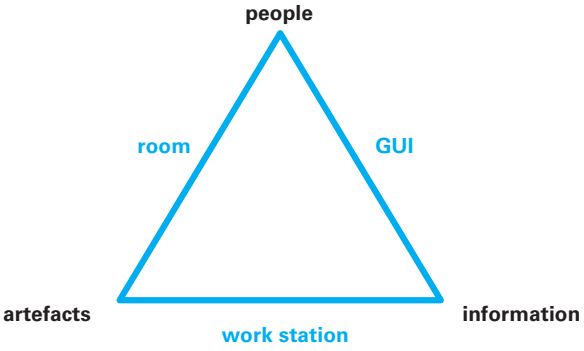


**Figure 3. Representation of the Command and Communication Center**

The corners of the triangle represent the three parts that the Command and Communication Center is made up of. As the graphical user interface has been the focus, ”People” refers primarily to the dispatchers and duty officers within the control room (leaving out the officers in the field, who are frequently communicating with the center). ”Artifacts” are all physical objects within the control room environment. ”Information” refers to all incoming, outgoing and static data that is accessible from the control room environment (including all means of accessing it, whether this is by searching a database or walking over to the wall to read a posted note).

A similar approach and conceptual model can be found in the Tilava research project[5], where the control room is divided according to spacial qualities and their combinations create room metaphors (Interactive-, Intuitive- and Boundless control room). For the purpose of rapidly prototyping a new Command and Communication Center it was however more relevant to have the three links represent distinct, ”designable” levels of the system. The three combinations of People, Artifacts and Information thus form the different levels in the information ecology - room, work station and screen interface(Figure 3). It can also be represented as a zoom in (Figure 4) that describes a process where the design of each level is dependent on the other two.

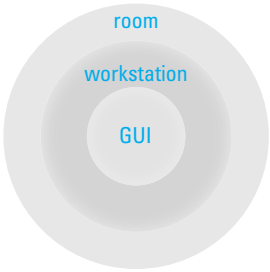


**Figure 4.**

## 3. METHOD CONSEQUENCES

Moving away from a GUI centered approach affected the design process as well as the final result.

### 3.1 Problem setting

The problems encountered in this project are dependent on multiple, interdependent factors and can be defined as wicked[6]. As every wicked problem can be considered the symptom of another problem, zooming out it essential for understanding what causes it. The designer needs use his/her peripheral vision to see the role of components in the greater whole. In this project, zooming out allowed the designers to frame problems so that they could be understood as contextually dependent instead of as belonging to a specific component or product.

When trying to solve a problem, there is a need for being specific and detail oriented or as Schön notes, technically rational[8]. Problem setting on the other hand requires a ”non-technical process of framing”. The framing process converts a problematic situation into a problem. It is not enough to just get the design right, we must above all make sure we are designing the right thing[1]. Unless context is considered and the problem framed correctly, the symptoms can by mistake be treated instead of the problem that is causing them.

Here, the framing of the problem was accomplished by creating a conceptual representation of the environment. This was used to sort the research material gathered during the visits to the center and to narrow down on problems relevant for the group to work on.

## 3.2 Problem solving

The way in which the problems were defined made for an open start of the sketch process where any combination of system parts could be considered for solving a problem. Although something at first presented itself as a room problem, it could prove to be more easily solved in the interface or the other way around.

Keeping the structure of the problem framing proved useful in order to make sure all aspects were covered in the ideation sketching. Since the focus was to create a system where the room layout, work station and user interface supported each other, all three elements needed to be visualized together during sketching. The interface was for example sketched in full scale directly onto a crude work station model.

## 3.3 Final result

An effect of the holistic process was that existing functions changed platform to better suit the needs of the dispatchers. The problem of knowing who is busy resulted in the status of the dispatchers (now a list in the GUI) being moved onto the wall projection area (Figure 5). This allows for a bigger, graphical representation that can be read from anywhere in the room, not only from behind the screens.

The informal collaboration method of the dispatchers listening in on each others calls to help others out was turned into a GUI function (Figure 6). In case an operator does not have time to assign a patrol, she can ask for help by tapping an icon.

**Figure 5. Room with groups of work stations**

Another important consequence of the work method was that it allowed the exploring of a richer spectrum of possible interaction methods. The potential of alternatives that could provide more direct manipulation of data was thereby recognized. An example is the ”Communication Puck”, a tangible interface (Figure 7). The traditional WIMP-style interface is mainly dependent on cognitive skills. The purpose of tangible interfaces is to engage the user in a richer interaction with computers that incorporates a wider range of human skills (cognitive, emotional, perceptual-motor)[2].

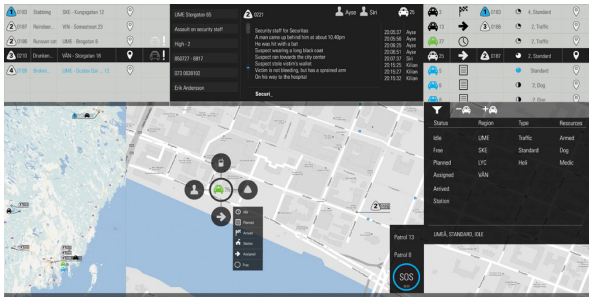

**Figure 6. Screenshot of the graphical user interface**

With the puck, physical and virtual parts belonging to the same system have been integrated. It is an extension of what happens on the screen, a physical object that ”fills” with virtual content that can then be directly manipulated.

**Figure 7. Work station with touchscreen, keyboard and puck**

# 4. CHALLENGES FOR INTEGRATIVE DESIGN

To reach more holistic solutions, the common design approach of focusing on tasks and goals may need to be replaced by one that is more directed towards context[9]. Wilkens states that ”When it comes to designing for the total experience, the activities that have little to do with the system you are designing are often just as important as those that are central to it”. This suggests a more complex task for designers and that the process needs to change and become more context and behavior oriented.

Frameworks have been developed to help designers understand total system design. One example is activity theory, which provides a framework for describing structure, development, and context of computer-supported activities. It focuses on the environment’s structure and the dynamics of interaction between internal and external components of activity[4]. However, it is argued that existing frameworks are too academic to be applicable for designers in their work[7].

Another issue is that companies most often are not set up to deliver holistic solutions. Coordination and cross-functional teams in the organization is needed. Also, designers may not be asked to participate in the early problem setting stage.

## 5. CONCLUSIONS

Focusing on context instead of immediate goals made the project different both in execution and presentation. Because of the nature of this project (school setting) the designers could to some degree set their own deliverables. In a situation with responsibilities towards clients other priorities often have to be made. However, it can be argued that considering context is the truly responsible approach in any project.

Approaching interaction design problems contextually with a GUI design to deliver in short time can at first seem intimidating, but has in this project proved to enrich the design concepts. An important insight from this project is that a tight schedule is not a restriction for working holistically. Retakes can be avoided by an initial contextual analysis.

By zooming out, the designers found solutions that considered important contexual aspects. The method can therefore be recommended in the development of similar professional/ cognitively demanding products and environments. This kind of process can be motivated in any case where structures are complex and efficiency vital.

In some time, tangible interactions and customized solutions will become more affordable and customers will demand more. In a future with more display surfaces in all our environments we are likely to place greater demands on their integration and context awareness. Seamlessness will be asked for and it is only by considering both environment and social factors that it will be possible to design borderless interfaces where both the physical and virtual assists people's interactions in the best possible way.

## 6. ACKNOWLEDGMENTS

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# Enhancement of 7th-10th Graders' Understanding of Equations with Tangible Representations

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## ABSTRACT

This project examines the possibility of heightening the understanding of math equations by means of physical objects. The target group is students in 7th-10th grade. A certain part of the students in a Danish elementary school class has problems dealing with the complexity of equations and the rules that apply in the solving of them. Therefore the equation is made "physical" so the students feel that they can grab the individual parts of the equation and manipulate them. This will also make sure, that the students achieve a closer relation to the equation. In connection with the project a product has been made to alleviate the students' giving-up attitude. To examine whether the product presents a value to the students, it was tested and evaluated in the right environment with a representative user base. From the tests and evaluations it is concluded that the physical objects are instrumental in giving students a better understanding of equations. This understanding is created through equation parts affiliation shown in color and elements from gamification. Furthermore the conclusion is built on statements from the users dealing with the value of having the equation elements in their hands, and the fact that the users in the following equation exercises on paper use the acquired methods in their calculations.

*Author Keywords*
Math, Tangible User Interface, Learning, Dyscalculia, Gamification, Sifteos.

## 1. INTRODUCTION

Over the last couple of years the PISA worldwide evaluations of students in elementary school as well as high school have shown that the level of the Danish students in natural science does not match the level of other European countries which we in Denmark usually compare ourselves with.[1] In addition to this, there is a major need in society that the youth raises their interest in the natural science professions.[2] Therefore the Danish government has a goal of increasing the academic level in the Danish elementary schools. This is a lengthy process and it is a significant challenge for the teachers to elevate the ability to learn among their students. Especially, it is difficult for the teachers to reach the weaker students when these have passed through the lower grades and now find themselves in the end of elementary school, lacking the required skills. Today, the teaching methods in the Danish elementary schools imply that several students are left behind. This can result in demotivation when they encounter problems, and some begin to take on a despondent attitude towards tasks handed to them.[3]

One of the pioneers within tangible user interfaces(TUI) is Hiroshi Ishii, professor at MIT Media Laboratory. He had the idea of representing digital information in physical form.[4] This way of working with information gives new opportunities to manipulate objects, which can be exploited within the learning process. A series of scientific studies[5, 6] conclude that some children by means of manipulation of physical objects increase their learning ability, opposed to more common methods like the use of pen and paper, regular teaching from the blackboard and working on simple graphical user interfaces.

As of today the term gamification increasingly appears in various contexts. This element has become very popular to include because it has been proved that minor rewards can affect the user's behavior. There is focus on the rewarding of the user according to the progress he or she goes through, and thereby adjusting the level of further challenges. This makes sure that the user is focused on the purpose of the exercise, and that he or she will continue until the purpose is reached.[7] In this paper gamification is used as an experimental element for motivating students and giving confidence in situations of learning math.

In this paper the three fields mentioned above - learning, TUI and gamification - will be examined. Semi-structured interviews, think aloud tests and prototyping was used in researching these three areas. The collected data was used in the process of creating a product that embraces the findings. This product was then used to test whether it was possible to alleviate some of the problems addressed above.

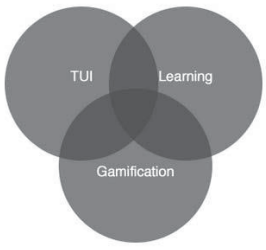


**Figure 1: Overview of involved areas of research**

## 2. RESEARCH QUESTION

*How can tangible interaction enhance 7th-10th graders' understanding of equations?*

# 3. OUR CONCEPT

## 3.1 Concept Requirements

On the basis of the empirical data, which was collected through semi-structured interviews with a math teacher and two think-aloud[8] sessions with two students, a series of requirements for the product were established. In the empirical data a psychological aspect of math was encountered. This was seen when students are stuck in an exercise. Here they have the mindset that they "cannot figure out math". If you have the feeling that you can figure out how to solve the equation, then you really can solve it. It is important to feel confident in everything you do, and in this case you should always know that no matter what you do in the equation, you will not be stuck, because you are in a safe environment where your actions are controlled. The following requirements should be fulfilled in order to meet the needs of the case class in their current situation:

- Better ability to solve and understand equations while using the product and after
- Motivating the students and heightening self confidence
- Supporting those students who have a reduced understanding of the basics in math

## 3.2 The Concept

In the higher grades of today's elementary schools there are some students who have problems in the area of understanding mathematical equations and the calculations which take place in that respect. The teachers do what they can but sometimes the students have a "giving up" attitude towards exercises containing equations. Moreover some students profit the most from doing practical exercises and physically touching the elements involved when learning. These students experience problems because they do not obtain the maximal outcome of the traditional teaching which is practiced in the Danish elementary schools.

By looking at TUI, gamification and the present teaching our concept will help the students to better understand which rules are applicable when it comes to equations. At the same time it shall motivate them to learn math while getting rid of the "giving up" attitude.

Our concept has the intention of making the equation physical and digital. The equation is presented so the students themselves can move and manipulate each link of the equation. The purpose is to have the student see the consequences of their actions and to give them the possibility to explore how equations are solved. Furthermore the students are allowed to examine the rules of the equation. By taking in gaming elements the students will start out on a low degree of difficulty and slowly move closer to their actual level and beyond. Along the way the students will take over some of the actions, e.g. sign changes, and have the ability to receive hints so they will not stall and thereby become frustrated during an exercise.

## 3.3 Product Description

The product itself consists of six Sifteo [9] cubes and an application running on a computer. The Sifteo cubes can detect when they are placed side by side, when they are tilted, and when the screen on the cube is pressed down. When starting to use this product, the student chooses the first badge on the computer and the first equation will then appear on the cubes, when they are put together in a horizontal line. Now the student's task is to move the cubes around to solve the given equation.

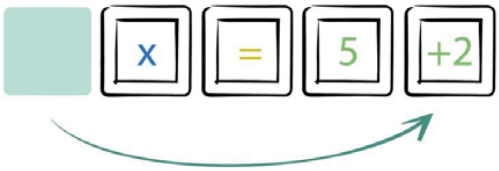


**Figure 2: Sketch of concept - solving the equation**

In the beginning the user has a lot of helping tools such as color indication which shows the affiliations among the different elements, automatic sign change and automatic calculation when elements are merged. To merge the different elements, you have to put two cubes together and then tilt one of them. The more equations solved, the harder it gets. This means that in the end the student has to do all the work. First of all, the helping colors are removed, and when moving an element past the equals sign the student now has to do a sign change by pushing down the cube's screen. Furthermore, the student has to do the calculation when merging two elements together. This calculation takes place on the computer screen where the right result is to be typed. If the typed number is correct it will show up on the cube, and the student can continue solving the equation. For every badge the student takes, the harder it gets, which should result in an easier return to the equations on paper.

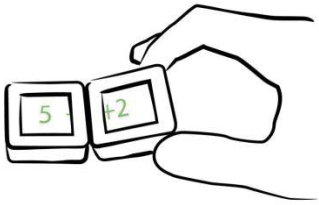


**Figure 3: Concept sketch, merging elements using tilt function**

The aspect of gamification is included in this paper as an attempt to alleviate the issue of psychological influences in the learning process. It is examined whether the students will benefit from the element of gamification when it comes to confidence and motivation. The lack of these is addressed problems in the mathematical learning process. In the coming sections they will be further discussed.

### 3.4 Motivating the students and heightening self confidence

A series of design considerations have been made when it comes to gamification. For each equation solved the student receives points. When the student has collected a certain amount of points he or she receives a badge as a reward. The badges represent the accomplishment of a level. This level can for example cover the category of addition in equations, multiplication or equations with more than one x.


**Figure 9: Achievement of the "Multi x" badge**

These elements are included to increase the motivation of watching your own progress and thereby define your goal for further personal development. These rewards are essential, but it is also important to give the students small successes, so they are rewarded every time they do something correct. This is for example implemented when two numbers are merged onto one cube, where the remaining empty cube will present praising words.

A video of the product in use can be seen by following the link in the Video Prototype section.

## 4. EVALUATION

After finishing the prototype with all the relevant features, a plan of returning to the case class took shape. An evaluation of the product should be performed in order to answer the research question. Before making an interview guide and deciding how the product should be tested, it was important to examine the best ways of testing prototypes involving children.[10]

The evaluation plan had three main goals; could the interaction form give better understanding of equations, how would the students react to the product and its features, and would the use of these cubes affect their individual learning curve over at short period of time?

The test and follow-up interviews were conducted in the students' own settings, in their school library. The school board and the class teacher at Frisholm Elementary School allowed for three of the case class students to separately come into the library. Each session with a student took approximately 40 minutes. After the three sessions an interview with the teacher was conducted. When the student entered, he or she was presented for the following tasks:

1. Solving of a number of equations with pen and paper
2. Working with equations on the Sifteo cubes
    - Including four steps:
        a. With all helping aids
        b. Without color help
        c. Neither color nor sign-change help
        d. No help (also do the calculations themselves)
3. Once again solving of equations with pen and paper
4. Short interview

The reason behind this order of tasks was to test whether the cubes helped the students in the understanding of the concept of equations. The first task gives insights on what the student's current level is, and how he or she normally deals with an equa-tion problem. In the second part the student was let through a fast scenario where he or she starts out on the simplest level of equations. Gradually the student makes him- or herself familiar with the basics and rules of equations, and in the end hopefully becomes able to solve an equation as difficult as the hardest one they tried on paper. Another part of this second step was the actual testing of the product. Here it was important not to explain too much to the student of how the product worked, so it was possible to see whether it was intuitive for them and whether they at all times knew what their next move should be. The third step was the student's return to the paper and new equations. It was here possible to see whether the student had changed his or her approach to solving the equations; does he or she think in the same way as when using the cubes, are the equations solved faster than before and is it easier for the student to recognize mistakes, move on and not be stuck. The fourth and last step was the interview where the students were asked how they experienced the product and what they thought of it. They were also asked about the different levels of the scenario and which effect they had on them. Another example of a question asked was what differences they encountered between using pen and paper and the cubes. The entire session was documented on video. This was done to make it possible to look over the events and take out some interesting points. Afterwards, an analysis of these points has been performed.

## 5. CONCLUSION

The main goal of this study was to find out whether 7th-10th graders with tangible interaction could enhance their mathematical understanding of equations. This has been examined through interviews, evaluations and testing of a tangible product. The results from the study tell that there is a significant connection between learning math and tangible representations. The product gave the students an understanding of how equations work and what rules apply in the equation space. They were able to bring the methods with them and use the cube-thinking metaphor when they encountered equations on paper after using the cubes. A great value of the cubes proved to be the exploration and inspection possibilities. This helped the students become familiar with the

equation universe on the Sifteos, because they were able to experiment with and control the environment in order to satisfy their curiosity. Ultimately this curiosity can help the students' progress faster when it comes to learning math.

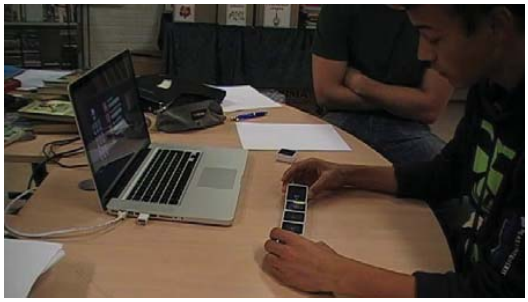

**Figure 4: Final prototype is being tested by student**

It can also be concluded, that the colors on the cubes had an effect on how the students understood the equations. The colors helped them connect the different parts of the equation, and especially for one student the colors were crucial in order to maximize the gains of the exercises. There was also an evaluation of the gamification and differentiation aspect, where you are moving from the level with colors to more advanced levels while receiving proper ongoing rewards. The result from this was that the students were motivated by the reward and it made them want to sustain their efforts. However, they were afraid that the cubes might feel more like a game than an actual learning device. It was essential to move away from the "mechanical" aspect of just using the cubes to do all the work for you.

A great focus in this study has been to examine the effects of psychology in math. What are the reasons for students getting stuck in an equation task, and how can it be prevented. One suggestion has now been presented, because the cubes give the ongoing possibility of changing the looks of the equation. If you are stuck, you can always try to move things around, and try to find a better starting point for your next move. Nevertheless this can still be difficult for some students, so the problem of getting stuck will occasionally present itself, but the value of the cubes in this area remains significant.

The final conclusion and perhaps the most relevant for the overall theme and the research question is whether there is a value of creating a "physical" equation through Tangible User Interaction. Can students benefit from picking up each link in an equation, moving and manipulating them? According to the research presented about children's learning combined with the testing done in this project, they can. The test students felt almost like they were "inside" the equation when they used the cubes and thereby it was easier for them to know what to do. At the same time being active in doing the exercises, and using their hands, made them feel like they could easier accomplish.

Finally, in the answering of the research question of how tangible user interaction can enhance the understanding of equations among 7th-10th graders, it can be concluded that one way of doing it is by giving the students a possibility of experimenting with the equation and make sure that the concept fits different ability levels. This should be combined with acknowledgements of student achievements, giving them confidence for further learning and making sure that they will not be stuck. Moreover it is essential to make a design that does not prevent the children from doing the math and thereby make sure not to automatize all the processes. Furthermore it is also beneficial to use physical elements, so the students come closer to and become more familiar with the equation.

# 6. VIDEO PROTOTYPE

## 6.1 Video of final product in use:

http://www.youtube.com/watch?v=2A0-xj-3fNA&feature=youtu.be

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# Choosing a personality for your car

## Directions for how deep smartphone integration enables new experiences in and away from your car.

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## 1. ABSTRACT

The immense success of smartphones and increasing sales numbers has created new ecosystems and opportunities, with regards to user experience, software development, communication and social encounters. In this paper we present an excerpt of the results from a project focusing on integration between smartphones and cars, with regard to new user experiences and design opportunities made possible by this coupling. We describe an academic experiment on cars as agents with personalities, present our results and discuss how the design space widens because of the shift in technological presence in our everyday lives.

## 2. INTRODUCTION

The results in this paper comes from a project, taking place in the autumn of 2011. The project focused on the integration of smartphones in electric cars and was conducted in collaboration with ECOmove, a Danish company in the process of building an electric car, the QBeak [1]. The QBeak concept differs from most other electric cars in several ways, but most notably in this context is the use of a smartphone as the instrumentation. QBeak has no conventional dashboard with knobs and displays spread out in front of the driver, instead all controls and information are placed inside the steering wheel in a non rotating panel in which the driver's smartphone is docked. Operation of the controls is laid out on a number of physical buttons on the panel as well as on virtual controls on the smartphone. All primary information presented to the driver, e.g. speed and battery level, is also placed on the smartphone. Furthermore the smartphone works as remote control and ignition key for the car. This effectively makes the smartphone a part of the car, which induces new relations between personal devices, in this case a smartphone, and cars.

The project covered several aspects of the smartphone integration, but the part we will be covering in this paper are the new possibilities in terms of user experience enabled by the strong relation between car and smartphone. In particular we focus on a certain possible way of utilizing this relation, namely by letting the car act as an agent with a personality in order to offer the driver new value with respect to user experience, convenience and sense of ownership.

In the following section we take a look at some of the related work and literature, followed by a section on the design space covering this topic. In section 5 we present an experiment and its results, which we use in section 6 to discuss the new design space.

## 3. RELATED WORK

The design of user experience is a wide and growing research subject and includes areas and backgrounds such as Computer Science, Industrial Design, Psychology, Ethnography and others. User experience can be directed towards many different kinds of experience, whether it be cuteness [8], efficiency as in classical HCI or aesthetics [9, 11].

In this paper we focus on the extension of the design space, made possible by recent advances in personal mobile technology and build upon research areas such as social computing [6], pervasive computing [10] and aesthetic interaction [9, 7] among others. By combining pervasive technologies with elements of social computing we hope to extend the user experience with social and aesthetic elements.

The prototyping of experiences requires a certain mindset and an understanding of the user in context [2]. Combining this with a technique inspired by [3] we use the concept of extreme characters, or personalities as it is in our context, and build upon that in the prototyping and experimentation process in order to design new experiences and map new areas of the design space. Other techniques relate to this challenge as well, such as [5].

Our experiment imitating an intelligent digital agent, relates to the broad field of artificial intelligence and agents. Yorke-Smith et. al. [12] present a framework for the design

| Experience Design Means | | | | | | |
|---|---|---|---|---|---|---|
| **Means** | Visual | Auditive | Aromatic | Tactile | Kinesthetic | Communicative |
| **Automotive Design** | Shape, Color, Size | Engine sound, Auditive feedback, Wind noise | Interior odor, Exhaust fumes | Material quality, Vibrations, Button feel | Steering response, Acceleration/ Deceleration forces | Driver support, Coaching, PA-functionality |

**Table 1: Design Space Toolbox**

of an agent resembling the one imitated by our experiment. Besides the technical difficulties in creating a well functioning agent, more work needs to be done in the area of user modeling and sensing [12].

# 4. DESIGN SPACE

Designers have gone far and wide to achieve the desired experience for the users, whether it be the right smell of the leather in the cabin, the sound of the engine or the handling in corners. As we introduce a new way of communicating with the car through a smartphone, both in the car and away from it, we are introducing a sixth means, that we call the Communicative means. See table 1.

Designing for the communicative means covers the communication with the car in ways traditional Visual and Auditive (and some times Tactile) feedback cannot do. It relies on human cognition and the way humans think and feel about the communication is a key factor. This means that the communication has to have a meaning and a dialogue between the car and the user. Our experiment is based on this sixth mean, to explore one of these new forms of communication between user and artefact. In the context of car design, examples of communicative means cover helpfulness or driver support, coaching and learning as well as personal assistant functionality.

# 5. EXPERIMENT

Inspired by [3] we identified a list of personalities based on different kinds of cars and their users [4]. The personalities were selected on the basis of the use and purpose of a range of cars and focused on reflecting the user's interaction with the car. The individual personality features were exaggerated with a view to clarify the personality and to evaluate how the users understood the personalities.

Each of the personalities were based on a specific car or type of car and a set of user values and a personality stereotype was identified as shown in table 2

To get a better understanding of the experience posed by giving a car a personality and having it follow a user's smartphone, we set up a test of some of the personalities. Through this test we wanted to test both if it was possible to create a connection between the smartphone and the car when the user was not in the car, and at the same time explore the design space created by adding personality to the car.

## 5.1 Method

The test was carried out with the same users who had already taken part in our test of the user interface earlier in the process. The purpose of the first test was to prototype and brainstorm on the interaction with a smartphone mounted in a car, and was carried out before the personalities were introduced. These users were chosen as they already had an understanding of the car, and had some kind of relation to it as they had helped design some of it. Therefore, we found them better fit to understand the concept of communicating with a car with a distinctive personality.

To test the experience we chose two of the personalities to test with, the Butler and the Activist. We then authored a scenario that lasted a couple of days for each, describing the communication between the user and the car. It was chosen to run the tests on the user's own mobile devices, and therefore the test was carried out via text messages. This was chosen as we found it to be more important that the users experienced the relationship with the car via their personal device, than the interface looking exactly as we wanted it to. On this basis the scenarios were modified to fit with text message communication, having both information on the thought situation and the communication from the car itself.

Before the test was started the users were explained how it would be carried out and how the car would communicate with them. The concept of an intelligent car with a personality was also explained, emphasizing that it was the experience rather than the personalities themselves that was to be tested. The test was conducted with the four test users getting the personalities in pairs, so that two got the Butler and two got the Activist, without the users knowing which they were given or even that it was these two we were testing. The first part of the test ran for two days, where the respective scenarios were played out, with the users receiving text messages from the car and taking notes about their reaction to them. After the first part, the users were given a break for a few days and then the personalities were switched between the two pairs and the test started over. This was done to see if it was easier to understand the communication from the car the second time around, even though the personality had changed. Testing the two personalities in parallel was done to be able to evaluate the experience without a better or worse experience in the second part of the test being due only to changes in personality.

## 5.2 Results

Our evaluation of the test was conducted as semi-structured interviews on how the test users had experienced the communication with the car. The interviews focused on the experience with the personalities, the experience of an intelligent car and the use of a smartphone as an interface to the car.

Not surprisingly, the experience of the different personalities

| Car Personalities | | | | |
|---|---|---|---|---|
| **Car type** | Family Car  | Sports Car  | Electric Car  | Rental Car  |
| **User values** | Safety, Practicality, Economy | Excitement, Status, Action, Speed | Economy, Pollution, Environmental Load | Availability, Functionality, Willingness, Desirability |
| **Personality /Stereotype** | The Butler. Helps in everyday situations | The Mistress. Fulfills a desire for action and passion | The Activist. Tries to educate and convince | The Prostitute. Fulfills basic needs or exotic desires |

**Table 2: Car Personality Matrix**

was very different between the users. Those who really liked one of them did not care much for the other, which was one of the reasons why these two very different personalities were chosen, and also why we had chosen test users with different backgrounds.

One of our test users, Jakob - 26, is a busy man, running his own company while being a husband and a father, and is a heavy user of calendars and schedules. Therefore, it was no surprise that he favoured the Butler personality of his car, as it helped him with the everyday problems of planning and arranging everything and reminded him of upcoming events. Although he liked the way the car assisted him in his everyday life, he did not see why it had to be the car, as it could just as easily be a virtual character following him in the cloud and on his smartphone. This suggested that the coupling between the car and the personality was not as clear as we hoped or that this kind of personality did not fit well with the image of a car, but could also be a result of the absence of an actual physical car for the users to relate to. Jakob though stated that it was clear to him that the communication came from the car, and that it could at least make sense to have the virtual character integrate that well with the car. At some points during the tests, Jakob tried to respond to the messages from the car, even though he had been informed that this was not possible, or at least that the response would never be received or seen. In spite of this he replied, hoping for a response and clarification of a question he had, suggesting that not only communication from the car but also a dialogue with the car could be desirable.

The only female test user we had, Maria - 20, on the other hand did not like the Butler personality very much, or at least did not see any need for the information given by it and therefore found the messages irritating. But opposite of Jakob, Maria liked the environmental Activist personality and enjoyed receiving messages from it. Her reason for this, was that the messages helped her do some good for the environment that she really wanted to do, but in her daily life did not know how to do and often forgot to think about. She even stated during the interview that on the second day with the Activist personality, she was looking forward to new messages from her imaginary car and was expecting certain types of messages.

The most important result from our tests was that it was possible to create a relation between the car and the smartphone, and through a character with a distinct personality create a certain experience for the users. Even though the test setup had some limitations in the possibilities for the test, the users experienced the personalities to an extend that resulted in valuable feedback for the rest of the design process.

## 6. DISCUSSION

Our work with experimenting with the car as an intelligent agent mediated through a user's smartphone has given us some clues on how the new design space could be explored. Using personalities in relation to cars has not only opened new possibilities for designing the interface of the car but also the user's experience with the car, inside it as well as away from it. The suggested use of distinct characteristics in these personalities made it easy for the users to understand the differences, and give qualitative feedback on their experiences.

In relation to the design of new experiences with the car, our work has suggested that there are several prior to this article un-explored possibilities in designing an extended user experience by integrating a smartphone. Our tests showed that using the smartphone while in the car, gave better meaning to the possibilities of personalizing everything in the car, as the personal device becomes part of the car and vice versa. And this relation could be maintained while away from the car, by having a deep integration between the car and the smartphone communicated via some kind of intelligent agent.

Using an intelligent agent with a personality for the car, could have some downsides though. As one of our test users mentioned, it could be hard to argument why it should be the car that comes with this feature, and not just something that could integrate with the car, along with almost everything else. On top of that, there are some general problems when introducing designs that have some sort of Artificial Intelligence. First of all there is the implementation of the AI, in both gathering data and creating a meaningful output, which even though computing power has become almost indepletable and the amount of information gathered already is huge still struggles to reach a level where it actually works and is not just a gimmick. Secondly, users may have experienced dissatisfactory AI-systems in the past and have grown to distrust or dislike products claiming to have an AI. Tendencies with for example Apples Siri, introduced with iOS 5

and the iPhone 4S, could introduce a change in the acceptance and use of such products, however it is still too early to judge or conclude on the success and practicability.

## 6.1 Perspective

We have used personalities in our project on the design of a possible new kind of experience with regards to car design, but see great perspectives in using personalities in design processes in general. Taken out of the context of car design, we see a potential for using products with personality as a part of the design process, to explore the design space in new ways. When brainstorming with users, the distinct personalities makes it easier to communicate ideas and introduce crazy ideas, as long as they correspond to the personalities. The use of personalities in other design processes does not only apply to designs where the final concept needs a personality, but could also work as an explorative brainstorming technique for any design with some kind of user interaction and as a communicative tool for setting up larger brainstorming sessions with possible end-users.

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# DEVELOPING AND UNDERSTANDING THE EXPIERENCE CREATED BY VIDEO GAMES

## AND TRANSLATE THEM INTO INTERACTIVE PRODUCTS TO INFLUENCE BEHAVIOUR

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## ABSTRACT

As we nowadays are so used to technology, we have reached a state in which it plays a dominant role in our daily lives without us being genuinely aware of it anymore. This trend of ubiquitous computing [15] makes current intelligent products inclined to disappear from view, to be taken for granted, because *"the central significance tends towards to go to the context"*. (Orlikowski and Iacono, 2001).
This means that no longer the aesthetical nor functional design might make a product appeal to its user, but rather the experience it creates. To emphasize this 'need of experience', this paper points out there is a great potential in developing and understanding the experiences created by video games. This can be pursued by removing focus from games on a screen to instead focus on video game elements in interactive products. Designers can use the guidelines proposed in this paper to create everyday commitment and responsibility in people's lives based on desired behaviours in order to have a positive impact on society at large.

## Keywords

*Behavioral Design, Experience Design, Game Design, Gamification, Interaction Design, Product Design*

## 1. INTRODUCTION

Michael Highland [5] was the first person who encouraged me to reflect on video games with a different point of view than most people have by stating: "*Critically thinking about games and virtual experiences is the first step in collectively understanding video games have the potential to be far more than just entertainment products or educational tools".* (Michael Highland, 2006)

It was his video "As real as your life" (Highland, 2006) which inspired me to think of product design regarding to what it should exemplify. In this video, Highland starts by telling that the boundary of his brain that divides fantasy from reality has finally become to crumble; he has trouble with distinguishing reality and his game environment and elaborates on this by saying:

- *"Video games left a mark on me"*
- *"At some point, something clicked"*
- *"Although I know am I losing my grip on reality, I still crave more"*

One of his most interesting comments was however when he said that he is addicted not because he plays for hours without sleep, but because by playing video games he claims to have *life altering experiences*. Moreover, Highland states that what he learns or plays in his virtual world, he is also likely to be able to do in the real world. He adds to this statement that the beauty of video games is that they make him emotional, more emotional than any news story or textbook could ever do.

I was very moved by the way a video game, a virtual reality [13], could trigger such strong feelings/emotions and wondered if products designed with the same approach could trigger the same effects.

## 2. VIDEO GAMES

Let us start with a definition of video games. Over time they have evolved in a lot of factors such as quality and scale, yet the core has always stayed the same. Especially the word *video* in video game claims the attention, by traditionally referring to a display device, it now implies any type of display, commonly known as platforms; examples of these are personal computers and game consoles. Generally speaking however, a video game was and still is a game that involves human interaction with a user interface to generate visual feedback on a video device. Yet it is exactly this interaction point where we can find new opportunities.

### 2.1 THE GAMING EXPERIENCE

But before discussing what these opportunities embody, we will identify what makes video games such a valuable source of inspiration.

These days a lot of research has been done regarding why people play video games and why they can trigger such strong emotions as pointed out by Highland. Noteworthy, a paper by Lazzarro [7] revealed that people play games not so much for the game itself, but rather for the experience the game creates. Based on Lazzarro's research, she concludes that people play games *to change or structure their internal experience* (p. 4). For example adults enjoy filling their heads with thoughts and emotions unrelated to work or school, others enjoy the challenge and chance to test their abilities.

The research showed that games offer an effectiveness and order in playing that they want in life. It is stated that *"players" value the sensations from doing new things, which they otherwise lack the skills, resources, or social permission to do* (p.4). In other words, this indicates that we are talking about a certain experience, people have difficulty accessing to in their 'normal life'.

### 2.2 GAMING AND EFFECT

Apart from gaming triggering experiences you would have troubles with finding in your real life, if we again look back at Michael Highland, we notice another important factor which games offer. Highland states on his blog gamerthink.com (2011) that the power of video games is that *people are kept engaged* while playing, particularly; games offer much room for both commitment and discipline. Which are both factors, people in their daily lives often have difficulty with realizing.

Also Lazzarro reveals in her paper details about this "player emotion". Here it is described as *instinctive, behavioural, cognitive, and social responses to games* (p.3). More interesting is that she adds that players play to experience these body sensations *that result from and drive their actions* (p.4).

So by analyzing the effects of playing video games, we are now able to grasp the opportunity mentioned earlier in the paper; by looking for ways which will let people experience life in a way they currently are not able to do, resulting in a behaviour characterized by commitment and discipline, this could accordingly drive their actions and intentions.

### 2.3 INFLUENCING BEHAVIOUR

This direction, in which we sketch out a scenario in which gaming or game elements would have an influence on our behaviour, is not new.

One of the people whom predicts the increasingly prominent-role games will play in the near future is Jesse Schell [12] (2010). Schell draws a line from the recent wave of *reality-based games* like the Wii Fit, Guitar Hero and Webkinz, to a future where game-like point systems are in place for every possible human activity, from brushing your teeth longer to taking public transport to getting to work on time. He characterizes a future *"where 1-ups and experience points break 'out of the box' and into every part of our daily lives."*

Furthermore, in Schell's opinion this prominent-role of gameplay in our daily lives would lead to significant improvements – using increased monitoring and measuring by the use of sensors – all in order to change our personal behaviour.

It seems that Schell sees gaming as the tool to get to a specific effect, it is however not necessarily "playing the game", but the fact of being watched, measured and judged which would trigger the change in behaviour; an interesting hypothesis, yet a correlation which may be somewhat oversimplified. I argue if there is indeed a correlation between information display (e.g. receiving *points* for getting out of bed in time) and a change in behaviour. As described by Kanouse and Jacoby [6] (1988), only providing information is seldom enough to accomplish a change in behaviour. If information has to influence a change, then the game Schell is talking about must be designed to maximize the conditions facilitating this change. Kanouse and Jacoby also stress the importance not to ignore other factors that determine whether change will occur, such as a *participant's motivation* to change, the *context* in which the decisions are made, and how the information is *presented*.

In this perspective we are redefining the boundaries of Schell's vision, by no longer talking about a game based on "reality enhancement", but rather a game based on "motivation enhancement". This could mean the change in behaviour in a gaming context as described by Schell as well as in this paper, could still be realized if we take into account what motivates a participant.

### 2.4 GAMING AS MOTIVATOR

There are two types of motivation; the first one is *extrinsic motivation*, motivation that comes from outside an individual. Examples of extrinsic motivation are for instance grades, money and status. Or more related to the current game dynamics; achievements, rewards and self-expression. This approach would be high likely shared by Gabe Zichermann [17] (2010) who states that not reward, but status is the main motivator while playing a game; when everything is public, people want to show off their skills, especially to their friends.

However in a paper by Deen and Schouten [2] (2010), the opposite is argued, namely the importance of identified regulations in order to get *intrinsically motivated*. When developing the game, game designers should *create a correspondence between the game regulations and the participant's perception about the displayed information* (p.1). To accomplish this, game designers should not hide the effect caused by the game, but should explicitly communicate it to the player. Progressive feedback, the availability of various gameplay styles, and the embedding of the game in a social environment, might satisfy a participant's need for *competence*, *autonomy* and *relatedness* [10] to significant others. When these needs are all satisfied, participants might become motivated to play and consequently change their behaviour.

Either way, an involvement of gaming in our daily lives can be seen as something positive as long it suits the context. An optimism which is also shared with Jane McGonigal [8] (2010), who claims games will lead to improvements using gaming activity to solve real-world problems by players keeping up the habits that they have learned in their game. By combining McGonigal and Schell, you could state that by introducing a point-system to one's activity could be highly beneficial, for example for people who fight against obesity; the habits learned through getting points for their daily activities could lead to a healthier lifestyle.

### 2.5 GAMIFICATION

In that scenario, we would be applying the mechanics of gaming to non-game activities to change people's behaviour, commonly known as *gamification* [1]. Though the overall goal differs from the previous sketched out scenario, because gamification nowadays mainly serves as strategy to engage with consumers and get them to participate, share and interact in some activity or community. Moreover, it is mainly used for websites, business services, online communities or marketing campaigns, all in order to drive participation and engagement. Yet it has not found its way into the interaction design community. Hopefully by the end of this paper, designers are inspired to pursue this further.

Although the term gamification is related to make a change in people's behaviour, it may be better to speak of an influence to act, than an actual change in behaviour as to how it was discussed earlier in this paper. To get to an actual change in behaviour, I wonder if game mechanics and dynamics are sufficient enough to facilitate this.

## 3. ANALYSIS OF GAMING STRATEGIES EMBEDDED IN INTERACTIVE DESIGNS

So far we have sketched out what makes games interesting, in what context they could be used, which effects they may offer and how we could realize these effects or how they have been realized already. There is nonetheless a big difference between how the term gaming is used by Highland, Schell and McGonigal and the way how it is treated in this paper. In their perspectives, similar to Salen and Zimmerman's *Rules, Play, and Culture framework* [11] (2003), the applied medium to get to the specific effect would still be a video game. Yet so far we have only described the effects games trigger and the potential to use these effects for other desired outcomes (*"side-effects"*). If we take into account what motivates and triggers the participant to keep them engaged, I believe we can realize desired behaviour and the according actions/intentions,

by *translating* the effects of playing video games in *a product*, and not in a display.
This means that we are no longer designing the product, but designing the experience it creates. As explained earlier, this experience has the same characteristics as when playing a video game.

Therefore the role of a designer becomes to design the experience rather than the actual product.

### 3.1 EXPERIENCE DESIGN

Today, the notion of experience design is becoming more and more central to the interaction design community and its literature. Some of the approaches take the perspective of the user, others attempt to understand experience as it relates to the product, and a third group attempts to understand user experience through the interaction between user and product, as illustrated by Forlezzi and Battarbee [4].

The proposed take on experience design discussed in this paper, tends to go in the direction of the user-product interaction approach. More precisely, towards an expressive user-product interaction*; interactions that help the user form a relationship to a product, or some aspect of it* (p.262). In contrary to cognitive and fluent interactions, Forlezzi and Battarbee illustrate that in expressive interaction *users may change, modify, or personalize, investing effort in creating a better fit between person and product* (p.262).

### 3.2 DESIGN TO AFFECT BEHAVIOUR

An existing example will be illustrated to put these statements into perspective. In 2010 a Ford Hybrid was developed with a so-called *SmartGauge* [3]. This LCD screen shows lively animations to guide drivers on good driving habits by displaying a stylized greenery for good behaviour; the more efficient you are driving, the more green leaves you will generate. As a result people were inclined to get as much green leaves as possible and (most likely unconsciously) changed their driving behaviour simultaneously.

So apparently a simple game element as making a tree grow connected to driving, had an impact. In this example of an expressive interaction, we can clearly see that the SmartGauge gave similar effects like games; commitment and discipline and at the same time it caused an obvious effect on the participant's behaviour, which raises the question: what if we design more products like this? Or rather: What if we design more experiences which will generate the same emotions to trigger a change in behaviour?

Of course one could argue that the SmartGauge is still a display, and therefore does not completely fit the criteria to how the involvement of gaming in design is anticipated as described in this paper. Therefore a different setting will be demonstrated, similar to the hybrid car, by again referring to an existing project: the fun theory [14]. As an initiative by Volkswagen, it is described as follows:

*"The Fun Theory is dedicated to the thought that something as simple as fun is the easiest way to change people's behaviour for the better. Be it for yourself, for the environment, or for something entirely different, the only thing that matters is that it's change for the better."* (Volkswagen, 2009)

Although there are several examples, there is one I would like to point out in particular, the well-known Piano-Staircase [16]. The idea was to encourage people to take the stairs instead of the escalator or elevator. To do so, the stairs was made interactive, by hitting one of the stairs, a sound was produced (the sound of a piano). And as it turned out, 66% more people than normal chose the stairs over the escalator.
Although in this case "fun" is seen as the main motivator, we will shortly analyze and try to improve this concept by the notions stated in this paper.

When we are talking about fun, this may be too vague as different people will experience 'fun' differently. Yet, it does seem to have had an effect on people. Therefore I would rather state that the designers have successfully created a life altering experience; an experience they were not able to achieve before that moment, resulting in a behaviour characterized by commitment and discipline, which accordingly drove their actions and intentions by taking the stairs over the escalator.

Additionally, to keep people engaged, so that the day after they will still prefer to take the stairs over the escalator, we have to have a better understanding what would motivate them to do so. If we take a look what intrinsically motivates them as pointed out by Deen and Schouten, participants should for example be made aware that it helps to be more healthy/fit. Or from a different viewpoint, when someone is able to see that you took the stairs, or maybe even listen to the song you produced; you will be communicating some sort of status, as pointed out by Zichermann. Due to this form of extrinsic motivation you will want to show off your best side, so you will adjust your behaviour in such a way, that you generate the desired behaviour the designer was aiming for.

### 3.3 LIMITATIONS

In that point of view, we are generating a co-experience [13] which takes place as experiences are created together, or shared with others. *"People find certain experiences worth sharing and "lift them up" to shared attention. Shared experiences allow a range of interpretations by others, from the expected and agreeable to the unusual or even deviant."* (p.263)
Co-experience reveals how the experiences an individual has and the interpretations that are made of them are influenced by the physical or virtual presence of other.

Still, one of the important aspects left out in understanding this experience is that it is focused on the interactions between people and products, and the experience that results. So this indeed also includes all aspects of experiencing the product itself: *physical, sensual, cognitive, emotional, and aesthetic.* (p.261)

So although the main aim is to design the experience, the product still plays a crucial role. Also, the produced emotion serves other roles in social interaction as well: *exceeded social regard is pleasant, failed interaction expectations can be disappointing, embarrassing or even enraging.* (p.264)
This again indicates the context's range the proposed approach offers, because clearly social contexts play a role in how we feel, express, and modify our emotions, as well as the resulting meaning that is made. Emotional experiences change, often quickly, in the presence of other people, activities, artifacts, and environments, and are therefore not suited in all contexts.

## 4. EVALUATING GUIDELINES

Note that when we are talking about translating game elements, this does not necessarily mean that you are still playing a game. Up to this point we have however illustrated how it is still possible to get to the same effects and what these effects accordingly could produce.

Nevertheless one could question if an interactive product could indeed let people experience life in a different way, and thus recreate an experience you have while playing a video game.

As indicated by Orlikowski and Iacono [9] it is explained that *the IT artifact tends to disappear from view, to be taken for granted, because the central significance tends towards to go to the context* (p. 1). They stress for a situation where *technology is taken as seriously as its effects, context and capabilities* (p. 1).

This means that the technology addressed in this paper should take a more prominent role in the design process and not only passive as the one whom is being developed, implemented and used. The observation of Orlikowski and Iacono is very relevant to this paper, because if we do not take this into account, we are heading towards a scenario in which people are only focused on context as well, resulting in a situation where everyone is getting more and more used to the technology. This would accordingly mean that it may occur to be very difficult to come up with the `life altering experience`, because people will simply take the offered technology for granted and thus not experience it in the way intended.

### 4.1 RESPONSIBILITY

When talking about interaction design and influencing behaviour this urges that the ethical side should be addressed as well. Understanding user experience, how people interact with products, other people and the resulting emotions and experience that arise, will result in interactive products that improve the lives of those who use them.
This implies that these designers will have the role and share the responsibility of exercising influence on society by taking into consideration the behaviours they want to address and the corresponding actions they want to achieve. This effect is however not only the responsibility of the designer and anyone else involved in the design process, but also the responsibility of the user. The experience should guide yet not force the user in a specific direction to change his/her behaviour. That will still be the choice of the user.

## CONCLUSION

By revisiting and reflecting on several previous studies and work related to the topic, we demonstrate
the relevance of getting to a better understanding of how translating video games to interactive could influence behaviour. Briefly summarized, we are looking for ways to remove focus from games on a screen to instead focus on video game elements in interactive products in order to let people experience life in a way they currently are not able to do. To get to the so-called "life-altering experiences", we also have to understand what motivates the participants both extrinsically and intrinsically. Then we are able to keep them engaged by providing emotions as discipline and commitment, consequently resulting in a desired behaviour which accordingly drive their actions and intentions.

We have analyzed several trends with a similar approach, in which gamification offers the opportunity to experiment with rules, emotions, and social roles and the fun theory tries to get a link between a fun activity and a change in behaviour, yet the game mechanics and dynamics may be overvalued, whereas this paper provides guidelines to indicate if similar experiences can be designed without actually playing a game.

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# Experiential Prototypes to Elicit Dialogue

## with Umeå Police Command and Communication Centre

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## ABSTRACT

This paper focuses on how low-fidelity and medium-fidelity prototypes create a dialogue between users, clients and designers. This dialogue is essential for creating designs that resonate emotionally and create alignment between clients and users at the different stages of the design process. It raises a discussion about how the level and type of fidelity of the prototype can be linked to the consequent dialogue with stakeholders.

## Keywords

Design, Methods, Dialogue, Stakeholders, Prototypes, Fidelity

## 1. INTRODUCTION

This project was carried out over five weeks in cooperation with the Umeå Police, with the aim of redesigning the graphical user interface for dispatchers at the Command and Communication Center (LKC). The current interface and system consists of approximately 20 different windows from 5 different software applications displayed across three monitors.

The client in this project was a team comprised of a superintendent, duty officers, and civilian staff working towards developing a new LKC in Umeå. A dialogue between the dispatchers (users), superintendent and duty officers (client) and designers was essential for creating designs that resonated emotionally and created alignment between the stakeholders. This design method provided a user-client centered approach, in contrast to being solely user centered or client centered. Client-user involvement can strengthen the design by providing more perspectives in the dialogue.

In the initial briefing, the client emphasized the use of a large projection wall and explained how the police system works. The focus was then shifted to analyzing, observing, and interviewing the dispatchers at the LKC. Dispatchers interact with the system eight hours a day and are highly efficient at using the system. Therefore, it was difficult for them to envision how the system and interface could be improved upon beyond adding functions. After spending time with both parties, it was apparent that the client's understanding of the of users' needs did not align with either the expressed needs of users nor the insights revealed by designers. This led to thoughts about using prototypes as aids in enhancing the dialogue between stakeholders.

The literature referenced in this paper use the term prototypes, even when sketches and mock-ups would be a more accurate term. For consistency reasons, the term prototype will be used throughout this paper. The focus of this paper is on how low and medium-fidelity prototypes aided in creating the desired dialogue with users, client and designers, and how this dialogue was essential for taking the project further.

## 2. EXPERIENTIAL VS. TECHNICAL FIDELITY

Fidelity is a synonym for faithfulness, ultimately coming from the Latin verb fidere, to trust. Today, the term is often used to describe the accuracy of technology in emulating something else. Typically, it expresses the degree to which an audio recording faithfully reproduces a live orchestral concert. In this paper the term fidelity refers to the degree of accuracy in which a simulation, in the form of a prototype, can mimic the user experience to be found in the proposed final product.

### Ambiguity invites dialogue

In interaction design, unlike computer science, a lower fidelity prototype which promotes discussion can be more important than one using higher fidelity software, that fails to ignite discussion. A medium-fidelity prototype for the purposes like this case study can be created using computer graphics instead of programming. A working model, which offers a higher level of fidelity, mirrors a higher level of operational reality while less advanced technology implies greater ambiguity. The advantage of using lower fidelity with its inherent ambiguity, is that it opens up a broader dialogue [3]. When a more specific dialogue is desired, it can be appropriate to prototype using higher fidelity. The table below has been developed by the author to compare the types of fidelities in prototypes mentioned by Buxton, Coyette, Ehn & Kyng, Erickson, Hartman and Rudd [1,2,3,4,6,7]. Coyette et al argue that a medium-fidelity prototype is one which is developed using software tools, but is not a visual representation of the final design [2].

### Choosing the appropriate fidelity

The table suggests that in the initial design stages, it is most valuable to use low fidelity prototypes to provoke with, in order to create an open but broad ranged dialogue. Further along in the design process it is more suitable to use medium-fidelity prototypes to

evaluate with, as they provide a higher level of experiential fidelity and an open, focused dialogue between stakeholders. Software

| Fidelity | Low-Fidelity | Med-Fidelity | High-Fidelity |
|---|---|---|---|
| Medium | paper & pen | computer graphics | programming |
| Technology | low | medium | high |
| Experience | medium | high | medium |
| Ambiguity | high | medium | low |
| Dialog Openness | high | medium | low |
| Time | low | medium | high |

Table 1: Comparing the qualities of low-fidelity, medium-fidelity and high-fidelity prototypes.

prototyping should be used to validate near the end of the design process, as it can limit the vision or experiential qualities, unless considerable amount of time and money is invested in both programming and graphics [3,7]. The method and outcome of using such prototypes in the design process will now be explained.

## 3. PROVOKING WITH LOW-FIDELITY PROTOTYPES

Stories are a natural way to begin a dialogue and a vague story line leaves openings for discussion of the design [4]. By combining a low-fidelity prototype with a roughly sketched scenario it was possible to create a space that encouraged users and clients to provide feedback and react to the concept.

### 3.1 Creating an environment for dialogue

The goal of the workshop was to provoke both users and clients and, consequently, to develop a dialogue about the design concept direction. The three hour workshop was hosted at Umeå Institute

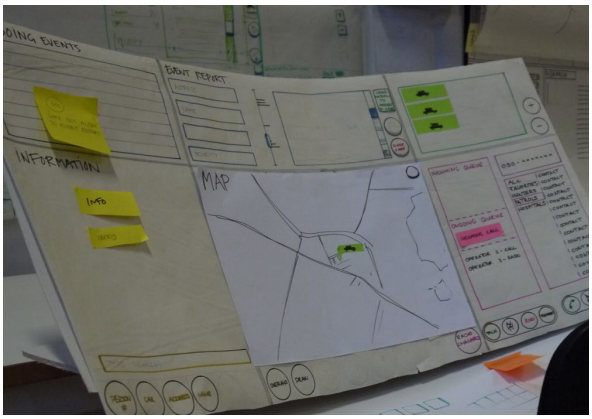


Figure 1: Low-fidelity paper prototype.

of Design and two rough paper prototypes were produced and presented to the participants along with a room arrangement activity. Six people attended the first workshop, four dispatchers (users) and two duty officers (clients), who were paired up in groups of two. Each pair rotated between stations of the different class projects. Each step was approximately 15 minutes and overall 45 minutes were spent with each pair. The first step of the workshop was the designers acting out a scenario of how one would interact with one of the paper prototypes. One designer told the story of the workflow while the other interacted with the prototype. After the demonstration the stakeholders were encouraged to try it out to see how the work environment felt. This triggered a discussion, before the next prototype was demonstrated, followed by a conversation about their reactions and work flows.

Figure 2: Room arrangement activity with stakeholders.

The last part of the workshop involved discussing the LKC room arrangements. Pieces of colored paper designated the different elements in the room and the participants were asked to reconfigure the room by rearranging the pieces of paper. Afterwards, a large board was placed on the wall, representing shared projection information. It was used to collect thoughts on what the space could be used for. The client brief mentioned that a wall projection would be an important part of the design. During initial observations it was not established how a shared wall projection could be useful for the users. Following the strategy used by Ehn & Kyng, the prototypes were very rough to ensure feedback and discussion was not hindered by minute interface details, but to focus on the hands-on experience and that the concept was understandable [3].

### 3.2 Dialogue influences design direction

With users testing the various work stations and from the discussion around the two paper prototypes, the preferred working method and design direction became clear. In addition, the duty officers were very keen to observe and listen to the comments of the dispatchers, and also contributed by asking questions. The room arrangements professed by the dispatchers and the duty officers differed because their needs were different. By listening to what was important to the dispatchers and the duty officers, the direction of room layout became clear. When asked initially what the shared projection screen could be used for, the dispatchers found it difficult to answer, while the duty officers suggested it could be used during special events.

The project lead team did not think about the actual application of the screen, but rather felt it was necessary because they are present in other communication centers. Low-fidelity prototypes provoked a good dialogue about the work environment at the LKC, and resulted in new insights about how the designers should move forward with the project. Decision making for the design team was enhanced when members were able to refer back to their dialogue with stakeholders.

### 3.3 Dialogue improves stakeholder alignment

The early client-user interaction sparked effective communication. The risk of misalignment between the two would be minimized in the later phases in the project, as the clients were able to see how the users reacted to the concepts first hand. Rather than clients making suggestions with just the designer, a much more efficient conversation occurred over a shorter time span because of the direct feedback between the user and the client. This dialogue between designers, the users, and the clients provided new perspectives that might not have arisen using typical methodologies. It ensured that the client, in particular, understood the specific users' needs.

## 4. EVALUATING WITH MEDIUM-FIDELITY PROTOTYPE

Medium-fidelity prototypes provide more detail-oriented feedback, and for this phase it was important to test how users and clients would experience the interface and for designers to see their reaction.

### 4.1 Storytelling to elicit user experience

One week after the first workshop, another workshop was hosted to get more specific feedback on the developed design concept in order to evaluate the design. This workshop was three hours long and also hosted at Umeå Institute of Design. The attendees consisted of two duty officers, three dispatchers and two LKC project team members, four of whom attended the previous workshop. A medium-fidelity prototype was presented, utilizing a curved plastic panel to simulate a touch screen using rear projection. The interface was presented as an interactive pdf file which was navigated through as slides by one of the designers while a scenario was narrated by another designer with step by step instructions. The dispatchers and the duty officers followed the oral instructions and interacted with the screen.To evaluate the intuitiveness of the design, a scenario was used which depicted the current work flow. Only the functions that were to be performed were explained, without stating how to do them. After having experienced the prototype a discussion naturally emerged in which more specific questions about interaction methods and interface details were raised.

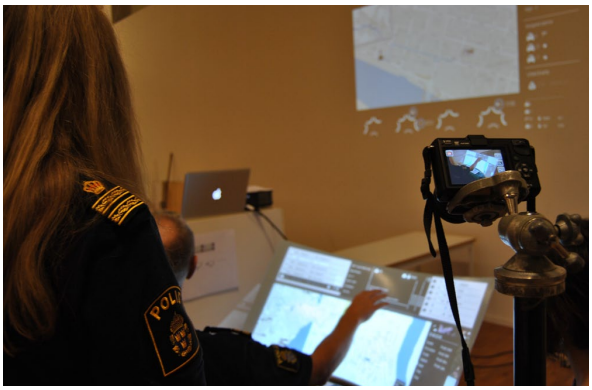

Figure 3: User testing with medium-fidelity prototype.

### 4.2 Storytelling triggers dialogue

Stories provide not only a rich user experience [4], but also provide a basis for starting the dialogue, as a way for the designers to dive deeper into the dispatchers workflow. During the user testing with the medium-fidelity prototype, the users interacted with the touch screen interface with ease, despite the prototypes lack of ability to provide realistic touch feedback. It was important to have all three perspectives as it provided a holistic and broader view of the project. This revealed, for instance, that dispatchers rarely call cars, but rather regions. The change was applied immediately, to both the interface and the way the story was told. The story behind the operation of the interface is a large part of the user experience, and also influences the dialogue. Those who were unfamiliar with the project asked "Is that a touchscreen?" meaning the prototype created the desired experience of being a touchscreen, although it lacked the technical scope of being a high fidelity prototype. As referred to in Table 1. the medium-fidelity prototype has a high experiential quality due to the nature of narratives [4].

## 5. DISCUSSION

The breadth and broadness of feedback and dialogue regarding design concepts often mimics the ambiguity of the stage in the design process. Something perceived as finalized will attain more detail-oriented feedback, while at the initial stages of the design process the focus should be on a dialogue about the overall concept. Changes to any high-fidelity prototype typically require considerable time and money, and may discourage stakeholders from an open dialogue [3,4]. According to Table 1. the high-fidelity prototype should be used to validate, and not to conceptualize, design concepts. Low fidelity-prototypes are intended to be quick, cheap and iterative, and changes and new ideas are encouraged [1,3]. Conversely to Buxton and Ehn & Kyng, Horst writes that "it is possible to develop high-fidelity integrated prototypes that convey a convincing use experience, and the dynamic details of a product interface, while still being very much open to change and continuous improvements, through a collaborative prototyping process with different stakeholders." [6]

The prototyping method described by Horst has become cheaper and more accessible over the past 10 years with programs such as Processing and Arduino. This is only helpful if the designers are fluent in programming and if the experience can be mocked up using existing technology. However, it is not always appropriate, nor necessary, to create high-fidelity prototypes to provide a convincing user experience. This case study included the use of lower-fidelity integrated prototypes that could be produced and modified

quickly, and were focused on the visualization and experience as opposed to technicalities. As there are no curved touchscreens on the market today, using a higher-fidelity prototype would not create the right user experience and desired dialogue needed within the short time frame available. Neither client nor user commented negatively about the disparity between a real-life interface, and the pseudo interface created. In addition, a working high-fidelity prototype would require a programmer, while a medium-fidelity prototype can be made by designers that are not advanced coders. This also ensures that the graphical interface is not limited by the software, but rather limited by the designers creativity, and the value of the design is focused on the user experience rather than the technical possibilities. The transparency in regards to how the prototypes were made and how easy they were to change encouraged stakeholders to not feel limited by time or money constraints when providing feedback.

By having the designers implement many of the suggestions between the two workshops, stakeholders were given a feeling that their voices were heard and that their comments actually contributed to the design. This sense of contribution is important when creating a dialogue with stakeholders. More research is needed on how users feel, act and respond in the presence of clients, along with other methods to elicit comments from, and encourage dialogue between, various stakeholder.

## 6. CONCLUSIONS

A designer's role is not merely to engage in a process focused on the creation of a product, but to participate in, and often lead, a social process between stakeholders where communication plays a crucial role. The low-fidelity and medium-fidelity prototypes of the LKC project helped create a platform for dialogue between the users, clients and designers. The low-fidelity prototype provided a dialogue focused on the overall interaction and which provided a big picture of the project. The medium-fidelity prototype focused closer on the details of the interaction. This dialogue allowed designers to make design decisions quickly, without a need to meet with the two parties separately. Instead the sessions provided valuable feedback, and a common understanding of each other's roles. This, in turn, reduces the likelihood of misalignment between stakeholders. Incorporating stakeholders' feedback enhances their esteem, by acknowledging their contribution to the project.

## 7. ACKNOWLEDGMENTS

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# Researching Smart Grid through design:

## How social interaction affects electricity consumption

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## ABSTRACT

Smart Grid is currently in the making. While there is a tendency mainly to look at the technical aspects of the implementation, we wish to take a critical look at the current implementation issues from the users point of view. Previous empirical studies indicate that social interaction and visualisation of real time energy consumption patterns can trigger a more ecologically responsible behavior. This paper focuses on exploring this assertion through a qualitative study of a design called the "The Social Electricity Meter" by revealing an indication of motivational factors to change ones electricity use based on social stimuli. By reflecting theoretically on how this kind of empirical data is essential when designing future Smart Grid experiences, we also evaluate the capability of the approach *Research Through Design* to gather insights about future social practice.

## Keywords

Smart Grid, Research Through Design, Eco Visualisation, Social Interaction, Gamification.

## 1. INTRODUCTION

By the year 2050 the Danish Government is striving to make Denmark almost independent of fossil fuels estimating that up to 80 percent of produced energy will come from renewable sources such as wind, wave, and solar production [1]. Several initiatives have been taken to develop a new infrastructure to handle these changes. Initiatives which is widely referred to as Smart Grid – a term that covers several different notions but all with the purpose of creating a more flexible electricity grid.

Right now the consumption in Denmark is concentrated around electricity peak hours, requiring the power stations to produce larger amounts of energy at certain hours of the day.

Because it is not currently possible to store electricity extracted from renewable sources, the amount of available electricity increases in the grid during production. Therefore, renewable electricity has to be used immediately in order for it not to be wasted. The aim is to move the current consumption in peak hours to periods when there is an overload of electricity available in the grid. Due to the many aspects and the complexity of Smart Grid as a concept, we focus solely on the problems of peaks in the private electricity consumption and practices.

This study explores what possible incentives might persuade users to modify their electricity consumption patterns. Research undertaken by different company stakeholders within the field of Smart Grid identifies social relations as possibly having an influence on change in energy consumption behavior [1, 2]. Therefore, we wish to explore and discuss how social interaction and eco-visualisation influence the user's practice around electricity consumption patterns. With the aim of advancing the understanding of motivational factors behind behavioral change, this study should be seen as an early exploration providing inspiration and foundation for future research.

## 2. THEORY

Company stakeholders[1] in the field of Smart Grid have tested *Smart Meters* which purpose is to provide visualised information to inform individual users about their specific energy usage in an attempt to foster awareness of their own energy consumption as an incentive to change their consumption practices [3].

Common to all this research is a focus on the technological aspects, primarily on how to implement new technologies that will affect the everyday life based on limited understanding of the actual users of this system in the future [4]. Hence, the research appears not to take into account how technologies and practices are mutually influenced because they are affected by the context in which they are located or deployed [4].

Additionally, Redström, docent in interaction design argues that design is defined by the user, in the situated use, and shaped by the context and practices of the user. By using the approach Research Through Design we want to make use of the process in which the user assigns meaning and function to the design in relation to their existing practices and experience [5].

Fallman and Stolterman note that bringing forth an artifact to explore alternative designs is "shaped by the ambition to explore new solutions, new directions, new technology and new usage, to broaden the overall design space or to rock the boat, without necessarily trying to solve existing and well-defined problems" [6, p. 270].

Smart Grid as a technology is still in the development stage. Research Through Design presents an opportunity to transform the world from a current state into a preferred state by introducing a design artifact. In this case providing a way to explore the users experience with elements of technology design not yet invented [7]. Thus our main approach is the presentation of the design for

[1] GreenWave, HP, IBM, and DONG.

the user and the exploration of what and how the formation of meaning is created.

## 3. DESIGN ELEMENTS

To explore how social relations can have an influence on change in energy consumption behavior we have designed what we call "The Social Electricity Meter" based on game and eco-visualisations theory.

Tiffany Holmes uses the term Eco-visualisations to describe real time dynamic data visualisations of energy consumption as a method for inspiring environmental stewardship [8]. One of the purposes of the design in this study is to foster awareness of one's own energy consumption patterns through visualisation and thereby create an incentive to change consumption habits [7].

Game designer Chris Swain argues how games can be designed to affect social change [8]. By integrating game elements in our design we aim to explore how social interaction can influence our behavior in relation to private electricity consumption and understanding of electricity. The foundation for taking a playful approach to the design is that games set a frame which people can relate to. Given that the understanding of electricity is abstract, it is beneficial to bring it into a game context where participants can draw upon previous experiences and thereby know how to play by the rules [8]. By integrating social interaction, we aim to facilitate a *community of practice* by making it possible to share experiences and knowledge. Thus the users build social capital and accumulate new knowledge [8, p. 807].

## 4. THE DESIGN

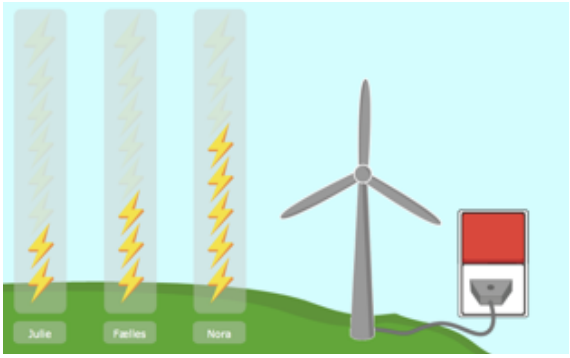


**Figure 1**

The design consists of a visual interface designed using HTML and PHP displayed on an iPad which was placed in the informants' home (figure 1). The informants' were asked to register every time they used certain products[2] by touching a button on the screen. The button is either green or red to symbolise whether it is a period with an abundance of electricity available in the grid or not. Whenever the informants registered electricity use in the "green period" they gained a point and vice versa if it was registered in the "red period". The design showed individual and common point scores simultaneously which made both of them able to compare their energy consumption continuously.

[2] Washing machine, coffee machine etc.

Four informants were using the design for seven days. The criteria for the selection was to find pairs of informants who already had a social connection thus creating the best conditions for studying the impact of the social interaction.

Two semi-structured qualitative interviews were afterwards conducted to follow up on their experience using the design, and how their electricity usage was influenced by the social aspect. The empirical data was then analysed by reducing the information to significant statements, and then placed into themes [10].

As we are not trying to provide categorical "truths", but rather raising questions of what social practices are possible, more informants would not necessarily have created more representative findings [11].

## 5. FINDINGS

Our research indicated five particular themes of motivational factors:

### 5.1 Solidarity

The informants described a feeling of the common goal as being too abstract which might be caused by the design not being distinct enough. This resulted in a lower support of direct social interaction and sense of solidarity between the participants than expected.

### 5.2 Discourse

An indication of an established societal discourse constituting that one has to act environmentally responsible was found. The discourse was a motivational factor in the sense that it was the decisive term behind the desire to create a representation of oneself as environmentally responsible both in relation to others and to one self. Thus, it was the major premise behind the following motivational factors.

### 5.3 Self presentation

Based on the fact that others were able to monitor one's performance, the study indicates both an explicit and implicit presentation of self in relation to electricity consumption. Some informants preferred actively presenting one's own results whereas others preferred self presentation triggered by the system

### 5.4 Comprehension

The electricity consumption was made tangible and easier to comprehend when it was visualised through the design. It was also considered motivating to see one's own performance compared with the friend's.

### 5.5 Predictability

In certain instances some of the informants mentioned that they did wait for the "green" electricity before performing a specific task. There would be a larger willingness to change behavior if they could get an indication of when there would be green electricity as suggested by one of the informants.

## 6. DISCUSSION

Initially we expected this study to show how social interaction would have an effect on energy consumption by creating a sense of community. On the contrary, what seemed to be a coherent tendency was the way social relations had an effect on the energy consumption in relation to the individual and self representation. This was due to either an implicit or explicit wish to represent one self as energy responsible. The sense of solidarity was not visible

but instead the primary motivational factors for changing behavior seemed to be on an individual level.

Research Through Design as an approach to explore future practices enabled us to zoom in on the detailed elements of electricity consumption and the behavior around it.

Contrary to former research within the field of Smart Grid [1, 4] we have been able to explore the effect of social relations but also acquired information and understanding of the underlying structures governing the motivational factors embedded in the social interaction. Thus, creating an understanding of how the specific findings were intercorrelated, mutually influenced by the context, the user practice, and the design.

Because the design is put to actual use, existing practices are projected into the users' understanding of the design. Especially notable is how the aforementioned societal discourse on energy consumption has an influence on the use and understanding of the design. Most significant was how certain elements of the design which enabled enrolment in the discourse served as the motivational factors to change consumption behavior.

The visualisation aspect of the design turned out to be a strong medium with the attribute of making the energy consumption tangible. Thus, it becomes a means for the user to create an understanding and a sense of self in relation to the above mentioned discourse on energy consumption.

The pivotal factor for the visualisation aspect seemed to be the allocation of points reflecting energy responsible behavior. It seemed, though, that the comparison of the points in relation to the other informant was what made the concept of consumption tangible.

The value assigned to the points did not only create a base for comparison with each other but also with one self over time. The comparison on different levels created a foundation for self representation. Thus the motivational factor was both a clearer conscience and also representing oneself as an environmentally responsible person on the basis of the shared discourse.

# 7. CONCLUSION

This study took a starting point from other research within the field of Smart Grid, but with the method Research Through Design we took it into a more defined context and thereby gathered more detailed and focused data. An underlying societal discourse was located as the premise behind other motivational factors to change electricity consumption behaviors.
The visualisation enabled the user to compare their performance with others thereby making it more tangible and concrete as to what their contribution to a renewable environment looks like. Hereby transforming abstract and "diffused" information into comparable and comprehensible data and altering the understanding of what constitutes sustainable electricity consumption. Also, either explicit or implicit self representation played a part in the motivation for behavioral change.

The study has opened up the design space by showing how social interaction, because of the societal discourse can be a motivational factor towards sustainable energy consumption. The specific findings could be used as guidelines when researching and designing for behavioral change within the field of Smart Grid. Either as an inspirational point of departure, or a continual of this research by redesigning "The Social Electricity meter" going into depth with the elements which were regarded as motivational.

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# The Living Area – An exploratory approach to awake empathy in female youth in public urban areas

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## ABSTRACT

Public urban spaces are often misused and vandalised, as people in the neighbourhood do not feel responsibility and emotional engagement towards them. This project started in collaboration with the municipality in Malmö, who wanted an interactive concept for a, not yet built, public activity area in Rosengård, Malmö focusing on young girls as its primary users. The theme for this project was 'Embodied interaction', so it had to involve a high level of physical interaction from the users.

The project idea is based on the basic human quality; empathy – the ability to care about other living things. The hypothesis was that by appealing to the public area users' sense of empathy, we would create emotional engagement and a feeling of ownership among the users. In order to succeed in this, it was evident that the area should be brought to life somehow. The notion of a public area that could act and react according to the presence and behaviour of the users quickly became the idea that suited our hypothesis the best.

Through a participatory and exploratory design process involving both the municipality and residents in Rosengård, a prototype was designed, implemented and in the end tested at a Christmas market situated in Rosengård. The findings from this project is discussed and the end of this paper.

## KEYWORDS

Embodied interaction, participatory design, exploratory design, empathy

## INTRODUCTION

This project is made in collaboration with four other group members and all design processes have been a part of group discussions. The design process of this project has been partially participatory and partially exploratory.

Firstly, this paper will describe the development of the design concept and from there go into a more detailed description of the final concept.

Secondly, it will address some of the most important design decisions and their grounds.

In the last section a description of the prototype will be presented and in the end the matters addressed in this paper will be discussed and concluded.

## CONCEPT DEVELOPMENT

The idea of making a public area come to life was among others inspired by the installation 'Fühl-o-meter' in Berlin (Wilhelmer) (see fig. 1). In this installation a giant smiley face changed its facial expression based on the collective mood of the city, gathered from cameras tracking the citizens' facial expression. The elements that the installation changes dynamically over time, and that people interact with it by simply being at a specific location were very appealing, and those two elements became a core part of The Living Area.

**Fig. 1 - Official photograph of the Fühl-o-meter (Wilhelmer)**

One challenge that quickly emerged was that The Living Park was first and foremost a conceptual notion of having a public area express human characteristics, and that this notion could be concretised in a wide range of different ways with many different forms of inputs and outputs. A number of different concrete concepts were developed and the choice fell upon a concept based on the physical phenomena of shadows.

## SHADOW CONCEPT

The concept revolves around the concept of shadows, which is believed to be phenomena that everybody can relate to, but in this case the shadow that is cast, is an augmented version of the user. It will react to the user's bodily movements as a real shadow will, but the movements will not be exactly precise and the physical appearance will be a simplified version of a human.

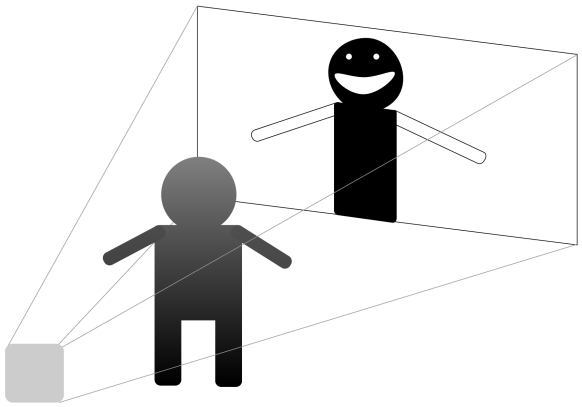

**Fig. 2 - A sketch of the shadow concept**

The grey box to left in fig. 2 resembles a projector that draws graphics on top of the user's real shadow to give the illusion of another person standing in front of him/her and mimics his/hers movements. If two or more people would use it simultaneously the shadow would expand to fill out the empty space between them, thus establishing a connection between them.

The Living Area is also designed to have an online social media part, for people to be able to interact with it without physically having to be at the public area. Those online activities will also have influence on the behaviour of the shadow character. Apart from the physical and web inputs, we distinguished between instant output where the user gets immediately feedback in his/her actions and then aggregated output where the input is collected over time for later feedback. Together, this combination of short-term and long-term interactions would create an interesting and future ready installation, as it has the capability to adapt to the behaviour of the local people and the ever-changing trends in society.

Fig. 3 shows an example of different inputs and should not be considered a complete list.

| | INSTANT | AGGREGATED |
|---|---|---|
| WEB | - Google search hits<br>- Facebook (likes, check-in, posts)<br>- Online booking of the park<br>- Other social network based input | |
| PHYSICAL | - Number of users<br>- Face expressions<br>- The users' height<br>- The movement of the users (body/arms/head)<br>- The users' distance to the projection | - Amount of people in total<br>- Time of day<br>- Seasons<br>- Weather |

**Fig. 3 - A table of examples of inputs and their relation to the output**

The shadow character is designed to be a combined representation of:

a. The current user(s)
b. The living quality in the public area

In this way, the user is interacting with The Living Area in a very easy understandable and playful manner, in order to emotionally engage the user.

# THE SHADOW CHARACTER

The shadow character turned out to a very important aspect in terms of empathy. We wanted to give it a personality for it to seem more emotional appealing to the users, and we took our starting point in real people. It is commonly said that the personality is shaped by a combination between the surrounding environment and the heritage and this notion was then applied to the shadow character.

The environment part of the character is all inputs it gets, among others users' movements, online social activities, weather conditions etc. These input will keep evolving the character over weeks, months and years to avoid it go out-of-date.

The heritage part of the character is in other words all that is designed by the group behind this project, which includes its appearance, various constraints and then we gave it a friendly and agreeable nature. A study done in Spain with boys and girls in the age 12-17 showed that empathy strongly correlates with friendliness and it also showed that the girls generally have higher levels of empathy and friendliness than the boys (Del Barrio et al., 2004). This study is here compared with another study investigating the link between personality and friendship and it showed that agreeableness (which is closely related to friendliness and empathy) has the strongest relationship with a healthy friendship and furthermore it supports the claim "*that agreeableness facilitates more positive experiences in social situations*" (Demir et al., 2007). These two studies in combination suggest a relation to the design decision to make the shadow character friendly and agreeable, in order to awake empathy in girls in particular and to emotionally engage them in the interaction.

The way the shadow character was designed to be friendly, was simply to give it a big smile. The smile is based on the 'broad smile' as proposed by Ewan C. Grant (Grant, 1969), but in a slightly more extreme fashion. The smile is believed to be a very recognisable expression of joy and happiness, and on the other hand a mouth cornering downwards is an expression of sadness, and was chosen to be the only expression of the character's mood in the prototype.

As shown in fig. 2, the shadow character is a very simple humanoid figure. It has no ears, fingers and legs, but still it is easy to see that it resembles a human. The inspiration for this design decision is found in the concept of 'the uncanny valley' (Mori, 1970), which is shown in fig. 4.

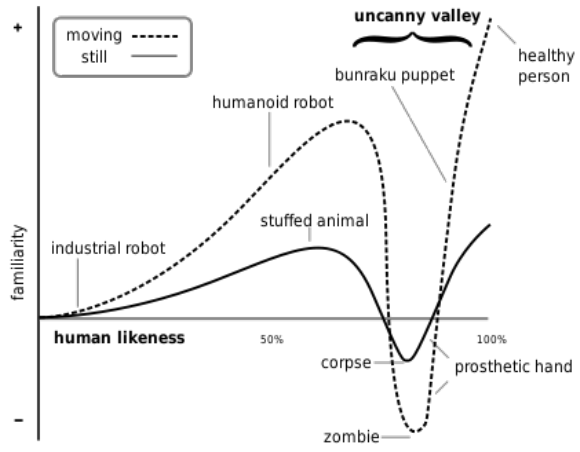


**Fig. 4 - The graph of the uncanny valley (Mori, 1970)**

'The uncanny valley' is a concept originally used within the field of robotics, but since then it has also had its influence within animations. It basically describes that the more an object looks like a human, the more familiar it seems and we can to a

higher degree emotionally engage in it. But there is a gap in this relationship when approaching a real healthy human. Objects that fall into the 'valley' is perceived as unfamiliar and uncanny, and it is often concerns objects that pretend to be human. As Mori explains it with the case of a prosthetic hand "*So if we shake the hand, we are surprised by the lack of soft tissue and cold temperature. In this case, there is no longer a sense of familiarity. It is uncanny.*" (Mori, 1970).

We, as humans, emotionally engage with abstracted figures because we subconsciously suspend disbelief, but once a thing becomes too realistic we are more concerned with criticising the ways it is not perfect. The shadow character's appearance is therefore designed to be within the safe side to the left of the valley.

## PROTOTYPE

The prototype made in this project was from the beginning meant to be a proof of concept and therefore only included what was believed to be of most importance, namely the physical input with instant output, which can be seen in fig. 2 and fig. 5. It made sense only to test this part and thereby exclude web activity and the aggregated outputs, as we would test it at a Christmas market for a few hours only.

The prototype was altered a bit to give a more realistic appearance, which meant that if the user was standing still for at least 5 seconds, the smile would turn into a sad face, but when the user started moving again the smile would come back. In this way, the expression shifted between sad and happy throughout the test, which seemed more in connection with the idea of a living organism.

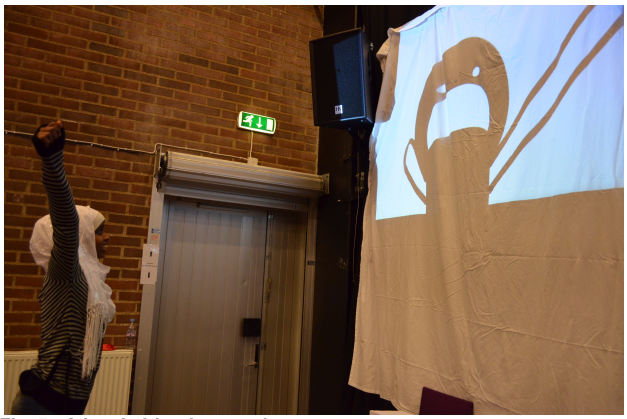

**Fig. 5 - A local girl trying out the prototype**

## DISCUSSION

The main focus of this paper is to investigate the emotional response towards the shadow character of The Living Area. The test showed a lot interest towards The Living Area and even small children about 3-4 years of age tried it out with the a lot of enthusiasm. All the participants seemed to become immersed fairly quickly when trying out the installation and did not seem to take much notice of the people looking at them.

Nobody seemed to be intimidated and scared by the character even though it is almost twice as big as most of the participants, which supports the design at being on the safe side of the uncanny valley (Mori, 1970). Participants also tended to want the character to smile, even though they did not know how to do that. This behaviour could be an indication that the participants felt empathy towards the character.

In regards to the concept of the character representing both the user and the living quality of the area at the same time, the test showed interestingly that some of the participants seemed to have non-verbal communication with the character. They reacted instantly when the character shifted to a sad face expression and also by some of the slightly imperfect movements. It is believed that it because of the elements of unpredictability that makes the experience much more meaningful for the user as it is a series of actions and reactions from both parts.

## CONCLUSION

The prototype tested in this project did only include the physical input and instant output and does not at all take the long term perspective into account, which is an important part of the sustainability of the installation.

The emotional engagement that was observed at the test cannot be verified from a single test and furthermore the importance of the theories can neither be verified.

However, the rather immersive experience, intuitive interaction and the positive emotional response from the girls who tried it out, suggests that further investigation should be carried out in order to clarify all the variables and their respective importance.

## ACKNOWLEDGEMENT

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# Designing for Senses: Exploring Experiential Qualities with Tangible Design

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## ABSTRACT
This article points to qualities in the interaction between children with developmental disabilities and tangible designs that offer sensory stimulations. The research focuses on non-goal oriented environments and has been driven by prototypes that materialize three design ideals questioning how tangible designs can contribute to sensory experiences. The qualities emerge in the interaction between child and prototype and will be discussed based on the notion of experiential qualities. By research-through-design the qualities of the design ideals have become visible and the research has indicated the importance of focusing on aesthetics, when designing for sensory and non-goal oriented experiences.

## Keywords
Experiential Qualities, Design Ideals, Research-Through-Design, Participatory Design, Tangible Design

## 1. INTRODUCTION
Playing means being engaged in an activity without having any fixed goals, but just being in it for fun[1]. This, however, does not mean that we cannot learn anything from it. Snoezelen is a pedagogical and therapeutic practice that focuses on multi-sensory rooms for children with disabilities to experience and engage in their own pace and with utilization that places no demands[7]; see figure 1. As such, Snoezelen shares many values with the nature of play. Snoezelen is constituted by the relation between the child, the personnel, and the constellation of the sensory rooms. The constellation of the rooms can be varied through different sensory-stimulating artefacts, sound, and light. Snoezelen offers both arousals of curiosity as well as relaxation for the child.

During six months we have participated in the SID research project. SID is an acronym for *Sensuousness, Interaction and Participation* (in Swedish *Delaktighet*). The project explores how tangible technology can support and develop new forms of interaction in the Snoezelen concept[8]. This exploration is driven by prototypes that materialize questions regarding how tangible technology is relevant in Snoezelen. The prototypes are introduced and evaluated in three different Snoezelen centres participating in the SID project.

Our role has been to participate as interaction designers and from a research-through-design approach we have explored how children with disabilities in compulsory school age in Snoezelen can be engaged by interactivity, touch, and light.

The SID project includes three design ideals: "*Bodily engagement*", "*More than a button*", and "*Essence*". These have prior to our involvement been set up as part of Henrik Svarrer Larsen's ongoing research programme and are the basis for the SID-project[8].

In this article, we describe experiential qualities that have been indicated in the engagement between children, Snoezelen practitioners and designs[3]. Although, what is presented in this article comes from designing for the Snoezelen concept, we will argue that this knowledge can be used in other design contexts and use situations as well.

**Figure 1 Two Snoezelen rooms**

## 2. THEORETICAL FRAMEWORK

### 2.1 Design Ideals and Research-Through-Design

Research-through-design allows us to look at possible futures by creating changes in the world through design artefacts[6]. Redström[6] proposes *programme* as a way of framing the research explorations in research-through-design. Being engaged by interactivity, light, and touch is the programme for the design experiments conducted in the Snoezelen centres. Design experiments[6] are used to elucidate our programme based on empirical work. The empirical work comes from introducing our designs to people in the use context[2]. Bagalkot et. al[4] offers "design ideal" as a situated manifestation that connects the programme and the situational experiments. Within our programme of investigating touch in the interaction with tangible designs, three areas are central in the SID project[8]. Obviously, these are reflected in our work and are considered as our design ideals. The design ideals are "*bodily engagement*", "*more than a button*", and "*essence*"[7]. *Bodily engagement* refers to interacting with a system through the engagement and awareness of ones body. *More than a button* examines how interaction with design can be more than just digital on/off, but instead offers a gradually alternating feedback that happens co-located. *Essence* explores the opportunities of the design possessing the ability to recognize and change over time; thus, being recognizable, yet unpredictably.

### 2.2 Experiential Qualities and Aesthetics

Within the interaction design community, Löwgren and Stolterman[4] have argued how the identification and articulation of experiential qualities is useful for both design practitioners and design researchers. Experiential qualities provide transferable knowledge that can suggest conditions for good use relevant for both design practitioners and researchers[3]. With our research we aim at investigating how and when our designs contain qualities that encourages the children in Snoezelen to be engaged in our designs. Udsen and Jørgensen[9] discuss different approaches on aesthetics. As interaction designers, the notion of experience-based approach allows us to investigate subtle qualities that cannot necessarily be articulated by the user, yet still, influences the engagement and experience of the system[9]. With the techno-futuristic approach, Udsen and Jørgensen[9] argues how the engagement of the body in the interaction allows for haptic pleasures of technology; thus, adding new dimensions to the aesthetic experience.

Löwgren and Stolterman[3] identifiy five main areas of experiential qualities that will serve as a basis for the discussion of qualities we have encountered in our process. In this paper we will use qualities from the areas of *motivation* and *immediate sensation*.

## 3. METHOD AND DESIGNS

Research-through-design and participatory design have been the central approaches in the SID project. To do participatory design and understand the Snoezelen context we have been engaged with personnel and 25 children in three Snoezelen centres. Several of the children have a lack of language skills, which is why asking through prototypes and looking at actual interaction, allow us to understand how to meaningfully contribute to the Snoezelen practise.

When we entered the project several designs were already outlined. In the project, the designs are not possible product solutions, but are instead prototypes that facilitate the exploration of the design space. The designs were on different stages, but we have been a part of researching with, and iterating on, four of these designs. In practice, we have participated in the sketching and building process of the design, as well as taking the design to the centres for evaluation.

In this paper two of the designs will form the basis for the discussion. The designs are called *LivelyForm* and *LivelyButton* (figure 2):

*LivelyForm* reacts when it is being touched by closing and making LEDs light in different patterns. Removing your hand makes the design reopen. When the design remains untouched for a while it lures the user by subtle changes in the light.

*LivelyButton* is interactive and changing light glows through the fabric on the top. When touching it, two metal spirals start turning in the box; thus, making a perceptible waving movement and changes in the light. The sensitivity of the design can be adjusted to make the design interactable, without actually touching it, but just getting close to it.

The Snoezelen centres have been exploring and evaluating the designs. This has been the foundation for iterating on the designs and indicating experiential qualities.

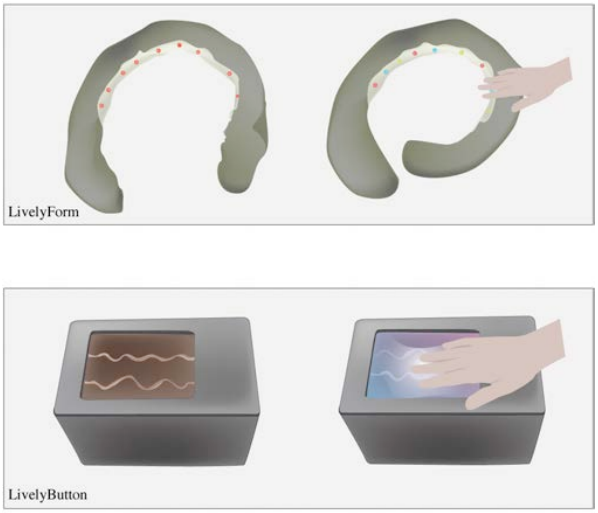


**Figure 2 Illustrations of the two designs (*LivelyButton* and *LivelyForm*)**

## 4. EMPIRICAL FINDINGS

### 4.1 LivelyForm

As we wished to learn about the luring element of *LivelyForm* we decided on experimenting with the light setting in the room. It seemed to have an impact on the children; especially, one of the boys showed greater awareness. His reaction on *LivelyForm* was to lift it up and place it around his neck. Furthermore, he pushed and pulled the design and tried to touch the diodes; however, the material that covers the diodes is not conductive, so it did not give him any feedback; see figure 3. There is a slight delay in the reaction from *LivelyForm*. This delay influences the understanding of the interactivity.

**Figure 3 A boy interacting with LivelyForm where the design does not react to touch**

## 4.2 LivelyButton

Our main purpose of *LivelyButton* was to explore the relevance of co-located feedback; action-reaction happening at the site of interaction. As designers, we expected *LivelyButton* to primarily address *hand-to-artefact*-interaction. In use we became aware of the diversity in ways the children interacted with the design; one boy put his cheek to the top of the box, a girl bit in the edge, and several children placed their faces closer to the box looking at the light; see figure 4. One of the boys has a reduced motor function. Nonetheless, he could still explore *LivelyButton*, as the sensitivity was adjusted to switch on the design if he was just close to it with his hands. Furthermore, he had difficulties focusing on the box in a bright room. When we moved to a darker room his interactions with *LivelyButton* became significantly more focused towards the design.

**Figure 4 A boy interacts with LivelyButton with his cheek**

One girl showed us that using the designs multiple times influenced her interaction with the design. After using *LivelyButton* several times, she reached out for it before it was even plugged in. She also intensified the pressure of her hand on the design. There is no intentional feature in the design to react to this behaviour, but when she pressed the surface harder, the metal spirals had difficulties turning; and the mechanic sound from the motor halted.

# 5. DISCUSSION

Our findings are all from our process with the Snoezelen practitioners and children, and do not provide any generalisable knowledge or theory. However, we wish to contribute to the collective knowledge base among interaction design practitioners and researchers alike by reflecting on and pointing out experiences from the children's interaction with the designs. Petersen[5] is, for instance, designing for playful experiences for co-located people in domestic contexts. As we are also not designing for task-solving, but for being engaged in the experience and interaction with tangible designs, the qualities we have investigated in this project could be explored in other projects, such as Petersen's[5] concept about collective and playful family history.

## 5.1 Bodily Engagement

*LivelyButton* has shown us that engaging bodily with the design is more than just using ones body to interact with the design. In the previous section about *LivelyButton* several examples were given on how the children sense their bodies by bringing the design close to them. This was also the case for a boy who was introduced to *LivelyForm*. He too, began the interaction by bringing the design close to his body. In the techno-futuristic approach on aesthetics, Udsen and Jørgensen[9] point to examples on bringing the haptic pleasure, bound to physical objects, into digital designs in order to open up for new aesthetic and emotional dimensions in the experience.

*LivelyButton* has shown diversity in the way the children are touching and engaging with the design. Nonetheless, all children seem to get an experience from the haptic interaction; thus, the design allows for several ways of touching and interacting with it; without losing qualities in the experience.

## 5.2 More than a Button

Löwgren and Stolterman[3] present the experiential quality *fluency*. He describes it as something that is more than on or off. This is in line with the design ideal *more than a button*. The girl increasing her hand's pressure on *LivelyButton*; thus, getting altered feedback, is an example of a fluid interaction that moves beyond on or off. With *LivelyButton* the way the light changes as a result of time will be explored, but there are yet many aspect of the gradual feedback to be investigated.

We have seen indications of the importance of the tight coupling in '*action-reaction*'. If one interacted with *LivelyButton* for a while it did not return to its luring mode instantly. Comparably, *LivelyForm* is quite slow in its reactions and movement. This pattern of reactions makes it harder for the children to experience that they are the ones controlling the design.

With *more than a button* we have also explored the qualities of the interactivity being co-located. The boy touching the light in *LivelyForm* without getting any feedback from the design paves the way for the question: How would the experience have been different if this action had caused a reaction from the design? The example of the girl biting in the edge of *LivelyButton* suggests some advantages of the designs being co-located. She gets direct feedback simply by acting.

## 5.3 Essence

Löwgren and Stolterman[3] point to *autonomy* as an experiential quality that allows the system to act on its own based on what inputs are accessible to it. The system's ability to choose its own means can, for instance, be seen in *LivelyForm's* behaviour of automatically opening when it is not being touched, and; thus, seeking to reach its goal. From an experience-based aesthetic approach, this subtlety can still be regarded as relevant in the experience of the interaction with the design. *LivelyButton* serves us with another example. The girl who made the motor unable to rotate, due to pressing it hard, gave a surprising feedback that also

gave an essence-like quality. Although she touched the design almost as before she now got both sonic and tactile feedback.

Löwgren and Stolterman[3] categorise *playability* and *seductivity* as qualities for motivation. *Playability* is a quality of the need to stay engaged with the design, whereas *seductivity* refers to the emotional and evolving relationship between user and design[3]. Although *playability* refers to the game-like qualities, the idea of "*just-one-more-time*" is interesting in the sense of, not forcing the children to stay engaged with the design, but the design motivating them to stay engaged. Some of this motivation comes from the seductive qualities in the establishment of relation between user and design. Whereas Löwgren and Stolterman use the notion of progression in the seductive quality, it seems in our case more relevant to think of it as process; a process that does not require improvement or continuity.

# 6. CONCLUSION

In this paper we have shown a variety of qualities in the aesthetic experience of tangible designs in Snoezelen. Working with three design ideals has proven useful as a frame for designing for our design programme about touch, light and engagement.

We have seen the importance of being able to explore designs close to ones body. *Bodily engagement* also showed how diversity in the way of touching and interacting with the design could give a relevant experience; especially, if the design is not used as we, as designers, would have imagined.

*More than a button* has suggested how co-located and gradual feedback in the interaction allows for an aesthetic experience and how the experiential quality of fluency seems relevant in our design space; however, an understandable coupling seems important.

*Essence* has given us indications for further investigation. The idea of interacting with the design in the same way but getting a different feedback and the idea of autonomy in the design as the subtle ability of the design to perform its own will seem relevant.

Our designs have been explored with practitioners and children from Snoezelen and it is difficult to claim that our findings are relevant to other contexts. However, we do believe that the qualities used in this paper can be relevant in other interaction design settings as well; especially in areas that focus on non-goal oriented play-like processes similar to those in Snoezelen.

# 7. ACKNOWLEDGEMENTS

We would like to thank everyone in the SID Project for letting us take part in this exciting and challenging project. Thanks to the children and their families and to the practitioners on the Snoezelen Centres. Especially, we would like to thank Henrik Svarrer Larsen for inviting us into the project and giving us this opportunity to grow as research and design students. Also, we would like to acknowledge Certec, FUB, and Furuboda for their role in the SID Project.

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# ROBOTICS AND AUTOMATION IN MODERN WORKPLACES

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## ABSTRACT
In this paper, I will describe the experiences of employees working in automated environments and express my concern on developing machine/technology dependency.

## Keywords
Automation, robotics, co-experience design.

## 1. INTRODUCTION
Many people are fascinated by technologies and the opportunities they give us in our daily life. The aim of this paper is to warn designers of the possible consequences of implementing technologies in every sphere of our life. The paper describes findings of the design specialization course "Exploring co-experience". The work is done by three IT Product Design Students at the University of Southern Denmark . The paper contains author's personal point of view in relation to findings.

## 2. CO-EXPERIENCE DESIGN
In January 2012 I took part in a design specialization course called "Exploring co-experience". This project is a part of "Sterilcentral Project" which is done in collaboration with five public hospitals in Denmark, Xperience Design Group of the University of Southern Denmark and Roboclaster - a Danish innovation network within robotics and automation. We focused on the sterile ward of the Sønderborg Hospital. One of our aims was to explore how staff at the sterilization ward would experience future automation and robots at their working place. In order to get a better understanding of what happens when automation and robots "come to power", our group visited two Danish factories. One of them was Hartmann, which is a producer of egg-boxes and another one was Sauer-Danfoss, which produces steering units. Both companies are highly automatized and also use robots in their production.

In general, both positive and negative reactions were expressed in relation to automation and implementation of robots at all working places. At the factories, attitudes of the interviewees can be described as more positive. However, it needs to be taken into consideration that interviewees at the factories were selected by the management of these factories, who favor automation.

From the employer's point of view automation is a positive phenomenon, since it reduces both the costs of production and of the final product. When machines and robots are in use, an employer does not need so many workers anymore, so by firing them, costs can be diminished. As the production in both Hartman and Sauer-Danfoss got more automatized, a lot of employees got fired. Sønderborg Municipality would like to introduce more automation at hospitals for the same reason: they would like to cut down their costs.

For factory employees who "survived" the automation, physical working conditions became better, because the amount of physical work was considerably reduced. These employees also found the new conditions more challenging and interesting, because their job changed to troubleshooting machine failures instead of just "pressing a button" on a machine.

However, there is also a downside of automation and employing robots in modern workplaces. For instance, a senior factory worker we interviewed said that there used to be more communication between employees when there were more of them and they were located not far from each other. He feels frustration because now they have fewer workers, more working press and less time for communication.

During our first visit of the serialization ward, we had made an attempt to understand the whole process of sterilization. This was done by using both interview with the chief nurse and by our observations. We've also mapped out the touch points of nurses in different areas. We got a lot of impressions from this visit, that could be used for achieving another goal we had set for us : to explore what kind of mock-ups are possible in early stages of designing co-experience. Our impressions were transformed into a mock-up that can be called guillotine.

Figure 1. Mock-up "guillotine"

This mock-up helped us to explore some ideas we had gotten during our observation of the whole sterilization process. We wondered what kind of feedback – visual, sound or tactile - would be the most appropriate when one nurse is about to receive instruments, for example, at the conveyor-belt.

Figure 2. A nurse is receiving a package at the conveyor belt.

We chose the "guillotine" mock-up, because it can be adjusted to show only hands of a nurse or only her head or both. We used the mock-up in our workshop with four nurses of the sterilization ward.

## 3. WORKSHOP AT THE STERILE WARD

A workshop we conducted consisted of the staff from the Sønderborg Hospital's sterile ward. This workshop was based on a future scenario which takes part in the "Sterilcentral Project", provided by PhD student Jesper Legaard Jensen and also briefly described below. We were aiming at finding out how the staff of the sterilization ward would feel like, when the process of serialization becomes more automated than now. Another aim for the workshop was the co-design of the working space.

The workshop was conducted by three students of the University of Southern Denmark. To create the workshop, we presented Jesper Legaard Jensen's concept of the star-shaped packaging station and a map of the future scenario that we also explained to the personnel during the workshop.. We used different cards when creating a mood-board of the future scenario and a simple sketch of the conveyor belt – this way we designed an ideal work station placement.

In order to understand future scenario, one needs to know about the present process of the serialization. Currently there are about twelve sterilizing nurses doing the job of sorting the tools out, setting them into the washing machine, checking, packing and setting tools into autoclay. During our visit to the serialization ward, we observed that at some points of this process they needed to communicate to each other or get a possibility for small-talk.

In the future scenario,the first person in the process - porter - can be eliminated, because there would be an automated delivery system. So, the tools are delivered automatically to the pre-wash area where they are sorted out and inspected by nurse. The next steps - receiving the tools after wash, inspecting and assembling and packaging can be all done by one person that is separated from the first person in the pre-wash area by a glass wall. The last step - autoclay - would be fully automated in the new scenario. The map of the new scenario can be seen here.

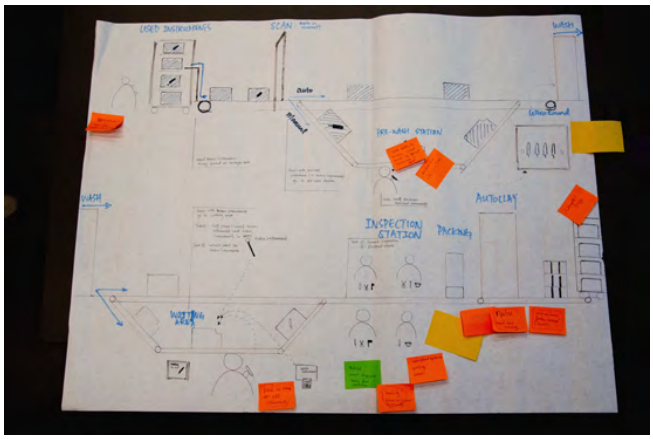


Figure 3. Future scenario map with comments of the personnel

Presented to this scenario, the staff expressed their fear towards the possibility of being fired. Indeed, about ten nurses would lose their job with the use of this new scenario.

Another concern was that if machinery takes over too many of their tasks, their job can become boring and not motivating.

Staff also said that they would miss the face-to-face communication, and that they would feel lonely. On the other hand, the staff was positive about the improved ergonomics at their working place, because the movements they would have to make during work would be taken to a minimum.

Currently, the sterilization ward at Sønderborg Hospital has a half-automated system, including software where staff can register a tool and track it throughout sterilization process. However, during our visit to the sterilization ward, the chief nurse said they had a failure of the system once and as a result of this failure all the work had to be stopped. In the proposed future scenario, the situation would not be improved: there would be a huge dependency on the system, which would mean that work cannot be done when the system is down.

I think that designers have to be very careful when designing systems like this. Ideally, the sterilization-process should be possible even if the system is down, because we are talking about the instruments that are used for operating patients.

In general, I think that any kind of technological development creates a society that is dependable on the machines and technology. We need to be very careful and think of the implications of the things we design, including ethic significance.

I have attempted to find some academic articles related to design of co-experience and the experiences with automation and robots.

I could not find any information with the discussion of the downsides of the automation and implementation of robots.

A striking example is the article "Robivie- IV: A robot enhances experience", where the authors discuss what characteristics a perfect robot should possess. It should be like a human, being able to remember people and express emotions. The authors have been aiming at creating an ubiquitous medium that gives some information about a particular experience just as web, newspapers

and TV do. However, the authors do not give any account about the feelings of people who have interacted with the robot.

In the *Robotica* magazine, some articles about robots used in the health care can be found. For example, Issue 2, 2010 is a special edition, titled *surgical Robotics: System Development,Application Study & Performance Analysis.*

In addition, an article on the similar topic is freely available online and called *Development of robotics for rehabilitation therapy: The Palo Alto VA/Stanford experience.* Neither this or one of the articles in Robotica give any account on what patients and health care personnel are feeling when concerning the use of robots and how they experience the use of technology. For example, it would be very interesting to find out, how the patients would react to finding out that they would be operated by a robot.

All in all, I think that many designers nowadays create more dependency on the new technologies without thinking carefully about the implications of their designs. I think we need to discuss the downsides of the new technologies along with their positive sides.

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# Re-reading String for Designing Interfaces in Animated Movies

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## ABSTRACT
In this paper, we address the current status of fictional interfaces in movies and their effects on population and developing technologies. While they carry no such intention, the unrealistic interaction scenes in the movies affect popular tendencies and therefore the technologic developments. This study is on the application of the "re-reading model in design", a design practice we have used in previous studies, on an everyday instrument, "string" with the aim of leading the animation artists to design more realistic interfaces without sacrificing from impressiveness.

## Keywords
Interaction Design, Design Practice, Animated Movie, Human Computer Interaction (HCI), Tangible User Interfaces (TUI's), Experimental design, Design Methods, Interaction Techniques.

## 1. INTRODUCTION
The futuristic interfaces designed for fiction movies hold many clues for what we may see in actual future interfaces. Yet, we examine these interfaces to evolve into more detailed and complex forms in each popular movie as opposed to researchers advocating simpler and more intuitive interfaces in real life [1, 2]. This conscious complexity in the movies has the goals of expressing the genius and mastery of the protagonist and enchanting the viewer with such talent. On the contrary, in real life the user isn't, or shouldn't be expected to be as skillful and experienced. Therefore this complexity tendency of movie interfaces causes us to have an unrealistic projection of the future [3].

It is more or less undeniable that the gestural user interfaces (GI's) are going to be a significant part of the future human life. In many futuristic interface examples we see in movies the protagonist successfully completes many complex operations with pre-learnt knowledge such as in GI's (*Johnny Mnemonic*, *Minority Report*), eye tracking user interfaces (UI's) (*Iron Man*), voice activated UI's (*Star Trek*), holographic UI's (*Avatar*), transparent UI's, adaptive UI's. Again we can observe the lack of feedback and predictability elements, together with physically exhausting interaction concepts. Such interfaces are called "audience interfaces" instead of user interfaces [4].

We can claim such unrealism, or usability mistakes of movie interfaces are not important as long as they fulfill the entertainment criteria. Eventually the way these interfaces and the scenes of their use are designed to serve the purposes of visibility, visual impressiveness and expression of the protagonists' talents. Likewise, we can overlook the technological inapplicability issues and see these as elements that push the technology market forward. Yet the lack of realism they have on the physical and cognitive ergonomics side brings up two major problems: Firstly they mislead the market demand into a visually satisfying but unrealistic direction and thus create a significant waste of research funds, to which we can exemplify Minority Report's interface designer John Underkoffler's efforts to launch the same interface to the market. Secondly they mislead the user beliefs as well; making them think working through such complex interfaces is a piece of cake and despise themselves for their lack of talent as soon as they get to interact with an unusual interface.

So, do these movie scenes of futuristic interactions, despite usually being designed by interface designers, have to be useless in order to be impressive? The answer would be yes, if we recognize these fictional interfaces as a part of the distant future, since it is commonly accepted that interface designs based on today's realistic technology are unimpressive. Yet we choose to believe that interfaces which satisfy the viewer visually and also illuminate the future of real life interfaces can be designed with the inspiration from timeless applications that have always been in our lives.

Yet, we know for a fact that current interaction design education doesn't encourage designers to create extremely futuristic and visually satisfying interface designs. We also believe that the existing inapplicable interface concepts in the movies are also caused by this fact. We think we have to take a new approach for this goal.

Obviously, in the light of the specifications above, our main perspective includes the movies that rely heavily on computer generated animation (CGA) such as *Avatar* and *District 9*. We believe that our concerns stated above will perish if the designers lead the process right while designing interfaces for CGA movies.

Departing from this suggestion, this paper questions what training process should the CGA artist fulfill in order to (1) make better designs all over, (2) giving the viewer a more realistic perspective as to what the future of interfaces might hold, (3) not sacrifice and even improve the impressiveness factor over the viewer while doing so.

## 2. RE-READING MODEL IN DESIGN FOR TRAINING ANIMATORS
We consider "re-reading in design" that we developed in our earlier studies, as an effective model for achieving the goal above.

Within a series of researches we conducted since 2001, we have suggested taking inspiration from formal solutions of past cultures might be a fruitful way to develop innovative ideas in the field of interactive media design. We name this method as "re-reading in design". In order to prove our hypothesis we have analyzed this method over Traditional Turkish Shadow Play [5], Turkish Miniature Art [6] and Traditional Turkish Calligraphy [7]. We can claim that we have put forward a series of realistic sources of inspiration that will produce significant benefits to interactive media design.

In the first research on Turkish Shadow Play we encountered four different screen and viewing setups as "two sided viewing", "playing without a screen", "spatial viewing" and "interaction between the image and the actor", and in the experimental studies we conducted with students, with the consideration of possible future technologies, we saw that unordinary design ideas may come out [5].

In the second research we applied on Traditional Turkish Miniature Art that we consider to be the ancestor of contemporary visual information design, we claimed that properties of this art such as "mapping", "scaling", "bonding diagrams", "symbolization", "framing", "separation" and "representation of separate spatial and temporal features together" can be useful sources of inspiration. We asked the interactive media design students to exploit these sources of inspiration and build innovative information design ideas using contemporary technology and subjects without imitating the style of miniature. We got the conclusion that unusual design ideas can be achieved by the students using this method [6].

In our third study over Traditional Turkish Calligraphy, we took inspiration from the methods and philosophy of this art that focuses on full body use, for digital interaction and we have witnessed once again that innovative solutions can be obtained for gestural interfaces that allow the use of natural body movements [7].

In the light of the positive results we got out of the studies above that are based on "re-reading in design" method, we have the courage to use this method on other subjects that we need inspiration. Our studies have led us to believe that, not only cultural methods from the past, but also our daily life habits can prove to be resourceful in finding inspiration to develop realistic and usable futuristic interface designs for CGA movies. We believe that an instrument we use with many different purposes, "string", which has not been studied previously in terms of interface design, can be a valid source of inspiration.

# 3. METHOD

## 3.1 Re-reading the String

We think that re-reading the string, an instrument that the humans have used for many different and complex purposes since pre-historic ages, is an effective case for training a CGA artist in the perspective of interaction design.

In order to understand the importance of the inspiration from string, we have to begin with observing its distinctive qualities:

*1. Bonding, 2. Lineation, 3. Modality, 4. Knotting, 5. Information design* [8].

The use of string has several advantages over any other instrument in design thinking. For example, the knots on the strings help us comprehend the fact that a line is composed of dots that are not perceivable when drawn on a paper. There are many ways to interact with a string, various knots, knitting and textures can be achieved, it can combine with other strings to produce a thicker one or dissolve to thinner ones. It is possible to manipulate the form of a string continuously and easily with hands as opposed to a line on paper or screen. Again, the string is spatial while a line on screen or paper is planar. This renders the string more open to randomness. Creating a lines form on screen or paper is more or less a conscious action while the string may take unexpected and unintentional forms. While the paper and screen have their own advantages, such features of the string bring up a spatial added value when taking inspiration. Simply playing with a piece of string is an inspiring action both with its form and use.

Therefore we consider design practices with the sting can give many inspirational leads to interaction possibilities. With the re-reading study above, we've derived such a design practice study in order to identify these inspirational points.

## 3.2 Design Practices on String with the Re-reading Method

With the perspective stated above; we consider two separate practices can be conducted in order to take inspiration from the string and help artists design better interfaces for CGA movies. We name these practices as *(1) awareness, (2) design scenario*.

The awareness practice is important for the CGA artists that are used to work with a computer or pen and paper to get familiar with working with strings. We believe that the result would be more effective should the artist begin with exploring the added values of string prior to addressing the design problem of this paper.

We propose various steps for this awareness practice:

First of all, the artist is supposed to explore the possibilities of exploiting the shifting form of the string in order to create a message with it. We believe this will help to achieve both a design constriction and an idea for a composition. Our goal in this unusual practice is to help the artist not only have some interface ideas but also expand his idea generation capacity.

Exploring the string requires playing with it in different ways. The first study should be on seeing how strings can be controlled and modified. Without a predefined goal, the artist should be given the opportunity to use and play with strings of different qualities

(material, thickness, length). This practice aims to help the artist explore various features of the string such as flexibility, transfiguration, tightness and how it can be separated into fibers.

After a brief exploration of interacting with a single string, a second similar study will be conducted with multiple strings in order to practice ties, weaves, nets and conjunctions. A final study will be made with strings using additional helpful instruments (weights, objects that can provide pivot points, pulleys) to observe qualities such as lifting, fastening, friction, cutting and separating.

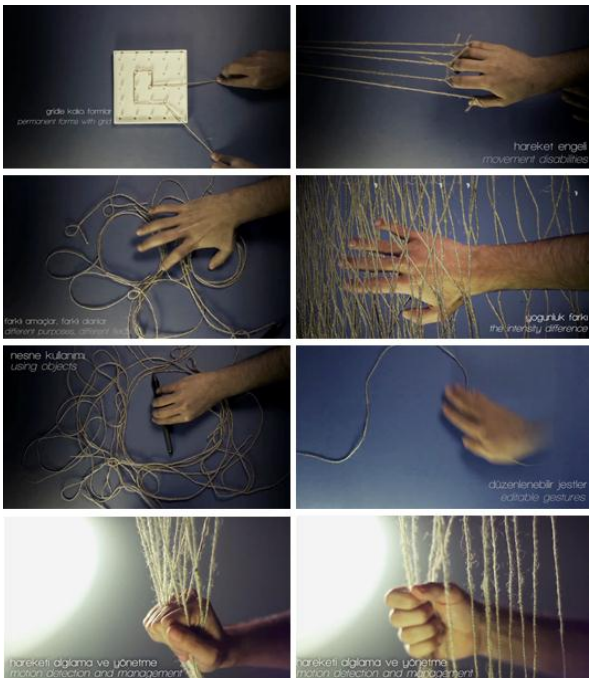


**Figure 1. Awareness practice on string.**

We think that as a result of these practices, many inspirational points from string can be achieved to design fictional interfaces that allow many interactional possibilities for CGA movies without conveying unrealistic or excessively complex methods.

In the second phase of practices, namely the design scenario, we are going to ask the CGA artist to design a futuristic but technologically realistic and meaningful interface to be used in an animated movie with the inspiration from the string. In the design scenario we expect the artist to use string's following properties: Transfiguration, Separation/Conjunction, Knot/Marking and Fastening.

Yet again we are going to ask said properties to be used only in controls that are needed in the scenario for which the interface is designed. Therefore, the artist is to predetermine which controls and other interactions can prove to add value to the fiction. We suggest the artist to put forward ideas on which interactions are meaningful or impressive for the viewer and which are needlessly complex or unidentifiable by the audience in the initial sketch of the scenario, to achieve our goal for a realistic interaction that will help enlighten the future.

According to this outline, the CGA artist that we studied with has written up an interface scenario for an animated movie and moved on to the project process.

The setting of the animated movie is as follows: In the times that the earth consisted of a single continent, a young and curious explorer who's used to travel to further lands, one day comes home only to find his village burnt down to ashes by evil forces. He prays the goddess *Aichatra* to give him supernatural powers so that he can end the villainy in the world and avenge his folk. The goddess asks the young explorer to steal the robes of ten most powerful wizards of the past from their graves and bring them to her. She separates the robes into their fibers and combines them into a magical staff that allows the explorer to find his way to the evil forces. And so a fantastic journey begins.

A brief video that shows the use of the interface can be viewed via this link:

http://www.youtube.com/watch?v=ikUTKDYb9DA&feature=youtu.be

## 4. OUTCOMES

At the end of the process we believe we have achieved creative ideas that can bring light to the future of interaction even if they are based on imaginary/futuristic technologies and have little applicability as of today.

The interface that is a result of our design practice is used by the protagonist of an animated movie to explore the environment in addition to transforming into a transport and a combat device. Within these functions it embodied many commands that can be resourceful for future entertainment interfaces. We evaluated these functions according to the features we have defined, in the perspective of futuristic and functionality factors.

*Transfiguration:* The fact that the form of the interface device can be changed according to the needed function is a solution to the problem of using a device of a single set ergonomic properties for various functions someone which are inappropriate or do not serve a purpose other than impressing the audience with visual effects. Also, most entertainment interface devices of today are designed in a static form and more often than not they are either used for inappropriate functions that don't refer to the commands they give, or require additional devices such as driving wheels, weapons and musical instruments for every little separate function. Below picture shows the designed interface used for exploration and combat functions. This way the device becomes more impressive and gets more air in the movie in harmony with the scene without falling to redundant actions.

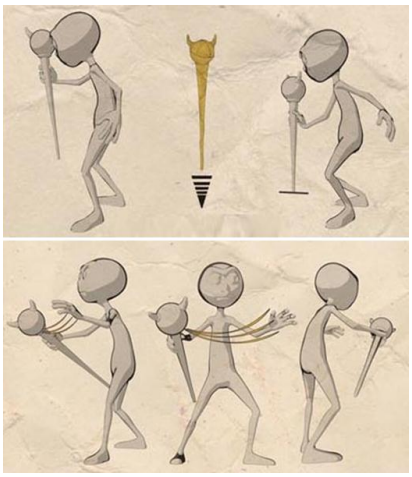

**Figure 2. Exploration and combat modes of the interface device.**

*Separation/Conjunction:* Most existing interface devices are decorated with lots of buttons and sticks to perform separate functions simultaneously. But as these extensions do not change according to the application they create physical and cognitive complexity in addition to taking up significant space even when not used, not to mention there are situations their numbers are considered not enough. The artist has designed an interface that can bring up additional control extensions by separating into thin fibers like a rope does, whenever necessary and recombine into a single body when additional extensions are not needed. Apart from addressing a problem in the current interfaces, this feature both provides better visibility and directivity for the audience and allows impressive visual effects.

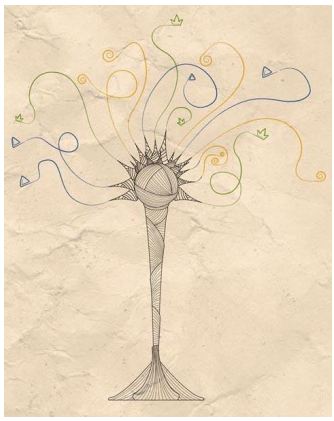

**Figure 3. Features inspired from string's separation into fibers.**

*Knot/Marking:* The futuristic interface in the project produces signs and marks over its display and control extensions to define their functions according to the application used so that the control is more predictable and the learning curve is shorter. This makes more complex control layouts and functions more believable and easier to understand for the audience. This feature also addresses a problem in the current interface devices which have no predictability clues for each changing function and thus make the users need to memorize many complicated interactions for each application they use. This cognitive problem often causes the users to refrain from using unknown applications.

**Figure 4. Marks indicating control functions.**

*Fastening:* With the inspiration from the string, we believe that physical interfaces can be designed to use the advantages of physical interaction with other objects apart from the users, whereas current technological and productional problems limit such possibilities. Many interface devices connect to other digital devices only with 3rd party apparatus for tasks such as variable functions and battery charging. In this project, the chosen flexible materials allow the interface to be fixated on the ground, body parts, or other non-digital objects in order to identify them, carry them, and even use their stability thus give the interface new uses. This also allows the interface to be used in scenes of the animated movie without taking the main focus and replacing some other instruments that the protagonist needs throughout his adventures.

## 5. CONCLUSION

The subject of the study has been useful not only for designing impressive and realistic interfaces for animated movies, but also for shedding light upon functional possibilities on future interfaces. We believe it is a positive step towards overcoming current restrictions of interface technologies with the use of unusual materials. In the light of this study, we can foresee that the future of interface device technologies will tend to have variable functions and universal compatibility.

The string which is an instrument the humanity has been interacting for ages and still being used in many diverse areas in this age of technology can provide inspirational points for future interfaces beyond expectations. Aside from the fact that people are familiar with the string due to its uses in daily life, its properties bring up various functions that need to be further explored. In this study we chose to inspire from the most basic attributes of the string, but it has many other and more complex uses out there that can provide novel outcomes, waiting to be explored.

Most significant outcomes of the project developed with the inspiration of string is cognitive, physical and ergonomic adaptability, which already are some of the most used properties of the string throughout the history. The futuristic requirements of a fictional animated movie allow us to look for solutions in unconventional areas for problems, in this case, of interfaces that provide control for multiple applications. The string, with its many different uses in daily life, gives us a good point of inspiration for such purpose.

Another significant novelty is beneath the outcomes in the compatibility section. We believe that, once flexible structure of the string that we interact with other objects with ease is applied to physical interfaces; it will bring many different uses to interfaces.

Researching other materials than string, that the designers can take inspiration from, for futuristic interfaces will not only benefit the movie industry but also provide motivation for future interface technologies.

We believe that the design practices we derived by re-reading the use of string may prove to be a valuable alternative to current idea generation methods for purposes of futuristic interface designs.

## 6. ACKNOWLEDGMENTS

Our thanks to Gökalp Gönen who has developed this project using our method and E. Gökçe Çimen for proof-reading.

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# Between participants, props and stage: Eliciting insights through interaction

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## ABSTRACT

How can we develop innovative concepts? The purpose of this paper is to investigate how generative prototype sessions can elicit so-called tacit and latent knowledge from participants through interaction and play. To illustrate this, a session from the design process will be described along with a brief take on current theories. It is discussed how practical tools and methods along with the dynamics occurring during such a session can translate actor knowledge to become useful throughout a the entire design process. The paper concludes that knowledge gained from generative prototype sessions is an indiscernible blend of different types of knowledge, but that tacit and latent constitutes an important part.

## KEYWORDS

Design research, co-creation, staging, generative prototypes, knowledge, product development.

## 1. INTRODUCTION

The design case for this project is to develop a new concept for fire fighters, ensuring effective and safe operations in fire and smoke. It is part of a master thesis project carried out at The Technical University of Denmark, Design & Innovation. Actor Network Theory is used as the overall methodological framework for this project to analyse interaction.

### 1.1 Theoretical basis

To design more innovative future products, it is necessary to reach a deeper knowledge within the relevant actors [7]. This so called tacit and latent knowledge contains what the user knows, feels and dreams [11]. It is proposed that tacit and latent knowledge could be reached through *generative methods*. Figure 1, illustrates how different research methods reveal different levels of knowledge. So, to create innovative concepts, generative sessions seem to be an interesting method, with artefacts, henceforth called *props*, needed to facilitate a generative behaviour. It is furthermore indicated that it is far more complex than illustrated above how the different types of knowledge interact [8].

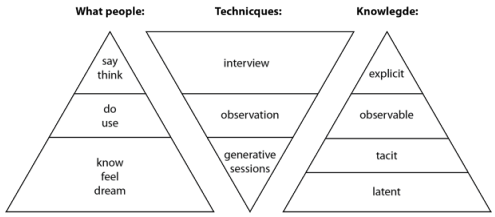


**Figure 1: The different types of knowledge and techniques, adapted from Visser et al [9].**

We have found that it could be promising to use *prototyping* as a generative prop in generative sessions, as it is argued that the interaction between *prototypes* and relevant actors (e.g. users) can be used as a tool to express subconscious knowledge and emotions [10]. These prototypes are defined as *generative prototypes*, and have to be created from different props by relevant actors. We call this combination of session and prototypes, a *generative prototypes session*.

Such *sessions* have to be conducted with participation from relevant actors, which is in line with the perception that users (relevant actors) should become active co-creators in the design process, rather than take a more traditional passive and reactive position as sources of knowledge [9].

*Enactment* of *generative prototypes* can be used for further revealing and envisioning the knowledge related to the future [4]. It is argued that knowledge is based on experiences, which are determined by the past, but contains wishes for the future [9]. Thereby, it becomes possible to experiment with future needs through enactment. As such, a prototype can be perceived as an artefact that lets the participant convey future experiences.

A *generative session* does not become generative and the participants do not become co-creators by themselves. *Staging* is a reflective way to describe the interaction between a stage (room), participants and props through different activities. Users or actors are experts on their own practice so designers have to *set the stage* for this knowledge to be revealed [3].

Therefore, it becomes central to apply tools in a generative session, to let the participants take responsibility and express their knowledge and experiences. These factors can, to some extent, be controlled by the design of the session [1] and hereby *staging*.

To sum up, *generative prototype session* should be a method to reveal tacit and latent knowledge creating a basis for innovative concepts. This is done both through creation and enactment of the

generated prototypes. Additionally, props should be added together with *activities* to *set the stage* of the session.

The following is a description of an attempt to stage and conduct a generative prototype session. The session was based on the described theory and principles to obtain tacit and latent knowledge from the fire fighters about their mask and water nozzle.

## 1.2 Staging ideas and knowledge

The session focused on generating ideas, thereby reflecting the current phase of our design process. The overall goal was to obtain tacit and latent knowledge through these ideas. The session was planned to *inspire,* then *create* and finally *enact*.

To make the session generative and support interaction, different props were developed.

Initially, a short introduction was given about the session and the six participating fire fighters were divided into two groups, with one designer in each team to facilitate.

### *1.2.1 The stage*

A high table in the garage of the fire station was chosen as the stage for the session. From our experience, standing up in workshops and meetings makes it less likely to dwell or be passive. The garage was also chosen, as it was a more natural stage for the fire fighters associated with serious work and maintenance of equipment.

### *1.2.2 Idea cards*

To inspire the fire fighters, *idea cards* were created. These represented small drawings from one of our brainstorms. They were intended as props to initiate interaction and assist dialogue between the participants and other props. The cards were meant to create an atmosphere, where wild ideas were allowed, as some of the cards contained unfeasible and funny ideas.

**Picture 1: Idea cards in use**

To get things started, each team was asked to take a look at the *idea cards* for inspiration, if necessary, and choose 2-4 principles and conceptual ideas. These ideas should be added to the premade *basic shapes* to kick-start the prototyping.

The *idea cards* definitely interacted with the participants as intended, to kick-start discussion. Between us, it was discussed if the cards would hinder the participants in developing their own ideas. This seemed not to be the case, and the participants only used them as starting points, perhaps due to the more wild ideas included in the set.

### *1.2.3 Basic shapes*

In an earlier session, it had become evident that the fire fighters were not likely to interact with given material on their own. It can be quite demanding to ask participants to be creative and build

**Picture 2: Example of a basic shape of a breathing apparatus**

from scratch. Semi-finished prototypes invites to participation [9] and could therefore be used as a principle to obtain co-creation and future possibilities [5]. This argues for creating material for prototyping that have prebuild elements or structures that can be altered in an easy manner.

Therefore, *basic shapes* (semi-finished prototypes) of existing equipment were created in foam and cardboard. This should give the participants a 'head start' in the prototyping. The materials for the prebuild *basic shapes* were white and simple, to underline that the final prototypes should be kept primitive. The materials given to alter the *basic shapes* were markers, foam, foam cardboard, elastic bands and various items to stick elements together.

The participants used the *basic shapes* of nozzles and masks to enact how components and added functionalities work. Difficulties arose when it came to assembling the representations and the materials into prototypes, even though they had good ideas. In this situation, we took the role of assembling the *basic shapes* and *props* under guidance of the participants. This was done with as little interference from our side as possible, so as to not affect the original ideas of the participants.

We believe, that it was helpful to use *basic shapes*, and this indeed helped start the prototyping, as it has been stated in theory. Moreover, the *idea cards* were a helpful tool to let the participants interact with the *basic shapes*. The discussions while creating prototypes highlighted important points and problem areas of the fire fighters. This gave valuable knowledge and criticism of our ideas and the fire fighters' work in general.

The generated prototypes now contained knowledge from the participants as they were built on their command. By adding the prototype props, the basic shapes were altered, adding new knowledge while creating the prototypes. In theory, the prototypes should contain tacit and latent knowledge. The problem is that this kind of knowledge is unspoken. The generated material had to be analysed to extract the explicit knowledge. In our perception it is difficult and would be based on *our* interpretations, which may lead to uncertain results. This is why enactment was introduced as an activity of the session.

### *1.2.4 Enactment*

The second and last part of the session was meant as a presentation of the different prototypes to the other team. A fire fighter, who had been rather quiet during the first part of the session, took the nozzle prototype and started presenting. On his own, he started enacting the prototype, illustrating its use. It was interesting to see how the participants acted differently and started interacting by themselves. Through this interaction, they showed what support they needed in their work.

**Picture 3: Enactment of a prototype representing a mask**

The enactment of the generated prototypes helped create interaction. Moreover, this was completely self-propelled. This led us to take on the role as observers. We argue that enactment is easy to do with participants. Moreover, it helps to reassemble the context and start a discussion. The problem with the enactment might be that it is very dependent on the previously generated prototypes. The dynamics within the enactment are interesting, since it allowed the knowledge embedded in the prototypes to become articulated. The generated prototypes can therefore be seen as translators for knowledge. Moreover, an enacted prototype helps articulate the embedded knowledge, through activation of dynamics between participants and props.

The session ended with thanking the participants and explaining how the results of the session was intended to be used as input for the further design process.

## 1.3 Knowledge transfer

The reason for having these generative sessions is to transform knowledge from the user into a final design. This will be illustrated through an example from the session. Both teams, independently of each other, had a focus on a nozzle for one-handed operation:

*"Sometimes you hold, for instance, a ceiling tile […] then you need to let go and turn on the water. That is annoying. […] If you make a trigger, here, [to give one-handed operation] it would be brilliant."* – Session participant 1

*"Then you could think it further and make a switch, like this, that changes the water beam [all with one hand]. When you are lying [on the ground], you could change everything with the other hand free to support you."* – Session participant 2

Back at the office the statements and observation from video were processed. The knowledge was put on post-its and added to an *affinity diagram* [6]. Here, it became clear that this particular expression conflicted with knowledge from previous interviews. It had been expressed that they did not need their hands free to do other stuff. But through the sessions this latent need was articulated.

The knowledge from the example above was translated into the design process and resulted in placing a thermal camera in the mask instead of carrying it in the hands as they do presently.

# 2. Dynamics in knowledge

In this part, it will be discussed how knowledge can be a result of the interplay between participants, props and the staging. We will unfold how props translate into prototypes as shared knowledge.

When talking about translating knowledge from sessions to design process, it would be preferred that the knowledge would stay intact and unaltered. We will argue that artefacts that translate knowledge with little or no disturbance, should behave as intermediaries. We have adopted the framework of intermediary objects from Boujut and Blanco [2], to describe the process from prop to prototype. These objects, will have the ability mediate, translate and represent knowledge from participants into the design process.

We will argue that our props act as *boundary objects* and are *ambiguous*. Thereby, a prop that enters a *stage* both ties the acting together, but also points out the differences between the participants. The ambiguous element of props are linked to negotiations through the participants' different interpretations of the artefact and its script. Thereby, *props* must be perceived as complex *mediators* as they enter the stage. But these mediator props, becomes artefacts that could be defined as objects of negotiation within the creation. This seems to support the eliciting of knowledge.

We will argue, based on the case that the creation of the shared representations of knowledge, a prototype, happens through negotiations initiated by the ambiguity of the props. Through negotiations, knowledge, participants and props are mediated towards a common understanding represented by the production of a prototype. We will argue that the negotiation create *disambiguation* [2] in relation to the elicited knowledge. Moreover, artefacts are an externalisation of knowledge [2, 8], and thereby translates implicit knowledge to an explicit state. This seems to leave the generated prototypes and the process as a true, shared representation, which define the network between the actors. Clearly this is a mediation of knowledge and an *alignment* of the *temporal actor network* within the session. We will therefore argue that the complex ambiguous props are interpreted and negotiated into a shared knowledge representations, as prototypes, through mediation and knowledge conversions [8]. Thereby, it could be argued that props as mediators are translated into intermediary objects and might end as stabile intermediaries within the session itself. We will argue that this process based on intermediary objects creates dialogues that elicit important and implicit knowledge suitable for the design process.

After the session, the generated prototypes are translated into the design process. We have experienced that the prototypes through this translation again becomes uncertain mediators of knowledge. This could be explained by perceiving the generative prototypes to only be a shared representation in form of the relations they create within the session as a temporal actor network. The translation seems to change the generative prototypes into strong mediators. As such, we believe that it is too uncertain to interpret the prototypes themselves outside the *temporal actor network* of the session they were created in.

As we found, the generated prototypes acts as mediators once taken out of the temporal actor network, other methods had to be used to translate knowledge from the session to the design process. We will argue that our video recordings, if done impartially, preserved the session and could therefore also be seen as *intermediary object* [12], even when taken out of the network. The video was co-reviewed and turned into post-its to form an Affinity Diagram. Through these negotiations this diagram could also be defined as an intermediary object. We have found these methods suitable for translating knowledge from sessions into the design process while preserving the meaning of the knowledge.

The interesting thing with the generative session is that it had not just revealed tacit and latent knowledge. We experienced that all types of knowledge was revealed. One explanation is that the session consisted of more than just generative methods. While

participants created they also discussed and for this, the enactment was an important tool. Thereby, knowledge was a result of interactions based on articulations, observations and creation of prototypes. We believe it was important for the staging of the session to apply a combination of methods. A generative session can then deliver all kinds of knowledge.

We have to distinguish between the types of knowledge to create innovative solutions since only tacit and latent knowledge can do so [5]. But in our case it is difficult, maybe even impossible, to distinguish between them. It is described that these different types of knowledge are created through interaction between tacit and explicit knowledge [8]. Therefore all kinds of knowledge are needed and valuable.

It is clear that tacit knowledge is indeed useful. However, is it useful without explicit knowledge? It seems obvious that explicit knowledge is as important to understand as implicit knowledge. But the roles of the knowledge might be different. Explicit knowledge creates a foundation for understanding implicit knowledge. Whereas, implicit knowledge can create innovation. Obviously, the implicit needs a foundation to be turned into a design. Perhaps it is not tacit knowledge alone that creates innovative results, but a holistic and detailed understanding of the participants and their context. Generative methods can contribute to deliver these last pieces to the puzzle as shown in Figure 2.

## 3. Conclusion

As a design method, the generative prototype session provided valuable knowledge in relation to the design process. Moreover, we believe that this knowledge could not have been revealed by interviews alone. Using generative props to create representative prototypes was a suitable method for revealing tacit and latent knowledge needed innovations.

The used *props*, *idea cards* and *basic shapes* (semi-finished prototypes) ensured dynamic session conduction, even though it was still difficult for the fire fighters to create the prototypes themselves. Enacting the prototypes seemed to be the most valuable tool, enabling the participants to articulate tacit and latent knowledge trough interaction.

The props should act as *boundary objects*, thereby creating a point of relation for the interaction between participants and designers.

We will argue that the ambiguous element is central for props to act as objects for negotiations. Without this machinery, mediation might never happen. Moreover, the negotiations translate implicit knowledge to an explicit state. Finally, the output, the generated prototypes, can be perceived as intermediaries as long they are in the temporal network of the session. Here one have to notice that, even though a translation has happened, the described artefacts are still boundary objects that binds the acting together. In other words, the translation of knowledge seems to happen within or together with the translation of the boundary object from a mediator to intermediaries through intermediary objects.

The creation of generative prototypes can, as they are intermediary objects, mediate, translate and elicit knowledge. Dealing with these intermediary objects, it becomes possible to translate the tacit and latent knowledge from participants into the design process with little interference.

One has to be aware of that all types of knowledge will be revealed in a generative session. We believe that all types of knowledge should be combined and processed to create an innovative and holistic concept. For the purpose of eliciting actor insights, generative prototype sessions are a suitable approach.

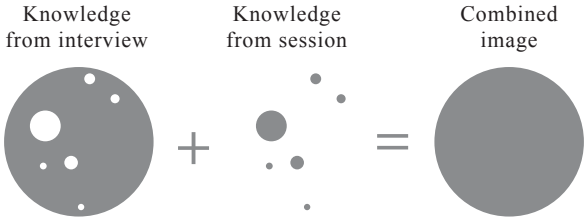


**Figure 2: Innovation comes from creating a combined and ideally holistic knowledge image**

## 4. Acknowledgements

First and most important, we would like to thank the team of fire fighters at Gentofte Fire Station (Falck) for their willingness and devotion to participating in the project. Without them, the project would not have obtained its value. Secondly, we would address a thank you to the TempoS project for support.

## 5. Further work

The final thesis report covering the entire development process and further discussions can be found at the DTU ORBIT webpage, by searching for our names at http://orbit.dtu.dk/. (Expected available from April 2012)

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# The Living Area: user studies and concept design

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## ABSTRACT

The city of Malmö is involved in Periphèria, an innovation project funded by the European Union, which focuses on the "Stråket" (the path) project that aims to enhance public spaces in the neighbourhood of Rosengård. The work presented in this paper is part of a student group project within the Stråket project and focuses on a specific public space in Rosengård called the 'activity area'. The aim of this student project was to create a new public meeting place by exploring how technology can be intertwined with traditional ideas to engage social play at this activity area. We focused on young people with the most important target group being young women 16 to 24 years old. Data from user studies was analysed to determine user needs and use qualities, which is the first contribution of this paper. The second contribution of this paper is a novel design concept called a 'Living Area'. This 'Living Area' idea was viewed as the big picture with philosophical meaning and is more theoretical in foundation. For a more practical concept we focused on one possible aspect of the 'Living Area' called a "Shadow Play" activity. A simple implementation of "Shadow Play" was made which allowed individuals to 'play' with a projection that looked like a shadow; the exception was that this projected shadow frowned when the user did not play with it for a few seconds but smiled again when play resumed. Shadow Play was tested and results showed that people of all ages and gender enjoyed playing with their shadow and said they would definitely like to have an activity like that in the activity area. From these results the main argument of this paper is formed, which is; the Living Area concept and the Shadow Play activity are novel and promising ideas for interactive play in community activity areas.

## Keywords

User studies, living area, use qualities, shadow play.

## 1. INTRODUCTION

Rosengård is a community in Malmö that has become infamous for the number of riots (Jashari, Hallin, Listerborn, & Popoola, 2010) and the creation of public places or activity areas has been found to play a vital role in the social life of communities offering many benefits (Worpole & Knox, 2008). The main problem addressed in this paper is the creation of a new public place, called an 'activity area', in Rosengård by exploring how technology can be intertwined with what is familiar and engage play.

To investigate this problem a 7 week project was given to a group of Interaction Design masters students. There have been many definitions of Interaction Design (Löwgren, 2007), however, the main parts of the Interaction Design process are user studies, concept design and product creation. In this paper we first present the user studies done for this project; the analysis of the findings and then, as a result the concept design, the decisions made and initial prototyping.

In Interaction Design, ethnography has been explored as part of the user studies process as far back as the early 1980's (Suchman, 1983). For this project, it is clear that the effectiveness of the activity area depends on the people using it and as such ethnography methods were an important consideration. There are many ethnographic methods (Blomberg & Burrell, 2009). The short time frame for this project allowed no planning of major ethnographic studies. Instead, simpler and shorter term techniques were used. Nevertheless, sufficient data was gathered for analysis which allowed the determination of target users' needs and their use qualities. Users' needs are requirements from the users' perspectives and by analysis of these needs the use qualities are derived and the designers' perspective is formed. Use qualities are guidelines to the designer in understanding what needs to be done in the process and enable planning of the process in a way that leads to good products (Löwgren & Stolterman, Thoughtful interaction design: A design perspective on information technology, 2004). The target users' needs and use qualities are presented here and is the first main contribution of this paper and the foundation for the concept design process. In the concept design process of this project several Interaction Design topics were considered including embodied interaction, performing perception, place/space specific computing and democratizing innovation. These technical topics were considered with the main aim in mind of intertwining the familiar and traditional to engage play. Many group brainstorm sessions resulted in a novel concept which forms the second main contribution of this paper to the research field, and the idea for a 'Living Area'.

## 2. USER STUDIES: NEEDS AND QUALITIES

Ideally user studies are done in the data gathering process and then from these results, concepts are made and implemented. In this project, however, direct contact with the target users, girls 16-24, proved to be futile. All the information initially available about the target group was acquired from field work documentation given to us by the stakeholders, Malmö Stad, including interviews and the results of workshops. As the designers, we made great efforts to learn more about the target user group both directly and from different perspectives. Observations were made by regularly visiting the Rosengård activity area and its environs and by using the fly-on-the-wall technique to observe people and locations. Interviews were done with professionals who worked in Rosengård and were also knowledgeable about its history, culture, education and free time activities. We also met at intervals with representatives from the stakeholders in the project, Malmö Stad. Furthermore we held workshops to give us direct contact with the target users; however, they were only possible later in the design process and were used to get feedback on concepts rather than initial data gathering. From this fieldwork we determined there were 3 user groups (1) girls between 16-24 (2) Malmö Stad and (3) the parents of the girls. This paper focuses on group (1) – the girls; however, for future real life implementation, it is important to consider all users. Further analysis of the fieldwork data gave the main needs of the user groups as shown in Figure 1.

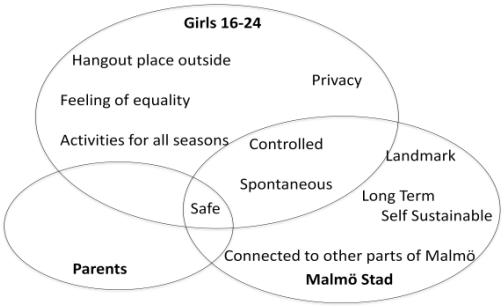


**Figure 1: Target users and needs**

It is important to note that the needs shown in Figure 1 are the main ones found based on our work and upon which we chose to focus in this paper. Different terminologies can be used to describe these needs and other needs may also exist. We focused only on the main target user group of girls.

Hangout place outside: We learnt that due to the small sizes of most homes in Rosengård, it is usually difficult to have several people over. Young people and young girls in this area, therefore, preferred to meet with friends somewhere outside of their home. Privacy: Since privacy at home was not available due to space restrictions, we learnt that while young girls wanted a hangout place outside, they also wanted a certain level of privacy so that they could chat with friends. Feeling of equality: Currently in Rosengård, most outdoor activities cater to young boys. In the interviews we learnt that young girls wanted a private place outdoor where they could feel like equals without domination of the area by young men. Activities for all seasons: Due to big seasonal and weather changes in Malmö, girls need an activity area that they can rely on and so ensure its use and success. Safety: this is a need for all target user groups but especially parents. Young girls' use of an outdoor activity area can be restricted without parental consent and so parents need a safe place for their daughters. Controlled and Spontaneous events: Malmö Stad will need to use the activity area for some controlled and planned community events such as markets. Young people also need spontaneous events to enjoy their free time.

From the user needs, further analysis was done to derive use qualities and the main ones are shown in Figure 2.

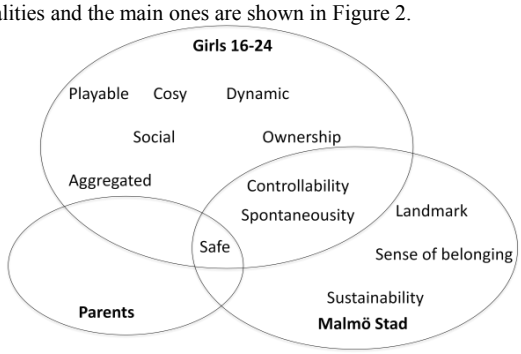


**Figure 2: target users and use qualities**

Similar to the needs, different terminologies and more use qualities can exist. Based on our fieldwork however we present the main use qualities for the girls' user group.

Playable: In relation to the need for an outdoor hangout place we learnt that something important to target group of girls is to have fun with friends by 'play'. This included favourite activities such as dancing and singing. Cosy: It was also important to the girls to have a feeling of cosiness in an outdoor meeting area. Dynamic: This means adapting to user needs and qualities over time and not remaining static. This is necessary to keep the interest of the target group over time and not only in the beginning. This quality should be integrated in the hangout place and also relates to the need of Malmö Stad for something self-sustainable and long term. Social: This relates to the need to feel connected to other parts of Malmö and the girls wanting a place to socialize with friends. Ownership: This quality means that the target girls feel, to an extent, that they are the owners of the activity area. This quality is important to motivate the girls to go to and even feel like caretakers of the activity space and it relates to the need for equality and, in some ways, safety. Aggregated: this means that the activity area itself and also the activities within are a collective representation of the target users and not of a particular group or individual. This feeling of collectivity relates to the need for equality and connectedness. Safe, controllability and spontaneous are self-explanatory as they are the feelings related directly to the needs stated.

The user needs and use qualities we present here are the first contribution of this paper to the field of research because it forms a framework or guideline for future design projects focusing on young girls in Rosengård.

# 3. CONCEPT DESIGN: THE LIVING AREA

Based on the defined user needs and use qualities, one main concept for further development, called the 'Living Area', was selected. Inspirations for the Living Area concept came from (1) "fuehlometer' ('feel-o-meter') that uses smile detection in a physical location to reflect a mood via a large smiley face sculpture (Wilhelmer, von Bismarck, & Maus, 2008) and (2) a mood-reading billboard for advertising called Jell-O's 'Pudding Face' which uses online input via Twitter to make a face on the ad smile or frown (huffingtonpost, 2011). From these inspirations, the mood of people either in a physical location or through online interaction is combined to output a facial expression that represents a collective mood. In this novel concept, the idea of something being alive and feeling moods is intertwined with the idea of creating interaction with and in the activity area using new technology. Furthermore, the Living Area provokes a philosophical approach of designing a public area as a living organism**.** One traditional metaphor for this idea is the digital pet game 'Tamagotchi' which was successful in giving a digital object "life" and forming attachments with the user.

At this stage in the design process a workshop was conducted with Radio RGRA. This workshop focused on getting feedback about users' interest in affecting the mood of a place as well as the impact of the mood of a place on users. A card sorting technique was used and pictures of the abovementioned inspirations presented. Results validated users' interest in the Living Area concept.

## 3.1 Living Area Inputs

The inputs of this Living Area concept include both digital and physical factors. Physical inputs refer to a combination of physical interactions with or physical presence in the activity area. Examples of physical inputs include statistics of physical and online visits to the activity area over time and other forms of mood/face/voice detection of users in the area. In traditional terms people's physical presence and activity in a place affects both the mood of the individual and others present. The Living Area concept provokes thoughts on translating this familiar experience to the mood of a specific place. This raises the question of

whether people determine the mood of a place or if the mood of a place determines the people present. Digital inputs refer to online interactions with or an online presence in the activity area. Digital inputs include interactions with representations of the activity area in social media such as a Facebook page; also online searches and website hits about the activity area and possibly even some form of smart phone app for information about and mobile access to the activity area. The options for digital inputs are varied and have not been developed further in this paper but are important considerations. By digital inputs, persons who cannot be physically present in the activity area can still affect the mood of the area.

## 3.2 Living Area Outputs

The outputs of the Living Area can be viewed as subtle or explicit. Explicit outputs refer to direct and obvious indications of the mood of the living area. Examples of explicit outputs include statistics related to the Living Area such as the number of physical visits and online hits; digital displays that show a distinct mood such as a smile or even music and tones played in the park or online that is already synonymous with a feeling. This relates to the field of music and mood (Murrock & Clark, 2005). The idea of the mood of a place is not traditional and no previous work was found on the mood of a public activity area. The explicit output is therefore important to bring the idea across effectively and obviously to the users. Subtle outputs refer to indications of the mood of the activity area that are not as obvious and more subjective in nature. Subtle ways to indicate and affect mood has foundations in other fields such as colour therapy (Wills, 1993) and light therapy for mood enhancements (Golden, et al., 2005). This is also intertwined with traditional subtle indications of mood such as the colour variations of a mood ring. Subtle output is important in order to not bombard users with only explicit forms of output and allow some user subjectivity and room for their own interpretations.

## 3.3 Living Area Applications with focus on 'Shadow Play'

The previous sections show that both inputs and outputs of the Living Area cover a wide range of possibilities and need for further development. Due to the short time frame for this project it was not possible to consider all combinations and developments of inputs and outputs. It was decided therefore to choose a sub-concept to our main Living Area concept for further development, define its input and output, and show how it can be used to represent and affect the mood of an area. The Shadow Play sub-concept was chosen; it is based on the traditional play with a shadow but intertwined with the use qualities defined and implemented using new technology to form a digitally playable shadow. This digital shadow represents the mood and life of the Living Area itself. Related previous work on shadows for play is shadow monsters (Worthington, 2005) which found that the traditional shadow with which everyone is already familiar can be combined with new technology to generate playfulness and enjoyment.

### *3.3.1 How Shadow Play works*

How the shadow works in practice is that it will always exist in a specific area in the activity area. Technically, it can be a digital projection on a wall or digital screen. For safety, equipment in the construction of the Shadow Play should not be easily broken or stolen. The idea is that when someone is not playing with the shadow its mood will take the form of the aggregated mood of the Living Area. When someone plays with the shadow they will see this digitally modified shadow following their bodily movements like their real shadow; however, other aspects of the shadow will reflect, not the user's mood, but rather the mood of the living area.

### *3.3.2 Shadow Play inputs*

The inputs to the Shadow Play are classified as either instant or aggregated as illustrated in Table 1. Instant inputs are taken directly from the user(s) playing with the shadow at a specific point in time. Examples of instant inputs are the number of users playing with the shadow, the size and shape of the user and the users' body movements. Aggregated inputs refer to a combination of input factors from users interacting with the activity area both physically and digitally and over a period of time and related to the Living Area inputs. Aggregated inputs are important to Shadow Play so that the shadow will be a reflection of not just one user and so it relates to the use quality of equality and aggregation.

| | **Instant** | **Aggregated** |
|---|---|---|
| **Digital** | | • Browser search hits<br>• Social Media interactions |
| **Physical** | • Number of users<br>• Facial expressions<br>• User's height<br>• User's body movements | • Statistics related to Living Area<br>• Seasons<br>• Weather<br>• Time of day |

**Table 1: Shadow Play inputs**

### *3.3.3 Shadow Play outputs*

The outputs of Shadow Play can be broadly classified as either instant or aggregated and each of these further divided into subtle or explicit. Instant output is direct output given to a user based on their instant input. Instant output is important because it is the current user's direct interaction with the activity and the user will have some expectations of response from the shadow. Examples of instant output include change in the size and shape of the shadow and body movements of the shadow.

Subtle and explicit instant outputs are connected to the Living Area output categorization. When applied to the shadow, instant explicit outputs are the body movements of the digital shadow and instant subtle outputs are the less obvious changes in the mood and attitude of the shadow as the user interacts with it. For example, more user interaction with the shadow makes the shadow happier. Aggregated output of Shadow Play is the same idea as aggregated output of the Living Area. The aggregated output is shown more in the facial expression of the digital shadow. The facial expression should be exaggerated, having human properties, but not be too human according to the concept of the uncanny valley (Mori, 1970) which states that too much resemblance to a human form can actually be repulsive. Other possible outputs like lights and sounds or music could emphasize moods and make a unified experience of the Living Area combined with the shadow. Dance can also be integrated into Shadow Play by provoking the user to follow the shadow in dance moves for more playfulness. This paper, however, presents the initial concepts and future work will be done on advancements.

## 3.4 Initial prototype creation and testing

Shadow Play itself has many opportunities and areas for development. Our initial prototype aimed at concept validation based on the target use qualities. An initial prototype was created that considered only instant physical input from a single user and which gave only instant output. Testing of aggregated inputs was not possible as it would require more time than allowed in this project. Implementation was done using processing and Microsoft

Kinect. The protoyped digital shadow was made to mimic the users' body movements; however, the facial expression was used to show a mood by showing a frown if not played with for 5 seconds and a smile otherwise. We tested the Shadow Play concept at a Christmas market in Rosengård with an audience comprising primarily of the target user group upon which we focused (girls 16-24) but also people from the other two user groups and all parts of Malmö. For the set up on that day we used a simple portable projector connected to a laptop running Processing and MS Kinect. Instructions were printed both in English and Swedish. The English version is shown in Figure 3.

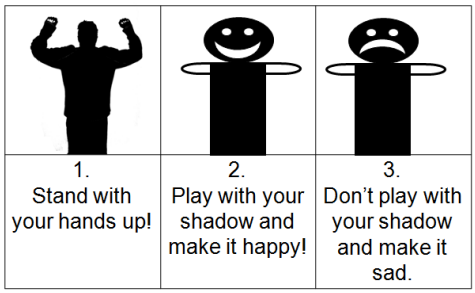


**Figure 3: Instructions for Shadow Play**

Approximately 30 people of all ages, gender and cultural backgrounds interacted with the Shadow Play prototype in over three hours duration in total. Each person was allowed to freely play with their digital shadow and then they were asked a few questions about this interactive experience. From observations, Shadow Play was intuitive, natural and familiar to everyone. No explanations were required. We found that people tended to make facial expression in the hope that their digital shadow would mimic this. In most instances users danced with their digital shadow. Overall everyone was observed to have fun playing with their shadow and confirmed this in the discussion after. Everyone said the shadow activity is something they will like to have in the activity area and a game they will enjoy playing with their friends. Unexpected findings were observed when two girls of each less than 8 years old also found the activity very fun and even understood the basic concept of mood behind it. Furthermore, the music present at the market was observed to encourage everyone to dance with their digital shadow. For further validation of these results at this point, the second workshop was held with some girls in Rosengård to get more detailed, direct and individual feedback. This workshop entailed mainly informal discussions and showed favourable feedback on Shadow Play.

# 4. CONCLUSIONS AND FUTURE WORK

The main problem addressed in this paper is concept design for a proposed activity area in Rosengård by intertwining traditions with technology for interactive play and focusing on girls between 16-24 years old. We focus on the user studies and concept design process of this interaction design project. From the user studies, main contributions were made by definition of target users' needs and use qualities. Based on this, the second main contribution is made by presentation of the philosophical Living Area concept and the more practical 'Shadow Play' activity. An initial prototype of the Shadow Play was created and tested and results found that it was very playable, social (since friends enjoyed observing their peers in this activity) and spontaneous (since the shadows' movements were left open to the user. These results support the main argument of this paper, that the concepts presented here are novel and promising ideas for interactive play in activity areas. Main lessons learnt for further work were (1) Shadow Play is fun for everyone but should be modified to attract specifically and especially the target group of girls and (2) To improve playability and familiarity with the shadow, variations on the appearance of the projected shadow need to be investigated such as inclusion of the shadows' legs and other body forms. Future work additionally involves more advanced prototyping of the Shadow Activity to include all input and output options already defined.

# 5. ACKNOWLEDGMENTS

The author acknowledges the hard work of the other group members in this interaction design student project, the support of Malmö Stad., and the help and support of staff at the Arts and Communication department of Malmö University both for project work and writing of this paper.

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# Assisting minor everyday pet chores

## - Remote controlled cat feeding device

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## ABSTRACT

This process explores the possibility of physical connectedness while asks the question: How can we control distant objects? The simple cat-feeding device that we built offers a basic platform using an Arduino board, two servos and sensors that are controlled by a mobile device over a wireless network. A nonverbal communication between the pet and the pet owner is manifested by animated icons on the mobile device and as sounds from both the mobile device and the prototype. The device generates a prerecorded sound loop each time the user shake the device. At the same time, the food package placed on the prototype get shocked and generates a natural sound by the content inside. The prototype shows that we can provide a quick solution for a simple problem in people's daily life.

## KEYWORDS

Interaction Design, Prototypes, Interface, Control distant objects.

## 1. INTRODUCTION

This paper explains a workshop called Mobile Hacking, which was a one-week school course at Umeå Institute of Design. The three classmates Erik Rydell, Yangchen Zhang and Maria Niva were given the brief in which we were asked to: "[…] explore telepresent, nonverbal, communication between a mobile device and a household applicaces. You should imagine that you are away from home and want to communicate with a pet left in the house." Our tutors were Matt Cottam and Brian Hinch [1].

## 2. DESIGN PROCESS

Brian demonstrated an example of how a mobile hacking concept could work, he also introduced us to the sketchserver software called NADA Mobile [2] that allow users to prototype "sketches" and transfer data from iPad to Flash and Arduino [3]. We sketched a blueprint of how we had to connect the prototype to make it work. In order to manage the given time in a sufficient way, we decided to split up the work with the software and the hardware.

### 2.1 Research

By remembering previous experiences as a cat owner and some discussions together with other pet owners, we started to think how we could bring some extra value to pet owners who wants to communicate with their pets when they are not at home. Nowadays, people spend a lot of time outside, i.e. at work or just outdoors, their everyday tasks tend to get unprioritized or forgotten. Therefore, we wanted to create a concept that can facilitate for the pet owner to keep track of the food and give the user an opportunity to refill the bowl with food from distance.

### 2.2 Ideation

Pet feeding robots are not new, they do exist both as mobile versions like what we think looks like a single prototype called Dog feeding robot on wheels [4] and stationary robots like RobotShop [5] which, unlike the dog feeding robot are commercial products. However, what we felt was missing in the two examples mentioned above was a concept that sends information to both the pet owner and the animal. For example, the shaking gesture could be a fun way for cat owners to bring the cat's attention even though it can be done over distance. We also got inspired to use the cat food package because the proportions of it suited the size of the iPad.

### 2.3 Hardware and software development

It took us about four days to get the code part to work and to connect all the gears with the Arduino board. We found an ActionScript class that worked good to use for the cat food pieces in our graphical user interface and it took a while before we got the code to work with Processing via the SketchServer software. We spent one day making the bottom part and the cage for the food package and assembling the two servos. One of the trickiest parts of the programming was to control the center of gravity of the prototype. The center of the gravity changes when the user tilts the iPad that results with a quite erratic and delayed behavior that we couldn't change.

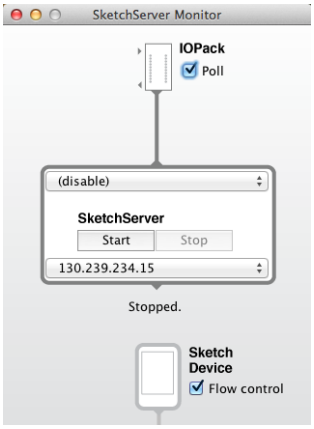


**Figure 1. The image shows the interface of the Sketchsever for receiving signals from mobile device and send to IOPack in a serial communication.**

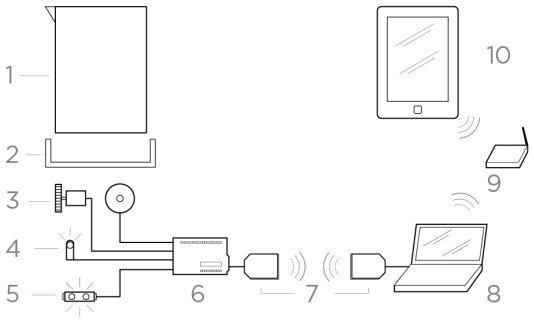


**Figure 2. The image shows the interface of the Sketchsever for receiving signals from mobile device and send to IOPack in a serial communication.**

## 2.4 Graphical User interface

We used sound as a tool to communicate nonverbally as a method for pet owners to communicate with their pets when they are away from home. The sound will hopefully get the cat's attention, and it also works as a parameter for the user to understand that the servos actually shakes the food package but in another environment. What we didn't had in our prototype was a weight sensor that could adjust the feedback- sound from the iPad according to the amount of cat food left in the cat food package. At the top of the interface, a cat and a bowl showed whether the cat was close to the prototype or not and how much cat food that remained. A distance sensor and a light sensor controlled these two parameters. We downloaded an appropriate ActionScript class and replaced the original objects with our cat food pieces. The cat food pieces on the interface are coded to react on the centre of gravity. Therefore they behave kind of like the content of a regular cat food package when the user tilts the iPad.

**Figure 3. An illustration of the how the Graphical User Interface could look like on the iPad after some revision.**

## 4. RESULTS

The final prototype enables the user to monitor, via the graphical user interface, if the cat food is about to run out in the bowl and/ or if the pet is about to approach the bowl. More technically, the user's gestures are detected by the inbuilt accelerometer in the iPad that sends the signals to the laptop via a wifi or a 3G network. (We used a wifi network to make it work, we didn't try a 3G network in this course but we got taught that it works too.) An Arduino sketch that runs on the computer is then receiving the values from the and forwards it via the XBee radios to the Arduino board, the Arduino board which in turn sends the data to the two servos which rotates horizontally and vertically relative to the user's gestures. The both XBees can operate in a data-transmitting mode for a serial communication within a limited distance from each other. Data that is being collected from the sensors by the cat's interaction with the device is sent back in an opposite route that enables the cat owner to monitor how much food remains on the device. The iPad will trigger an audio loop of a shaking cat food package when the user is shaking the iPad sideways, a sound from the physical food package will of course be triggered in order to get the cat's attention and approach the bowl. The audio is a very important feedback for the user to get in order to know that it works due to the distance between the user and the prototype. The sound feedback together with the graphical user interface on the device makes the concept more in line with the nonverbal communication, as we wanted to achieve.


**Figure 4. Image from the presentation of our concept on the project's fifth and last day.**

**Figure 5. A photo taken from user testing with a cat.**

## 5. DISCUSSION

The most difficult part of this project was how to simulate the feeling of tilting the physical cat food package. There is a gap between tangible object and digital device, i.e. a center of gravity. Therefore, the center is changing when the user tilts the cat food package. We designed a realistic interface to simulate the physical falling of cat food pieces in the package when user tilting or shaking the iPad. Furthermore, we added sound to the iPad when the user shook it in order to make it sound like a real food package and reach closer to the nonverbal communication feeling. Since it was a one-week workshop, refining code could be done in the future to improve the movement of the hardware making it run more smoothly. We also intend to minimize the time that takes from that the user makes a gesture with the iPad until the hardware reacts with a movement. Moreover, this prototype is just an example of how to control distant objects.

**Figure 6. Writing notes from the accelerometer at different titling angles.**

## 6. CONCLUSION

In this paper we explored a nonverbal communication tool, using gestures and sound. The challenges we faced during the concept development were how to frame the limits of how much the mobile device could be tilted and how that angel would correspond to the angel of the prototype.

## 7. ACKNOWLEDGMENTS

Our thanks go to Camille Moussette who planed and organized this workshop. We would also thank to our third team member Maria Niva for your work and Matt Cottam and Brian Hinch from Tellart for helping and supporting us through the exercise.

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# Can interactive toys augment social-learnability? An intercommunication approach for preschoolers

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## ABSTRACT
This report addresses our Tangible interaction project and is presenting a working prototype based on a systematic design process. The concept idea was about creating two socio-interactive devices that intercommunicates feelings wirelessly, so that the users can tangibly interact with each other on distances. The focal market is the children between 3-8 years old. This entertaining project is beneficial to create a better relationship between parents and children, possibilities to help preschoolers expressing themselves through using the devices together with the concerning 'care-taker' and general use for social communication upon desire. The final prototype was exhibited in the Interaction design Exhibition 2011 held in Kuggen.

## Keywords
Tangible Interaction, Collaboration, Socio-interactive device, Preschoolers, Intercommunication, Haptic feedback

## 1. INTRODUCTION
Tangible interactive technology is in constant development and there are great opportunities of developing new haptic or tangible devices through using the bulk of available micro-controllers and anticipated Tangible interaction toolkits. In our case, the Arduino played a crucial role in the project.

Like many other TUI developers, we wanted to propose a project that had the potential to hit the market. By that being said, we wanted to specifically hit the child market, where there are plenty of exquisite examples of well-marketed, entertaining and educational products.

Our group wants to go beyond the creation of a "mono-social device", feeling that it would be playfully engaging to include more individuals to take part of such a functional system. Therefore, we anticipated developing a communicative system, between two devices, allowing innovative ways of expressing feelings through tangible and haptic interaction.

This interactive approach may help parents and children to enhance the understanding of each other and communicates in a fun and expressive way. Another potential user group, briefly explored, could be children with autism, since they have difficulties with social interaction. They have repetitive behaviors that restrict their expressive ability [1] and create difficulties to understand them in general.

## 2. PROJECT PROPOSAL
Our aim with this project was exploring possibilities to provide useful intercommunicative devices through playful approaches. This was possible through creating an interesting experience for preschoolers', filling communication gaps between parents and their children by involving touch and expressions.

## 3. RELATED WORKS
We investigated and analyzed related works that helped us in our project work. One example in particular that inspired us was the Microsoft's ActiMates interactive Teletubbies collection [1](See Figure 1). The toy interacts when a user pushes a LED matrix (input/output) situated on the stomach area. By doing so, the device gives various conversation feedbacks to the user, through audio (output) and the audio itself results in displaying shapes on the LED matrix. Additionally, the toy interacts with the user through encouraging pressing the LED matrix in certain ways, to trigger more sounds.

Another project that has inspired us is the in Touch system made by Scott Brave and Dahley [2]. The project suggests physical connection devices, for people that are separated at long distances through haptic touch sense. According to Scott Brave and Dahley; 'communication through touch, however, has been left largely unexplored' [2].

Moreover, the group has been looking into a newer project considering this area, named ComTouch [3]. This vibrotactile device is a sleeve that can be fit onto the back of a mobile phone. The concept is built on translating finger pressure into vibration and the device is made so that users can send and receive signals at the same time. The goal of the project delivered was to combine haptic technology with audio.

[1] More information about this toy : http://www.youtube.com/watch?v=TjPtgTXT5e8

Finally, we looked into the LumiTouch [4], which was all about communicating through pair of interactive photo frames. The photo frame lights up when a user touches the photo frame and is translated over an internet connection [4]. Each colour lighten up by the user, symbolizes a certain feeling that can create a colour combination, conveying a certain meaning.

## 3.1 The Concept

The overall concept was challenging and we had to design it under three weeks time, fully functional. We brainstormed and made a task list before going into further depth with the Concept.

*3.1.1 Idea behind the concept*

The goal with the concept was to create two socio-interactive devices [2]that communicates feelings wirelessly, so that users can interact with each other on distances (See Figure 2), i.e. being in different places. We will give three example scenarios were such a communication device might be used:

• In a fun and efficient way to create a better relationship and understanding between parents and children.

• To help children with autism to express their feelings towards their 'care-takers' as well as letting them understand the needs of the concerned child.

• General emotional communication scenarios upon desire for social and entertainment purposes.

*3.1.2 Initial concept sketches*

We followed a typical "form follows function" dogma (Cooper 2007), hence sketched a template for the skeleton of the system for both devices, to keep the design proportional. We also tried to sketch the expected visual feedback (feelings) given from the devices and the aesthetic appeal of the device.


***Figure 1 - Microsoft's ActiMates interactive Teletubbies collection***

[2] *Description and BellyBuddies in action here:* http://www.youtube.com/watch?v=I4iLxePMVig

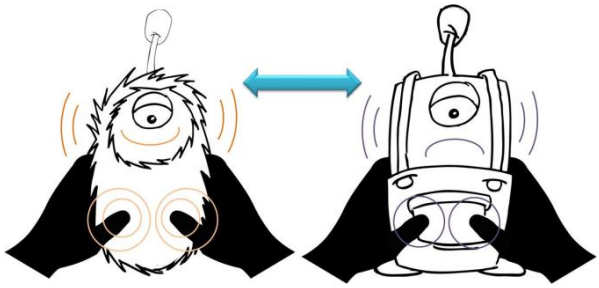

***Figure 2 - Example interaction process to activate the toy in order to establish communication***

## 3.2 Realizing the Project

We used one Arduino board connected to the two toys through wires, to visualize emotions such as happiness or sadness, through using an output LED-matrix and a pressing area functioning by using flex sensors. These flex sensors measure the pressure of the fingers and so outputting movement from the servo motors and additionally triggers the visual feedback. For example, if 'Device A' is pushed with intense force (flex sensor), 'Device B' will result in crouching and will display a sad mouth (the visual feedback).

*3.2.1. Electronics and mechanisms*

Although this prototype was using wires from the Arduino to connect the components of the two toys, the idea is to do a wireless toy as a final product.

Furthermore, we wanted to make a turn based system, which provides visual feedback that consists of a LED soldered with wires, put inside the designed antenna for each toy, giving better interaction feedback between users.

The antennas were made and arranged spatially by using the previously mentioned blueprint or skeleton, that was sketched on RHINO 3D.

The servomotors control the crouching movement, by rotating at opposite directions and were thoroughly reflected upon before construction. The design goal of it was to set a balanced and consistent movement, which after a lot of struggle, we succeeded to achieve. Each servomotor was carefully attached with glue, tape, metal pieces and screws and so added firmly to the material.

Like previously discussed, we wanted to add a LED matrix for visual feedback. The idea is that when the toy is happy, it should display a 'happy smile' through illuminating LEDs in a specific color of choice (See Figure 3).

*3.2.2 Programming*

Using the Arduino programming language, we achieved a communication structure, which allows users to control the toys. Although some programming issues with the turn based system due to the flex sensors being too sensible when applying a small movement, another majorly concerning issue was the programming of the RGB LED matrix. By this being said, creating our own custom built LED circuit board to simulate the similar effect as the RGB LED matrix, allowed us to simply switch the LEDs On or Off.

*3.2.3 Outer Shell Design*

Initially, we had to plan out what kind of materials we wanted to use, to give a 'childish' yet convincing look to the prototype. The chosen material was purple, blue, green and orange textile for the body, two spray-painted semi sphere Ping-Pong balls for the eye and black textile for the eyeball. Foam was stuffed inside the shell

forming a belly for the prototype, to adequately interact with the user, suggesting that 'this is the only area you can push' to communicate. The group also considered to adapt the size of the measured textile to the developed inside (mechanisms and electronics) of the toy. Buttons were added to neatly close and open the outer shell, allowing easy access for us modifying the 'inside' system whenever needed. Since we wanted to portray a variety of personas, each toy has different styles, e.g. one of the toys created have cloths as opposed to the second one being 'unclothed'.

We wanted to create a certain theme, which in this case is an adorable alien theme, to boost children's imagination and distinct it from other toys out in the market. To conclude this section, everything we added in the outer shell had a purpose connected to either the system's functions or interaction of the prototype.

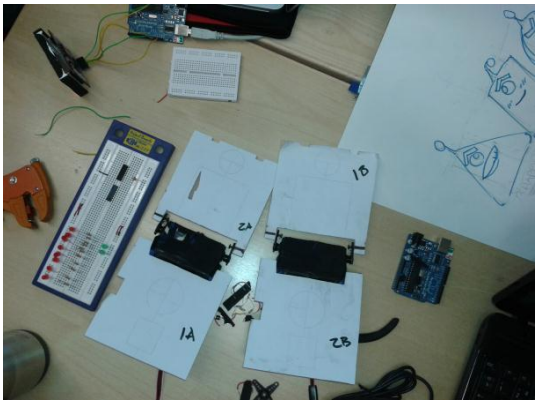

***Figure 3 – Skeleton and mechanism of the toys***

*3.2.4 Final assembled prototype*

The final prototype was a successful result of hard work and experimenting with tangible interactive system. The outcome of the carried out design process, meet our expectations as Interaction designers.

## 4. EVALUATION

We anticipated that the users would agree with our goals of the devices, such as if the Belly Buddies matched the purposes expected or if they liked something additional to be added. Through conducting a user evaluation method, we evaluated the users on spot, by using a questionnaire to collect feedback or suggestions from them. The enriched information collected from users, was taken during the Exhibition.

### 4.1 The poster

The poster was made to show an overview of the project. Moreover, simplifying the poster so that the users would understand it, i.e. by not adding to complex or technical aspects used, but rather focusing on the project itself, 'as a product'.

### 4.2 Users Reaction on the Exhibition

The users seemed to be happy with what we had achieved in this project. Furthermore, using the questions to get the answers from the users was an efficient way of understanding and getting feedback. All users have been kept anonymous, since most users wished for this.

### 4.3 End Results

We have demonstrated the viability of these kinds of systems in our proposed potential area talked about below in or discussion. However, they require a lot of development especially in a technical area, recreating a really good communication flow (See Figure 4/5).

***Figure 4 – Result of the final prototype – the skin was made in soft fabric and plush hair.***

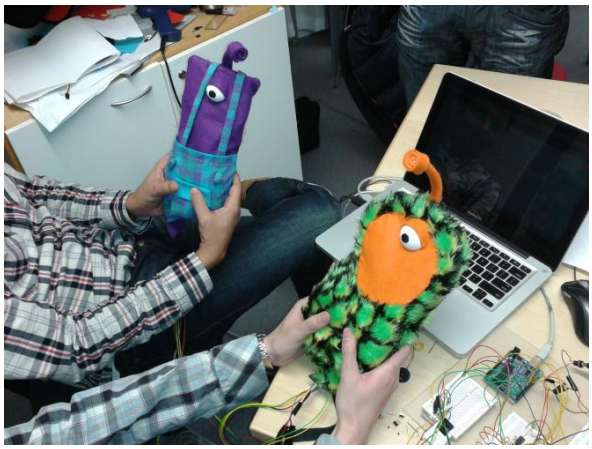

***Figure 5 – User testers interacting bellybuddies each other.***

## 5. DISCUSSION

This novel approach tries to go beyond the cold mundane communication means. In comparison to a mobile phone, the complexity of technology differs from the anticipated approach of developing a simple playful way of communicating feelings; helping to enhance the intimacy between parent and their children. Furthermore, this intimacy is important for children's development as good people in society as a whole.

We found that preschoolers are constantly demanding attention from their parents. However, from time to time they have difficulties expressing themselves. Therefore, these kinds of devices could be useful to bridge the communication gap, between the parent and the child, especially when the parent is absent at home.

## 6. CONCLUSION

We consider the BellyBuddies a successful project after the evaluation of the users. However, a lot of improvements are yet to be made such as increasing the amount of features and functions of the toys. We think this project as an open door for newer researches in this field; we believe the potential of this work is vast. We would like to encourage ourselves and others for further improvements in this research area in the near future.

So, Can interactive toys augment social-learnability?

The group considered interactive toys as a method to augment social-learnability, which gave us very good insights to create new means of intercommunication between preschoolers and their parents.

## 7. ACKNOWLEDGMENTS

Our thanks to Morten Fjeld for his great support and devotion of time and effort during our project work. Moreover, we would like to thank ourselves as a team, for working really hard during tough circumstances with a lot of mental overload.

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# Fear Fighter Project:
# A context-aware solution for treating acrophobia

- Exploring the qualities of the smart phone.


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## ABSTRACT

The overall motivation for this project originates from the impact anxiety disorders have on society. The research project Fear Fighter aims to consider a new way of treating these disorders by utilizing the technologies available, in this case the smart phone and context-aware computing. Previous solutions do not rely on scientific or thorough investigations, which are crucial when making solution for treatments that are both emotional and complex. This paper presents a research study that focus on motivating and captivating qualities of the smart phone, useful to take into consideration when designing a comprehensive solution like the Fear Fighter Project. The study sets the ground for further research that involves digital solutions in complex, and sensitive anxiety treatment.



**Keywords**

Acrophobia, Smart phone, Captivating Qualities, Cognitive Behavioral Therapy, Fear Fighter Project, Context-Aware Computing.


## 1. Introduction

There are currently defined approximately 500 different types of phobias, everything from acrophobia (fear of heights) to social anxiety, etc. In Denmark about 1-5% of the population (60.000-300.000) suffer from either one or more types of phobias that will require treatment [10]. It affects people's everyday lives and the extensiveness of the problem has statutorily resulted in necessary legal privileges for treatment of the disorder, thus creating an economically onerous situation in the society [11]. Both the society and the economy are adversely affected, because many of the individuals with phobias are prevented from doing their jobs proberly or they reach a level where they are not able to work at all. By making research contributions in context-aware computing and digital services we can alleviate some of the challenges that requires a certain sensitivity towards the context in which the use of technology is to be utilized. The mobile phone and more recently the smart phone are interesting media for treating phobias, due to the fact that they are integrated in people's everyday lives [3].

Numerous studies have given credence to the mobile technology's dynamic and communicative ability to be a successful mean in e.g. withdrawing people from smoking [1, 2]. In addition, recent studies have substantiated the use of mobile phone technology in the practice of Cognitive Behavioral Therapy (CBT), however without providing sufficient data or suggestions for an integration of a fully functional and effective system [1].

The basic element for CBT is to have the patient confront and remedy the irrational thought that provokes the anxiety, instead of avoiding it. Through therapy sessions the patient is introduced to a set of techniques to help reduce the symptoms. By increasingly being exposed to their fears and by applying the acquired techniques in the situation, it will gradually reduce the anxiety until the symptoms do no longer occur [7].

This paper has its offset in The Fear Fighter Project (FF Project), which is a proposal for a complete therapy program for treating acrophobia [9]. The system is intended for a certain target group who are people afflicted with a severe condition of acrophobia, often requiring professional treatment. The treatment program is meant to be free of charge and anonymous. It takes place at a public location, the IT University of Copenhagen, from an application on the patient's own smart phone. The system requires technical attributes such as the smart phone as the main technology and a tracking system. The treatment program builds on CBT, and will primarily consist of different in vivo exposure exercises, and proceeds over a period of ten days. The fact that the treatment is extended over several days raises issues concerning motivation and engagement of the users in the FF Project. Among professional therapists, a general agreement is that the most important aspect of CBT is the relationship and trust that the patient builds up with their therapist [7]. The fact that the users have no direct personal contact to a therapist in the FF Projects' treatment also raises some motivational issues.

In this paper our intention is not to design a complete solution to the problem, but to investigate how qualities of the smart phone can be exploited in the design of such a comprehensive, context-aware and digital solution with regards to motivational factors for the users to engage in it.

## 2. Research Design

### 2.1 Methodical approach

In our research study we wanted to understand the phenomena of being exposed to one's anxieties, in this case acrophobia, while the smart phone serves as a mean to keep the situation under control. The assembled study is grounded on a wish to account for the smart phone's involvement in the FF Project's vision and in further research in this area and context. This was done by collecting evidence from a preliminary study at the IT University

of Copenhagen, which we employed to construct a deeper contextual meaning in a follow up focus group interview. The questions how, what and why indicated motivational reasons for the target group to engage in the FF Project. Since the FF Project separates it self from other design solutions close to this topic by researching in more complex context-aware services, these were vital data for our focus on motivational factors.

Characteristics adjoining the phenomenological approach are to learn what the participants experience in certain situations and how they experience it. Through simulation and enactment in a controlled environment researchers are able to collect comparable data. This data utters something about the user experience, interactivity, and the potential, which mobile devices have to offer [6]. In order to get deeper into findings from preliminary studies, it can be beneficial to supplement with interviews [6]. At the same time scenarios and personas, have proven to be useful in creating empathetic insight from participants during e.g. a focus group interview.

Based on these theories on how to merge research methods for understanding mobile technology use, we assembled our study.

### 2.2 Preliminary investigation at the IT University of Copenhagen

During the public event *Kulturnat 2011* we constructed a situation with focus on simulation at the IT University of Copenhagen. 38 people with various grades of fear of heights participated. They were exposed to heights inside the building and were introduced to anxiety reducing techniques, which should enable them to cope with their fear immediately. These techniques were breathing, focusing and stepping exercises. Some participants received techniques from a psychotherapist and some through a prototype on a smart phone. The prototype consisted of a video, which was shown, in a full screen version, directly on YouTube. The video presented three techniques in two different combinations; either with text or with a combination of text and the voice of a therapist. In addition to the three different presentation methods (a therapist and the two versions of the prototype) we created a fourth situation to account for the placebo effect. This meant that the participants in this situation were not exposed to the techniques.


*Picture 1. Here is an example of one of the techniques presented in the prototype. The participants were to focus on the dots, counting each of the blue ones that would appear on the screen.*

*Picture 2. One of the participants trying the prototype.*

The main focus for us was to observe the behavior of the participants while they were interacting with the smart phone contrary to the therapist, hereby reaching an understanding of the phenomena.

*Picture 3. One of the participants is receiving some techniques from the therapist.*

### 2.3 Focus group interview

Subsequently we conducted a focus group interview with three participants from the preliminary investigation, with moderate to severe anxiety, and a therapist who participated in the discussion as an expert, representing her previous anxiety patients. The focus of the interview was on the use of the smart phone, as well as the participants' experiences with their anxiety. These led to a debate about motivational factors connected to the smart phone in the Fear Fighter program. Open-ended questions were formed and divided into themes, based on our findings from our preliminary investigation. Furthermore we used the method Persona and Scenarios, to make the participants relate to the phenomenon from the eyes of a persona with a severe condition of acrophobia.

### 2.4 Critic of methodology

Only few participants in our investigations could approach similarities of the FF Project's proposed target group. This means that the results cannot be generalized, and are not representative of the whole population of persons with severe acrophobia.

When involving people in studies revolving around sensitive areas such as anxieties, ethical considerations are to be made. In this regard, we collaborated with two psychologists during the planning and execution of both studies, making sure that the participants were under supervision.

## 3. Findings

### 3.1 Similarities between the smart phone and the therapist

From the preliminary investigation we found that the participants were positive towards being presented to techniques through a smart phone; they saw it as a distraction from the fear, and as a support. One girl showed a huge amount of fear, but was able to focus on the smart phone performing the techniques step by step while feeling more relaxed. The majority of the participants expressed that the reasons for this relaxing effect were clearly the sound of a calm voice.

As we proceeded with the interview it was confirmed that there had to be certain motivating elements connected to the smart phone, in the design of the FF Project, in order to retain the users in such a program. A participant in the focus group said:

”It can be a problem that the treatment takes it course through the smart phone. It is all up to you, and no one else. No one is pushing you to do it. You are afraid of heights, so why would you expose yourself voluntarily to heights here at ITU?”

### 3.2 Game as a motivational factor

An interesting finding from the focus group was that the participants mentioned game elements as a motivational factor. The therapist corresponded by saying that it could be of significance to involve challenge in a CBT program, but without exaggerating it.

Additionally, one of the participants stressed, “It is always nice to be able to measure ones success”. The others agreed on this. At the same time one of them mentioned that it is important that success is not measured in e.g. how many apples you can get as points, but it should be meaningful and appealing compared to the situation in which you are in, in this case a very sensitive and complex context. The complexity in the future application, should supplement the complexity of the future program, reaching and motivating the target group on a deeper level. This will be further elaborated on in the discussion.

## 4. Discussion

When designing for a complex scenario, where the goal is to treat people with fear of heights, there are a lot of elements to take into account. The application connected to this scenario has to be intelligent and more profound than the kind of applications we normally develop. The Fear Fighter application is connected to a strict program, and a location-based tracking system. At the same time it has to deal with humans in sensitive situations. Sensitivity is an essential part of design and it is important that we show much consideration towards this [8].

In this section we will discuss qualities of the smart phone that are important to take into consideration, when connecting the device to the designing of the future FF system. This will be in relation to our findings.

### 4.1Motivation

Bill Gaver states that human beings are playful creatures, as he calls them ”Homo Ludens” [5]. “Play is not just mindless entertainment, but an essential way of engaging with and learning about our world and ourselves — for adults as well as children” [5, p. 3]

The play elements though, should not take over the goals and rules that are incorporated in the treatment process. There has to be found a middle way where the elements assert as a motivational factor.

Löwgren defines two captivating qualities in digital artifacts as “playability” and “seductivity” [8]. Seductivity entails “...Enticement (attracting attention and making an emotional promise to the user), Relationship (making progress with small fulfillment's and more promises, possibly lasting for long time) and Fulfillment (making good and final promises and ending the experience in a memorable and positive way)” [8, p. 132].

An important aspect of the FF treatment process is the relationship between the partial goals and greater promises. Reaching a certain goal e.g. getting rid of an anxiety is what must keep them motivated and captured.

Seductivity seduces the user, whereas, playability is described as making the users addictive [8]. Playability is important in order to give the users a sense of joy, it appeals to the intrinsic motivation that drives Homo Ludens. E.g. reaching a goal, getting from first floor to second floor [8]. It is important to supplement playability with seductivity.

As mentioned in the findings the participants were able to connect to the smart phone, but in order to capture their attention and withhold them in a therapy program, it could be beneficial to integrate the following playability qualities in the design of the smart phone’s application, as ways of engaging the users in an emotional process:

**Challenge:** The application should challenge the users and their anxiety by gradually exposing them to heights during the treatment. For motivation, they are given an opportunity to measure and visualize their success during the treatment.

**Curiosity:** The application should awake the users’ curiosity by making them wondering, how far they can go, with the smart phone as a mean and if they are able to cope with the anxiety situation.

**Control:** The user should have control over the application, e.g. the length of the techniques or which techniques to use, and be able to stop if the anxiety level rises.

Norman states that users have to distinguish between the words "complicated" and "complex", because life today is complex and we need technology to embrace this complexity, without making it confusing, as users think about many products, when they interact with bad designs. To cope with the complication, the application must be understandable, sensible and meaningful for the user [12]. By combining seductivity and playability, it is possible to create a relationship between the application and the user that is necessary for motivating the user to complete the treatment. Furthermore it creates hints and clues for the user and makes the application more understandable and meaningful. The term sensibility is an important aspect that will be a part of the future design of the application. In a situation where the users experience anxiety, emotions are controlling them. In these situations, it is important that the play elements are not visible. There should be a fine balance between the seriousness of the situation and the playability qualities.

## 5. Conclusion and Further Research

The paper has through a phenomenological approach provided a ground for further research. We have discovered and discussed motivational factors for engaging the users in the FF Project, and

which qualities of the smart phone that could support this engagement. Besides the audible and visual qualities, the smart phone's ability to portray game elements creates seductive and motivating reasons for the users to engage in the FF treatment.

However this area of interest does not provide any conclusive solution for a comprehensive design. There are other aspects to include when investigating user experience, such as physical, sensual, cognitive, emotional and aesthetic [4].

Another finding that we have not mentioned was the wish for an online community, connected to the program. According to Löwgren network games, contrary to single games, entails a whole new class of motivation, based on the social interactions [8]. Doing something together with other people is a huge motivational factor, which could supply the FF concept with great value [8, p. 127]. Our participants felt that the smart phone in a longer therapeutic treatment without direct contact to a physical therapist cannot stand alone. This is worth considering in future research.

Further research should also involve people with severe acrophobia and take place over a longer period of time, in order to build on our findings. Along with the above mentioned, additional research within context-aware computing has to be made, more specifically, in regards to the tracking technology (BLIP) that will enable the therapeutic exercises to be monitored and moderated in accordance to the specific patient's needs.

## 6. ACKNOWLEDGEMENT

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# Fighting Genre Design Guidelines

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## ABSTRACT
This paper is intended to identify how fighting games can be better designed. It will clarify what user exists, and what they generally want. The paper will establish a categorization of fighting game characters, *arch types*. In the end guidelines for designing fighting games will be established, many of the guidelines (if not all) are also reasonable to use for designing modern beat-em up games.

## Keywords
Fighting games: Refers to the genre, of 1 user versus 1 user, duel game between 2 users.
Ultra Attack: Extra powerful attacks, which usually demands a very complicated input from the user.
Arch type: Each character in a fighting game is one of the eight arch types, and every arch type represents a detailed gameplay ideal a fighting game user can have.
Thor: *MVC*3 playable character, based on the Marvel comic character (which is based on the Nordic mythology)
Threshold: refers to how hard a character is to start playing, not how hard it is to master the character.
Combo: A user chains input one after another to perform more efficient damage on the other user's avatar.
Self -imposed challenge: User unnecessarily makes it harder for him/her to make the game more fun.

Blazblue[7] = BB, Dead or Alive[8] = DoA, Guilty Gear[9] = GG, Marvel Vs. Capcom[10] = MVC, Soul Calibur[11] = SC, Street Fighter[12] = SF, Tekken[13] = TK

## 1. INTRODUCTION
The fighting genre has had a steady decline in market segment over many years [6]. The genre is known by most casual gamers, to be too hard to learn. Meaning it has shunned away any new users for a long time. A big difference from other genres is that the games primarily only offers the pure core gameplay of the game, and most of all they usually have a total lack of user friendliness. Recent years some game developers have tried to create different modes to ease the learning curve.

This research's empiric studies were conducted by having several lab studies with different users groups. Field studies, by going to different fighting game tournaments/fighting game communities (observation) and having interviews with seasoned fighting game users, this was done from the end of 2010 to the end of 2011 [2].

## 2. EXTREME EXPERT USERS
During the empiric studies especially from field study method, showed that expert users are bountiful of the total percentage of users, which is to my knowledge rare.

This number is high, basically almost every user who regularly plays fighting games is an expert or "higher", which is why there was a need to create the term Extreme expert user.
In fighting games, the better user (player) always wins. It's a very fundamental piece of the genre, that for example mechanics that has to do with random coincidence is never used (extremely few examples exist). E.g. in fighting games an attack do not have dispersion damage of 10-15, an attack does exactly 10 damage. There is no "use of chance" [1]. In fighting games an expert users always wins over an intermediate users, but then during the empiric studies it was clear that an expert user, by all reasonable standards, playing the game 1-2 hours per day owning an arcade stick for roughly 2000 SEK. Still would lose every game to roughly half of the users in a fighting game community. In numbers for example, in game X with character Y a beginner user can do a 2-5 hit combo, intermediate 10-15, expert 20-30, extreme expert 70-90. From this a minor conclusion was taken (it eased the analyzing of other parts). It can still be a huge difference between users in the expert user group.
Note: Extreme expert is not the same as professional user, but reasonably is an aspiring professional user.

## 3. FUN FACTORS OF FIGHTING GENRE
A big part of the empiric studies was to conclude exactly what is the factor that makes people play fighting games. This was primarily done by using the Mechanics, Dynamics, and Aesthetics [3]. A combination of questioners (around 40 people) interviews (40), lab studies (20) and numerous Internet community, forums etc. (quantitative data)

Hypothesis A: Most users will answer that challenge fun factor is the most important one
Hypothesis B: Most users will say that sensation fun factor is the second most important factor.

Hypothesis A was proven right, more or less every user that plays fighting game enjoys the challenge, which is not a surprise as fighting game as stated is hard, if not the hardest game genre.
Hypothesis B was proven wrong[2]. While still many users indicated that they cared about sensation, the second most important aesthetic for a fighting game user is the expression fun factor. This was at first hard to grasp and understand, but according to the users, it's the feeling of being able to do show their skills that is a very thrilling emotion they want to achieve. Which then fighting games supplements by the combo indicating of hits, the more the better the user. And actually expression often becomes combined with challenge. As users of fighting games tends to strive for *self-imposed challenge*. It's extremely common

to observe a user, which has "won" the game, playing purposely wrong and trying to win with some special flashy finish of, then just wining. This is because the user enjoys the challenge aspect and the expression as other user(s) will observe this overkill, in lack of better words.

Another important thing when designing a fighting genre using the MDA [3] is to understand that they have absolutely no submission fun factor. Every expert/extreme user (which is roughly 90% of the user group), clearly explains that they feel the need to play the game for at least 1 hour per game session if not a lot more. Most users would say they feel there is no point turning on a fighting game if they do not know they can play for at least 2 hours without having to take a break. There are two different approaches to this, either decided to ignore to design anything that will support submission or add extra modes that can work as submission fun.

## 4. TOTAL LACK OF USER FRIENDLINESS

Fighting genre usually has a total ignorance of the existence of beginner/intermediate users, this is obviously not good .Especially as fighting genre is by far one of the hardest games for a new user to understand.

In recent years there have been a few new attempts to create some easy mode etc. No game has been able to do it well enough. The first problem is that many fighting games solely have their core gameplay, meaning the user have to really like the core gameplay right away to want to play the game more. Today a fighting game needs more than just arcade mode and versus to keep users who are not expert/extreme.

During the lab studies, the main agenda was to test how hard it was for beginners and intermediate users to learn a new fighting game. This was focused on the games, *Super SF* 4, *MVC*3 and *BB*, other games *SC*1-4, *VF*4-5, *GG*, DoA1-*4* and *TK*3-6, was tested to a less extent.

Specifically the Simple Mode of *MVC*3 (the game had been released the day before) was tested, and the Easy Input of *BB*. In both cases half of the testers would play with the games intended user friendly system. For *MVC*3 the testers had more problem learning the game from using the system (Simple Mode), this is probably because the system does too much for the user. This would lead the user to not evolve very far, but the system works pretty well for casual gaming. The Easy Input of *BB* works very well, the user can set specific commands to buttons this will still force the user to do normal combos. But the user does not have to do overcomplicated input for *Ultra Attacks*. This makes it easier for the user to learn how to chain the attack of their character. Note that the system is also well functional on the Internet gameplay, the Easy input is turned off for ranked games but in custom lobbies the host can set it to true or false, supporting users at different user groups to play with each other's.

Primarily with SF4 different inputs system was tested. The "Charge, Motion and Direction input" [2]

Hypothesis C: Charge input is the hardest to learn.

This was proven to be correct, not a single person was able to play easier with charge input. But there seems to an upside to charge input, which is that on expert level is very easy for a user to pick up any other charge controlled character and play them.

The genre does have some user friendliness which is that most companies follow a general design for user inputs. This makes a user know that Input A, is mechanic A. It eases the interaction part for the user, if the game follows what earlier game has used.

But some problems have been identified with this design approach, first of all this is depending on that the user has played other fighting games before. This is not something unique to Fighting games, more a point that the design cannot always trust in that the user knows on beforehand how the game works. Still it's better to follow established games then not to. The biggest problem is for example in *MVC*3, where more than 40 characters have Light-Medium-Hard-Special as a standard combo and then *Thor*, have Light-Medium-Special for the same combo. This will make the user press the combo wrong as they have trained their muscle memory to perform 4 inputs and not 3 for the same thing. Letting most characters have the specific mechanic with input A, e.g. character A-K has input A = mechanic A, but for character L input A = mechanic B. Having Characters with their own unique input system, makes the gameplay more unique (arguably), it's more that they just get harder to learn. A user that a start playing for example *Thor* as his/her first character is really confused playing any other character afterwards.

Many characters is also created by the developers with the mindset that the user plays with an arcade stick, making many characters be extremely hard to play with a normal console controller or keyboard.

Another problem is that they do not explain anything to the user, there is a need for 2 things.

First an explanation of the system (Tutorial/Campaign mode or something similar) is needed as this will help the user learn the specific games core mechanics.

Secondly, detailed explanation of each characters main strength and weakness

Arguably fighting genres biggest unique selling point, is the incredible unique gameplay each character can offer, meaning a game can have ridiculously variance in gameplay. This also means that a user who have played for 30+ hours with character A, just barely knows how character T works. If the game could explain most favorable mechanics and reasonable tactics per character the games would be much easier to understand. Currently if a user wants to learn how a game works they have to go and search for big Internet forums where other users have written guides/videos and learn from that. It's very much up to the user if they want to be good at a fighting game, while the games usually have some sort of training mode, but it's nearly not enough for the common person.

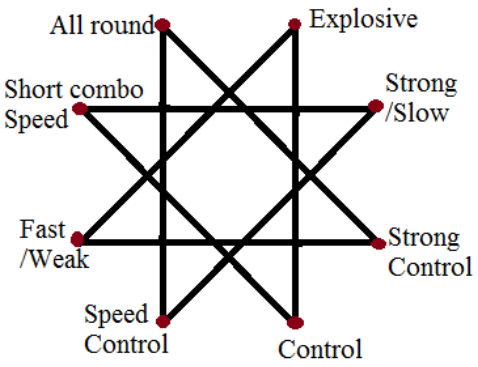


**Figure 1 The Arch Types in relation to each other**

Table 1: The 4 more popular arch types

| Arch Type | Fast/weak | Short CS | All round | Explosive |
|---|---|---|---|---|
| Learning Curve | Low /Medium Threshold | Low Threshold | Low Thres hold | Low Threshold |
| Gameplay | Aggressive (Fine Motor Skills) | Aggressive/ Variance | Varian -ce | Brute Force /Variance |
| Limited Resource | abundant | abundant | Abund -ant | abundant |
| Mechanic | Mobility (Dash,Air Jump) Different angled attacks | Dash Attack Wall /Ground Bounce | Mix of all | Take Down. Invisible Frame Attack. High Priority Attacks |
| Statistic | Low Recovery. Weak Attacks Low Health | Low Recovery. Weak Attacks Low Health | Mediu -m | High Health Slow Speed High Damage |
| Game Examples | Chun-Li:SF Pai:VF Chip:GG Zack:DoA Maxi:SC | Ken:SF Jin:BB Lau:VF Sol:GG Vergil.MVC | Anjo: GG Necrid :SC | Ryu:SF Ragna:BB Akira:VF Bryan:TK Ein:DoA |

Table 2: The 4 less popular arch types

| Arch Type | Strong/slow | Strong Control | Control | Speed Control |
|---|---|---|---|---|
| Learning Curve | Low /Medium Threshold | High Threshold | Medium /High Threshold | Medium Threshold |
| Gameplay | Brute Force | Proactive | Proactive/ Reactive | Reactive |
| Limited Resource | Several | abundant | Several | Several |
| Mechanic | Increased Defence Command Throw Priority | Back Traveling Projectiles Ranged Throw Game resource | Avoidance( Teleport, Counter etc) Projectiles. Chip | Long Range attacks or projectiles Mobility |
| Statistic | Very High Health Very High Damage Very Slow. | Extremely High Recovery Very Slow | Low value in everything (expect Recovery) | Low Recovery. Weak Attacks |
| Game Examples | Zangief:SF Wolf:VF Potemkin:GG Marduk:TK Hulk:MVC | Testament: GG Dormammu: MVC Astaroth:SC | Akuma:SF V-13:BB Eddie:GG Ivy:SC | Guile:SF Axl:GG Hawkeye: MVC Kilik:SC |

# 5. ARCH TYPES

The most detailed design pattern for fighting genre established by this research is the *arch type* categorization. Based on the empiric studies, especially connected to the field studies, mainly expert users of *SF*4 and *MVC*3 was observed for over 100 hours and usually connected with interviews, and from observing testers during the lab studies.

From this different behaviors[2] where identified, this was the base for the *arch type* design pattern. And then connected with game analysis, 8 *arch types* has been established. Every fighting game character can be placed in one of the 8 different types (Figure 1).

As stated by Björk et al [1]. There exist different aesthetic ideals which are important to different kind of people within a games gameplay. The 8 *arch types* is in a way a very in detailed version of different users' "ideals" within fighting games. The *arch types* do not only represent 8 different game characters, but more precisely represent 8 different gameplay in the fighting genre; the *arch type* can be used to describe different kind of users of a fighting game. Because of this each fighting game should have at least 8 characters placed each in one of the axles (Figure 1).
The arch type becomes a very good "Personalization" [5] as different users plays in different ways, giving the users different mechanics empowers different users skills. This will make the user feel powerful. The game will be suited to be played in a way where the user can utilize his/her skills the best, and the user will feel it much more enjoyable.

For example, a Fast/Weak character emphasize on that the user, has to learn exact inputs sequence, the user has to train the fine motor skills, and learn to how utilize movement mechanics[2] (Table 1). While a Strong Control features a very proactive gameplay, emphasizing Meta gameplay, with the usages of abnormal projectile mechanics[2] and letting the user be able to use game resource (Table 2). This two different *arch types* features completely different gameplay.

Fundamentally the *arch type* is similar to Orthogonal Unit Differentiation [4], it's clear that a game developer with limited resources (Table 1-2) should create 2 significantly different units, rather than having 2 units with the same mechanics. But the arch types are much more complicated problem, for example if every character has 15 mechanics. Control character A might only share 3 mechanics with control character B. Because it exist many different mechanics that all contributes to control gameplay. Its 8 dimensions (each axle). And each dimension has a few inner dimensions (mechanics).

When designing a fighting game, it's important to favor certain *arch types*, this to make the game more user friendly. The empiric studies also shows that even extreme expert users, tend to play with character that have a low threshold (Table 1).
Analyzing *SF*4 shows a game with 43 playable characters and not one is Strong Control. It's the most popular fighting game even while it's lacking a gameplay, instead it has extremely varied gameplay of low threshold characters.

A game should have more All Round, Short Combo Speed and Explosive, because the users tends to if they leave their comfort zone of for example all round they are very rarely going to move to play the reverse arch type the control. They will most likely play one of the closest axles (Figure 1), and these 3 are the easiest to get started with, it should clearly be more of these 3. The empiric studies shows that users prefer the Fast/Weak over many of the other *arch types*, especially in comparison with Strong/Slow(Table 2), while the Strong/Slow has the same *Threshold* to overcome as the Fast/Weak, it's not as popular to play.
And Fast/Weak is close axle (Figure 1) with Short Combo Speed, 2 steps from All Round. This makes, it a better design choice to have more fast/weak characters.
Summary *arch type*: Have one character per arch type as bare minimum or the game will lack a lot of gameplay, but to make the game more accessible for new users and for many seasoned users it's better to have an uneven distribution of arch types(Table 1-2)

## 6. MISCELLANEOUS

Internet: Fighting games really need a good system for letting users on the same level of skills play against each other. The genre is not a genre, where users of different skills can play with each other. Usually fighting games network functions, makes it neither enjoyable for the expert or for the beginner user.

Community: Still most fighting game users, tends to prefer offline gaming. There exit games with game modes with no offline support, for example *MVC*3 (Heroes and Heralds). Then many users won't use those modes at all, on the same time, it's important to have supplement for community gaming online. Which to be frank is hard, because fighting games are 1 versus 1 gameplay. It's more that it easy to find examples not how to do it.

## 7. CONCLUSIONS

From the gathered information, I have come up with these 12 guidelines. They do not have any priority order. But recommend a designer to start with designing the core mechanics and then design one character per arch type and what notable mechanic they each will have (some of this guidelines will be hard to follow without some former knowledge of fighting games).
Arch type: Have at least one character per arch type. (Means a game should have at minimum 8 characters), not having one arch type, means one type of user will be displeased.
Learning Curve: While every game should have at least 1 arch type, distribute the number of character per type after the indented user persona.
Uniqueness: Every character should have their own touch, don't create pallet swaps.
Mechanics: Use different game mechanics for the same effectual gameplay to make characters feel unique when playing them.
Notable Mechanic: Give each character a notable mechanic. This is an easy way to create different gameplay. This doesn't have to be over the top mechanics, good design usages the small detail mechanics to create different gameplay.
(Un)Official rules of user input: Follow the rules established by other games to make experience users quickly learn the game
Input most be consistent: Regardless of following the established input by other games, make sure your game is the same for each character. Is Dragon input *anti air*, for 5 characters the 6th cannot have *anti air* as quarter input.
Mixed Input: Mixing the usages of Motion input and Direction input. This is the best way to make characters work in different ways and creating a good learning curve for the user. This also gives room for more abilities per character.
Training Mode: Fighting games is possibly the hardest genre of games. Make sure the game has a good way to teach the user how it works, and add a system that explains the most important game mechanics for the user.
Extra Modes: Modern games need more than the core gameplay. Include different extra modes, especially arbitrary modes that make the user play the game in another way, indirectly teaching the user the core gameplay.
Internet: Needs to be very stable, fighting game users are in an extremely dislike of games with bad ranked functions, both on connection, delay, how the actual system works. And define user's skill on a character base and not all games played.
Community: Support a community, modes for community games such as lobby rooms and tournament mode, if possible add team play modes as they are rare. The game needs to have replay functions

## 8. ACKNOWLEDGMENTS

I want to thank Staffan Björk for letting me go wild with this research project.

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# Learning Over Education: Democratizing Education Through The Internet

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## ABSTRACT
This paper describes the relevance of self-learning over school based structured education for the underprivileged children in India. The paper discusses the biggest hindrances in education for these children along with the shortcomings of traditional educational systems in meeting their knowledge requirements and how unstructured ways of learning instigated by the Internet are better equipped to fulfil their learning requirements.

## Keywords
Literacy, education, learning, knowledge, India, Internet

## 1. INTRODUCTION- EDUCATION IN INDIA
Education is an essential tool for personal empowerment, eradicating poverty, curbing population growth, achieving gender equality and ensuring sustainable development, peace and democracy. [1] In spite of tremendous efforts from the government and non -government organizations, India's literacy rate is still 74.04 % [2] as compared to 99% of that of Sweden [3]. Even though the country has seen a rise in student enrolment, the quality of education and learning outcome has gone down significantly. [4]

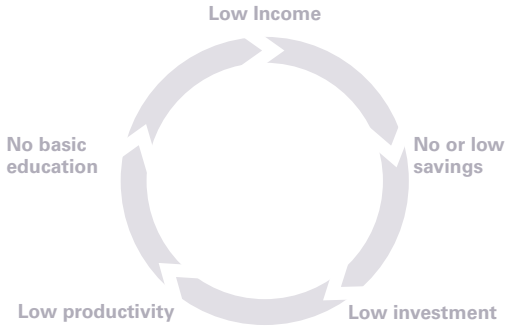


**Figure 1. Vicious poverty loop [5]**

Poverty and education are closely linked to each other in a vicious loop (see Figure 1). The existing educational model and traditional resources have been unable to help economically underprivileged children break away from this loop due to many reasons (analysed in section 2).

On one hand, the country is struggling to meet the basic educational needs and on the other is seeing a tremendous growth in information technology infrastructure and the use of internet and smart devices.

This paper attempts to analyse the problems in the existing educational set up in the country and explores the use of the Internet as a tool in overcoming some of these problems and in bridging this gap in knowledge deficit and its accessibility. Use of the Internet as a knowledge gathering medium gives rise to an interesting argument between learning and education, which is also discussed in this paper in context of economically backward children and young adults in India.

## 2. PROBLEM ANALYSIS
### 2.1. Research Methods
Qualitative research was done to understand the information and educational requirements of 13 to 25 year olds with household income of less than $300 per month. The study also inquired into the shortcomings of the existing schooling model in meeting their educational needs. Along with primary research, a range of published literature in the field of education and use of the Internet in education were reviewed. The primary research was conducted in first and second tier cities in India, (Ahmedabad, Bangalore, Delhi, Mumbai, Noida).These cities were chosen for their versatility of population since they attract high number of people from different parts of the country.

The ethnographic tools used for contextual research and information gathering were observations, direct interviews, surveys and immersion. [6][7] During ethnographic observation and immersion , time was spent with the target subjects to see and hear them in their own environments, at home and at work, to fully experience their daily lives as they went about it. It was crucial to be in the midst of the key sites and scenes of their lives in order to understand their constraints, what they found meaningful, experience the other little seemingly unimportant nuances of their lives and how they went about handling them. Direct interviews and surveys were done to gather factual information regarding the concerned topic.

The data gathered was analysed to find patterns in subjects's lives with regards to their information needs and their current ways

and challenges in meeting those requirements. Some of the key observations are mentioned in the next section.

## 2.2. Findings and Interpretations

The ethnographic and secondary research highlighted some key bottlenecks in the educational needs of the target subjects. Along with socio-economic factors, the traditional education system formed the backbone of majority of these causes. Few of the reasons were:

1. Poor or no access to educational institution.
2. High cost of good quality private schools.
3. Current forms of teaching, poor infrastructure, quality of education, redundant course structure makes education unattractive to them.
4. Massive gap in pupil to teacher ratio (1:42 in India as compared to 1: 10 in Sweden) [8]
5. Lot of children have to start working at a very early age to support their families, leaving no time to attend schools.
6. There is a huge gap between what is taught in schools and the knowledge these children need to survive in the real world. These children need specific skills in their field of work which is missing in the training they receive at school.
7. Cost and time spent in school doesn't have as much value as working in that time does.
8. Social systems make learning for young girls even more difficult. In a family, boy's education is given higher priority over a girl's. A girl's personal safety is another concern for not allowing her to go out and attend school. [9]
9. Parents themselves aren't well educated most of the times in this economic bracket, they don't understand the importance of sending their children to schools. [9]

The Indian government lays emphasis on primary education up to the age of fourteen years. The Indian government has also banned child labour in order to encourage more children to finish at least elementary school. These measures have however been largely unsuccessful in promoting basic education, as these laws haven't been strictly enforced.[10]

# 3. PROPOSED SOLUTION

## 3.1. Learning Over Education

The research analysis along with other issues highlighted the drawbacks of the standardised teaching structure of the existing education model. Broadly, almost all teaching-learning interactions can be classified as one of the following:

1. Those where the teacher or external resources determines the learning content and methodology.
2. Those where the teacher or external resources determines the learning, in consultation with the learners.
3. Those where the learners determine their own learning outcomes and how they will go about it.

The last mode of interaction encompasses the theory of constructivism. Constructivism theory talks about cognitive growth and learning. One of the foundational premises is that children actively construct their knowledge rather than simply absorbing ideas spoken to them by teachers. It posits that children actually invent their ideas. They assimilate new information to simple, preexisting notions and modify their understanding in light of new data. In the process, they gain complexity and power and with appropriate support they develop critical insight into how they think and what they know about the world. [11] The last mode of interaction is better suited to the earlier mentioned scenario where our learner needs specific working knowledge in a specific context more than generic theoretical education.

This methodology of education is hard to integrate in traditional schooling system due to the presence of great social diversity in India. Traditionally the Indian society was hierarchically arranged and the different communities and caste groups showed a pattern of social distance in which low caste, tribal and minority groups were discriminated against and looked down upon. Uniform and standardized learning resources help in bridging these differences and ensuring equal opportunity to all groups. [12]

An ideal sustainable self controlled model of learning in this context requires an alternative, independent platform for each individual learner.

## 3.2. Internet- The Free Virtual School

Internet is an omnipresent, vast resource of information, interaction and collaboration. It has the potential to negate most of the bottlenecks being faced in the course of learning by the target users. It has proven to be an excellent platform for contextual learning and has the flexibility to be used as either an assistive tool with the existing schooling system or as an independent education hub.

One of the most lucrative aspects of using the Internet as an educational resource is the fact that as a medium it has a very small learning curve to master, especially for the age group in discussion.

The same has been demonstrated by Hole-in-the-Wall project by Dr.Sugata Mitra. The central idea behind Hole-in-the-Wall is that groups of children learn on their own without any direct intervention. Dr.Sugata Mitra found that children using learning stations (PCs connected to Internet buried in a wall) required little or no inputs from teachers and learnt on their own by the process of exploration, discovery and peer coaching. Hole-in-the-wall experiment revealed that underprivileged children, without any planned instructional intervention, achieved a certain level of computer literacy. They were able to self-instruct and obtain help from the environment when required. [13]

**Figure 4. Hole-in-the-wall installation in Delhi, India**

More popular One Laptop Per Child (OLPC) (see Figure 5) mission is based on similar fundamentals of joyful and self-empowered learning and has gone on to provide rugged, low-cost, low-power, connected laptops with specially designed content and software. [14]

**Figure 5. School children with OLPC XOs in Khairat, India (Photo credit: OLPC Project / CC By 2.0)**

### *3.2.1 Advantages of the Internet as a School*

#### *3.2.1.1 Cost*

Cost of education is one of the prime reasons why most of the kids drop out of school. They see more value in working on tea stalls, as day labourers or as domestic help where they can earn money. Internet being the source of learning transcends this problem by being virtually cost free. Though there are costs to be incurred on owning a device and accessing the Internet, there are several models already in practice that take away the cost burden from the learners themselves, OLPC, subsidized Aakash tablets & for profit NOKIA Life tools for examples.

#### *3.2.1.2. Customizing of Content*

As discussed before, the structured course content for all is of little relevance to these individual kids. Their own curiosity is their biggest motivation to learn and the Internet gives them the freedom to customize their learning to their specific needs and questions. Their learning requirements could range from very basic life skills like counting currency or reading time to more academically inclined topics. A lot of these children are employed as helpers and skilled workers; Internet provides an excellent platform to build on their existing knowledge. Most of these kids grow up in difficult social settings, a lot of them with parents, family and friends who are incapable of satiating their curiosity of younger years.

#### *3.2.1.3. Flexibility of Time*

The Internet provides freedom to access information at any time convenient. It is not bound like the strict timings of school. Children can chose to learn whenever it is convenient for them, in between or after work or just when it is the right time to learn something.

#### *3.2.1.4. Self Paced*

Considering the diversity of social conditions in the country, backgrounds, caste and culture, it is unwise to assume that every student would grasp a new concept in the same amount of time. Schools put the additional pressure of time on learning and examinations, eventually heightening the fear of failure and leading to several psycho-social problems.

Input through the Internet is self regulated and as one controls the pace of learning, it becomes more comfortable and enjoyable to assimilate new ideas.

Salman Khan of the Khan Academy [15] has adopted a similar model. Khan Academy today is the largest free source of educational tutorials. These close to 2100 You Tube videos ( see Figure 6.) have been watched 41 million times, they demonstrate simple concepts in maths and science in unintimidating voice of Salman Khan himself. Learners can take their time and go through these videos as many times as they need to understand the concept and then work on exercises and track their progress through the website itself. These videos succeed in providing two most important components to learning, space and time.

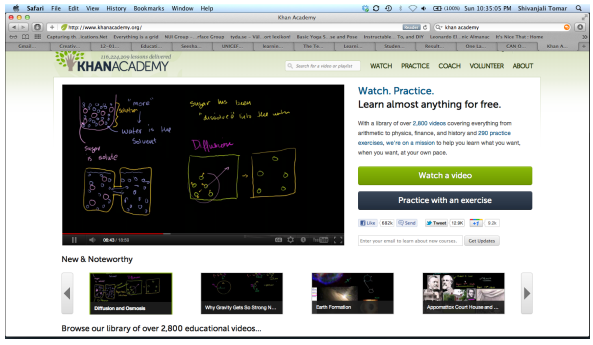


**Figure 6. Khan Academy website**

### *3.2.1.5. Interactivity*

The Internet along with up-to-date information also provides it in different media. Different levels of interactivity with the same information give learning more flexibility. Inter-linked topics and related information are provided on the same platter, thus, broadening the scope of learning manifolds.

## 4. CONCLUSION

The Internet based approach to education comes with several challenges. Hardware cost for the Internet enabled devices is still high, though the government of India has announced subsidized $35 Aakash tablet for students, it is still struggling to meet the technical specification at the time of writing this paper. Recurring cost of broadband usage is still unaffordable by a large section of this economic segment.

India has 216 different languages, which makes mass accessibility of information a concern.

The Internet provides a bright hope for democratizing education for masses across the globe and across economic segments. It shifts the paradigm of learning by taking the onus of teaching from educators to making it the onus of students to learn.(see Figure 7.) It is a tool that can be exploited for eradicating illiteracy which will significantly help in solving some of the biggest issues the country is facing today with population growth, poverty and gender inequality.

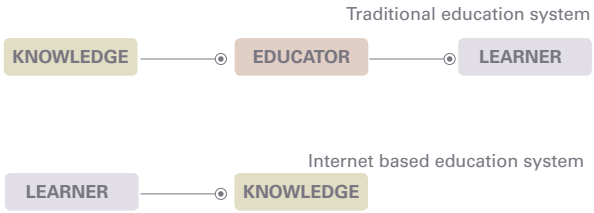


**Figure 7. Shift in education paradigm**

Knowledge and skill sharing culture has established itself well on the Internet and it now opens up plethora of areas for further investigation. One of the key concerns in the future would be to develop models to successfully integrate the Internet with existing learning spaces or to look into scenarios where the Internet technology would eventually replace physical classrooms as the main point of interaction.

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# Between play and storytelling, an augmented reading experience

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## ABSTRACT

This paper presents an attempt to combine gaming and reading. We want to achieve an expansion of a story-world by transmitting the sensual, emotional and cognitive expression of the book into a tablet game.

The paper presents a prototype implementation of an augmented reading experience for children in which a physical copy of the book "The Little Prince" is tagged with QR codes. When scanning these codes using an iPad 2, a series of mini-games, that relate to the corresponding narrative in the book, can be played

The main focus of the paper is to reflect upon our transmission of the story-world of the book into a series of tablet mini-games, and how the game interactions reflect back on the users perception of the story.

## Keywords

Transmedial worlds, tablet, game, interaction design.

## 1. INTRODUCTION

With this paper, based on our previous specialization project in the course Digital aesthetics, we want to create a coherent and believable concept for a story-world between the book "The Little Prince" and a series of mini-games on iPad 2, in order to make a new and different experience of the "The Little Prince".

Our definition of a story-world takes its starting point in the thoughts of Susana Tosca and Lisbeth Klastrup on transmedial worlds (TMW): *"A transmedial world is an abstract idea of a world generated on the grounds of the first actualization of the world and the core elements this world contained, but not in anyway restricted by this." (p. 4)*

The first actualization here is the book "The Little Prince".

The point in using TMW is that *"The imaginary construct of the world* [in question] *is evoked in the participant's imagination, and each simple act gains much wider meaning"*. (p.1.) By making mini-games that relate directly to the book, the actions in the games gets a wider meaning, as it is set in the wider context of the book.

This widening of meaning, along with Tosca and Klastrup's core elements for making a believable transfer of the world across two media (mythos, topos and ethos), is incorporated in our story-world notion.

Tosca and Klastrup propose a frame for transferring worlds that originates from the ur-actualization of the story, but does not retell the ur-story.

With our story-world concept the ur-story has a much closer relationship with the TMW, as we want to extend the experience of the ur-story. We do not retell the ur-story, but our mini-game extension builds directly on it, using the specific interaction potential of the tablet medium. By doing this we create a new interplay between the book and the tablet, which is based on the story-world. Without the story-world, the link between book and tablet mini-game would not be meaningful.

"The Little Prince For iPad" consists of a physical book, tagged with QR codes that links to a series of mini-games for iPad. We've constructed a prototype, in which you scan a QR code and access a sketch of a game by which you can manipulate an object via the gyroscope of the iPad. Furthermore we've made rules and concepts to four other mini-games, and drawn mock-ups.

### 1.1 Why the tablet

We choose the tablet medium to expand the story-world of "The Little Prince" onto, because of the relatively new interaction possibilities of the iPad 2, compared to a computer. The computer primarily offers interaction by keyboard or mouse, whereas the tablet features various kind of interaction such as touch -point and -swipe, sensory of balance and tilt (accelerometer, gyroscope) and augmented reality by picture recognition (camera).

Furthermore our concept invites child and parent to sit together, in the sofa for instance, interacting together with the book and the mini-games. The tablet medium is of proper size and weight for this purpose.

The bigger screen of a television or stationary computer might also steal too much of the attention from the family being together and the reading of the book.

## 2. RESEARCH FIELD

In the field of interaction design, several projects have attempted to create interplay between book and tablet or to augment the reader's experience. An example is a book attached with RFID tags that activates a virtual document on a tablet, created by scientists from Xerox PARC (Want, et al. 1999). Even though the augmented book created at Xerox PARC, can be considered

transmedial, the research aim was technological - to bridge the physical and virtual worlds.(Want et al. 1999)

Gradually focus has turned towards applications of the technology, and user experience. More closely related to our experience-oriented focus, Rocchesso and de Götzen, have created an augmented sound-book, seeking to boost the user engagement. By implementing sensors in a children's book, it enables the child to manipulate sounds by interacting with the book. (Rochesso and Götzen, 2005)

In recent years, especially film and broadcasting industries have unfolded stories across media, as a way to entertain and involve their audience. In Denmark, we see examples of transmedial storytelling such as the children's channel Ramasjang, which revolves around a universe with a set of consistent characters, while Danish series as "Livvagterne" have augmented their universe by an online game experience. We have not been able to find examples of academic work in the transmedial field that examine the book publishing industry, as fewer book publications are augmented with content across media.

The success of transmedial storytelling in film and broadcasting has reflected on the academic field, where media scholar, Henry Jenkins is concerned with how films and TV series can create a unified and coordinated user experience. Likewise are Danish games and media scholars Tosca and Klastrup, who provide a framework to identify transmedial traits in a world, partly by drawing on Star Wars as an example.

We consider "The Little Prince for iPad" as a transmedial concept, that can be classified as neither literature nor gaming. As a consequence, we focus on transmedial storytelling, but the discussion will draw on research from game design, because it can supplement with rewarding views on how games and stories interrelate.

## 3. THE CONCEPT

"The Little Prince" tells the story of a little boy who journeys out in the world to find a friend. On his trip he visits a series of asteroids, inhabited by disillusioned or otherwise misguided adults, and he questions the conduct of the adults.

We were inspired by the prince's wonder to design video games where children could not only ask questions, but also interact.

Our overall idea was to transform the conflict of each book chapter, if possible, into a mini tablet game, by transferring the story-world and creating a game interaction where the conflicts could be addressed (this would of course be affected by our interpretation of the chapter in question).

The outcome of our idea was a concept called "The Little Prince for iPad", which combines reading and gaming elements into an augmented experience for young children and their parents. By conveying the conflicts of the book, into a series of games, it extends and augments the experience of the book.

"The Little Prince for iPad" offers a close relationship between the book and the iPad 2, as the child scans a QR code at the end of a book chapter in order to activate a mini-game. The subject matter of the game is then the same as in the appertaining chapter, transforming the conflict of the book into a hopefully relevant and meaningful gaming sequence on the tablet.

We sketched five mini-games in our development of the concept (see figure 1 and table 1) identifying interesting issues and conflicts, with a potential for game interaction. Furthermore the mini-games have to be suitable for transmitting the sensual, emotional and cognitive expression of the book.

**Figure 1 Sketching mini-games for chapter 9: *Fight the baobabs* and *Sweep the volcanoes***

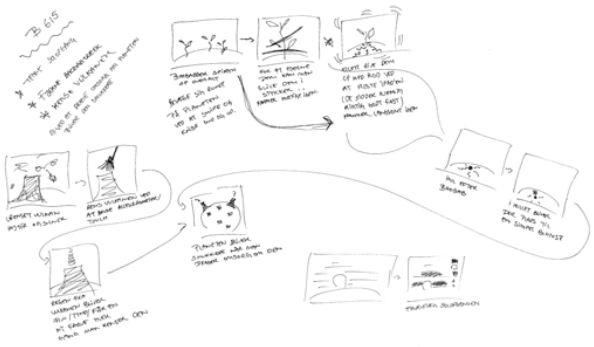

**Table 1. Five mini-game conflicts and interaction**

| Game | Issue/conflict | Interaction |
|---|---|---|
| Chapter 9: Asteroid of the prince *Fight the baobabs* | The roots of the growing baobab trees can crush the asteroid and destroy the prince's home. | Swipe with fingers to cut down trees, or shake the tablet to activate accelerometer, and tear the trees up by the roots |
| Chapter 9: Asteroid of the prince *Sweep the volcanoes* | One never knows when a volcano might erupt (due to clogging of dirt) and damage the asteroid | Swipe with fingers to clean the volcano or use entire hand to remove dirt more effectively |
| Chapter 14: The Lamplighter *Slow down time* | The asteroid is rotating very fast, making the work of the lamplighter stressful | Slow rotation of the asteroid by simply turning the tablet as a steering wheel |
| Chapter 14: The Lamplighter *Light a lamp* | Same conflict – instead of slowing the rotation, the user undertakes the lamplighters labour | Touch, swipe and paint by hand, to create your own version of the lamplight |
| Chapter 15: The geographer *Asteroid of the geographer* | The man at this asteroid is a geographer, but has never seen the world | Point and drag the planet, to search for explorer gadgets for the geographer's journey |

## 4. PROTOTYPE

Alongside the development of ”The Little Prince for iPad” concept, we created a prototype of one of the mini-games, called “Slow down time” based on chapter 14 in the book. The prototype is an html- and Java- script designed to try out the main interaction of the mini-game.

Chapter 14 in the book introduces a lamplighter whose asteroid is described as so small, that three strides will take you all the way around it. The faithful lamplighter follows “the instructions” to turn on and off his lamplight, every morning and evening. But since the rotation of his asteroid has increased over time, a day now only lasts a minute and the lamplighter has lost the passion for the job, and is forced to neglect what he loves most: sleeping.

The game revolves around the lamplighters lost passion and his desire to get a nap. The user can tilt the iPad as if it was a steering wheel and the asteroid on the screen tilts alongside with it. By doing this the user can keep the lamplighter and his lamp away from the sunlight, and make it possible for him to sleep. This task is made difficult by the rotating background shifting from night to day. In order to get a better understanding of the prototype “Slow down time” please view the storyboard on http://www.itu.dk/people/lisb/storyboard.pdf.[1]

As the prototype only enables the user to try the interaction, and not view the intended feedback of the mini-game, a small animation video was made alongside it; http://www.itu.dk/people/lisb/slow_down_time.html.

We tried the prototype with two boys the age of seven and ten. We read chapter 14 aloud to them, explained how to scan the QR code and then allowed them to explore the game in turn. After a little while we showed the animation video to them.

Methodically, it was not a scientific user-test, but merely a positive indication of the transparency of the concept. The boys were excited about the game-starting QR codes and the interaction, so different from their usual computer games. They furthermore recognized why the lamplighter fell asleep and were excited about it, as the oldest boy remembered that the book said that the lamplighter loved to sleep.

**Figure 2 Seven-year-old boy testing the prototype**

[1] Unfortunately we cannot offer the reader of this paper a demonstration video of the prototype, but we will bring the prototype to the SIDeR conference an encourage everyone interested to come and try it.

## 5. THEORETICAL DISCUSSION

This section discusses how the design choices based on our theoretical framework inform the concept “The Little Prince for iPad” and how this relates to our intention of making a new and different experience using a story-world across media.

### 5.1 The believable extension – transfer of story-world

In ”The Little Prince on iPad”, the transmission of the mythos and ethos is not as literal as suggested by Tosca and Klastrup. As mentioned in the introduction, Tosca and Klastrup define a transmedial world as an abstract idea of a world, where the first actualization of the world creates the frame for future versions. Their main criteria for a successful transmedial world, is a precise identification and transmission of the core elements of the ur-actualization: topos, mythos and ethos. (Tosca and Klastrup, 2004: 412)

The mythos comprises the original conflicts, objects, and characters of the ur-actualization. The topos defines the environment and time of the present course of events, while the ethos defines the ethics of the world, and which actions are acceptable in the context of the ur-actualization. (ibid.)

Their work on TMW is centred around large and complex worlds, such as *Star Wars*, rich on details and environmental descriptions, while “The Little Prince” is a quite short story with limited descriptive details on environment and characters.

Where it is possible, we have transferred objects and characters (mythos) and surroundings and time (topos), meaning that the mythos and topos directly described in the book were identified and actualized in the mini-games.

However a large part of the reading-experience could be described as a lyrical immersion, and even though the story is in the genre of fairy tales, we find a rich depiction of senses, thoughts and emotions.

Therefore we put the notion of core elements to use in a less literal way than suggested by Tosca and Klastrup, by transferring the lyrical aspect of the book, and converting it to actions. We put the mythological conflicts to use as basis for each mini-game. As a consequence, the gameplay solutions to these conflicts are reflected in the ethos of the ur-story.

Besides transferring central characters, norms and locations, the universe in our concept is based upon the lyrical aspect, which is an essential part of the story-world of The Little Prince.

An example of the lyrical transfer could be the game ”Fight the baobabs” on the asteroid of The Little Prince. The prince stresses the importance of cleaning the planet every morning. The lyrical aspect in this context consists of the strong emotions the prince has for the state of his asteroid. Thus the underlying logic of the sensual, emotional and cognitive expression of the book is transmitted to the tablet game.

## 5.2 Procedural rhetoric leads the user's interpretation

Some of our very first thoughts on this project originated from an excitement with the story of "The Little Prince" and we had a wish to make children reflect upon the conflicts of the story. One might question whether we succeeded, since our own reflections and interpretations of the story conflict (during the design of the concept) can possibly lock down the interpretation of the story-world's conflicts, into one way, namely our way, of seeing things.

We can use procedural rhetoric to explain how game interaction can both limit and lead the player's experience. Game scholar Ian Bogost explains procedural systems, in relation to the computer, as generators of behaviour on the basis of a rule based model. Ones behaviour inside the model will be catalyzed by the rules.

Bogost speaks of the enthymeme in relation to interactivity *"The enthymeme [...] is the technique which a proposition in a syllogism is omitted: the listener [...] is expected to fill in the missing proposition and complete the claim."* (Bogost, 2007: 43)

As an example, the enthymeme used in the prototype of "Slow down time" is as follows: The lamplighter feels pressured as a consequence of the increased rotation of his asteroid. > The lamplighter is stressed out, pressure releases (the users interaction) > the lamplighter experiences relief.

By producing an efficient procedural enthymeme, in our interpretation of Bogost, one can create a flow of interaction, where the users own interaction is filling the missing proposition, and thereby creating and argument.

This can be used to make persuasive procedures in for instance game design, giving the user the possibility of learning through interaction instead of giving him a lecture.

The quests in the tablet mini-games were designed to transmit the message of the book through the player's actions. By using procedural rhetoric we reconstructed the conflicts and questions posed in the book, and assigned the player the task of settling them. As a consequence, the user experiences the conflicts first hand, and gets time to dwell into individual issues, in a way that they would not if they had only listened to the story.

By making gameplay inspired by Bogost's procedural rhetoric, we tend to lead the interpretation in the direction of our own understanding of the mythological conflicts of the story.

Bogost argues, that gameplay designed with procedural rhetoric will produce an argument, through the interactions of the user. This argument has to be clear and articulated, in order to design the gameplay leading to it. This means that we, as producers, interpreted and articulated these arguments, while designing the gameplay.

Because of this the user might be affected by our interpretation of the book, as he or she interacts with the conflicts of the game, fulfilling the enthymeme with his/her actions and thereby making the argument.

The mini-games offer the user a possibility to solve the conflicts of the book, and the solution to the conflicts, designed by us, might influence the overall experience of the story-world. In other words: the conflicts presented in the book will not be an open question anymore. In consequence the user experience of our concept can be a more controlled interpretation of the story, compared to the experience of only reading the book.

On the other hand, Miguel Sicart states in his paper "Against Procedurality" (Sicart, 2012), that the intentions of the designer cannot be transferred directly to the user by means of procedural rhetoric. The user experience is situated, and influenced by each individual's realm of understanding and knowledge. When considering the experience as situated, the procedural enthymeme can be a way of leading the user to grasp the conflicts of the ur-actualization, in cases where their knowledge of realm and understanding is limited., it is not given that users will agree with the proposed procedural enthymeme, which in the case of "*The Little Prince for iPad"* is acceptable, since the purpose of the concept is not persuasive.

As the enthymeme of the tablet mini-games is based on the conflicts of the book and the solutions to these conflicts are designed in accordance with the ethos of the book, the procedural rhetoric creates a coherent story-world across media.

## *5.3* Establishing connection with processes

Even though our concept cannot be considered an absolute aesthetic experience, we can apply John McCarty and Peter Wrights theory of the aesthetic experience to understand how an interactor relates to our game. The processes of "cumulation", "conservation", "tension" and "anticipation" might help creating a coherent story-world across media.

McCarthy and Wright explain the processes as follows: Cumulation encompasses the temporal construction of an experience. Without cumulation, which can be experienced as increase of tension or meaning, there can be no feeling of satisfaction or fulfilment.

Conservation of the past is embedded in the present and ones next experience will therefore be perceived on the basis of the past.

To create tension in an experience, resistance is built up. Without resistance the energy of the experience will be flat, as the tension would be released immediately. Tension is therefore highly related to cumulation.

Anticipation happens both before the actual experience has begun, as the expectation for the experience to come, and during the experience. Does the experience live up to the expectations of the user or do they fall through? It is relevant to consider the concordance between the anticipation build up and what can actually be fulfilled in a given experience. (McCarthy and Wright, 2004: 62-64)

The mini-games of our concept are designed in order for the user to explore and figure out the game rules of each game by her- or himself. In order for the user to do this and have just a fragment of an idea of what to do in a given mini-game, the relation between the story in the book chapter and the mini-game must correlate. This explorative way is necessary to the concept, as the user in this way contributes to the procedural rhetorical enthymeme on his own, passing on the message of the story. (Bogost, 2007)

The process of conservation is therefore highly applicable, as the mini-games in our concept rely on the users conservation of the book chapter in order to experience a broadening of meaning, e.g. the logic of why the game is responding in a certain way to the user interaction. It is not impossible to play a mini-game without

reading the chapter to match, but it doesn't offer a high level of meaning either.

Tension builds up cumulation, as resistance is used to block release and therefore the tension increases. Without resistance the tension would immediately be released, and the experience of the mini-games would be dull. Our game's explorative approach to game rules and the transfer of the conflict from the book creates tension in the mini-games.

The anticipation of which mini-game comes up next in the following chapter also contributes to the overall cumulation, which is based on the conservation of previous experience with the relation between book and mini-game.

## 6. CONCLUSION AND FURTHER WORK

With our concept we have sketched a frame in which a story-world between the book "The Little Prince" and a series of mini-games on the tablet medium can be created. This is not exclusively a reading-, nor a game-experience, but an experience combining the two in order to experience an enlargement of the story-world and the possibility to interact with it. If the tension of the mini-game is experienced as suitable for the user in question, if the rules of the mini-game are identified, if the story-world is believable and if the lyric aspect of the book is recognized in the actions of the game, the user might experience the story-world as a whole, transcending media.

Future work on this project would be to investigate the interplay between user, book and tablet. We propose the construction of more complex prototypes with more developed game mechanics and responses, of several of the hand-drawn mini-games of our concept, in order to conduct a series of empirical user studies of the reading and gaming experience as a whole.

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