EMBODIED INTERACTIONS

27TH-28TH of March 2015, Kolding (DK)

PROCEEDINGS OF SIDER 2015

11th Student Interaction Design Research Conference

Edited by Andrés Lucero, Michelle Castañeda, Anne Louise Bang & Jacob Buur

University of Southern Denmark

design skolen kolding

Embodied Interactions
Proceedings of the 11th Student Interaction Design Research Conference (SIDeR 2015)
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FOREWORD

Interaction design (IxD) is a young discipline. Those of us who studied graphic or industrial design found our way into IxD by designing websites and user interfaces. Even for those who nowadays go through a 5-year education program in IxD, the field is not constant as interaction designers work at the cutting edge of technology and innovation. Being in this position is both exciting and a privilege for interaction designers, but this also means that graduates as well as faculty need to continually adjust and reinvent themselves.

The theme for this year's conference is Embodied Interactions. Computers are getting smaller, more powerful, and closer to our bodies. We are witnessing a transition away from screen-based touch interfaces towards more intuitive and meaningful ways to interact with technology, ones that rely on the use of our body. The book that you are holding in your hands is a collection of fresh, stimulating, and diverse IxD research work done by students that reflects the very nature of our young discipline.

Now in its 11th edition, the Student Interaction Design Research conference (SIDeR 2015) is jointly organized by students from the two IxD educational programs in Kolding: the University of Southern Denmark and the Design School Kolding. We have taken the original motto of the SIDeR conference back in 2005 – *this should*

be about students presenting to students – and have tried to extend it to *this should be organized by students and for students*. As such, students have worked to create the conference that they would like to attend, by at the same time giving them a taste of what organizing an academic conference entails. As an example, each author has been asked to peer review one other paper, so that every paper would have one review from a student, and another from fellow academics to ensure quality.

Together with graduate students, we have prepared an exhilarating program for these two days, with a mixture of keynote lectures, demonstrations, workshops, interactive sessions, and a discussion panel with members of industry. Our social events should provide plenty of opportunities for you to network with your future colleagues.

Finally, we would like to thank the IT Product Design students in Kolding for their invaluable effort and persistence in making this current edition of the conference happen. You can find their names listed on the next page. We would also like to thank our fellow academics that reviewed papers for this conference.

Andrés Lucero, Michelle Castañeda, Anne Louise Bang and Jacob Buur

Kolding, March 2015

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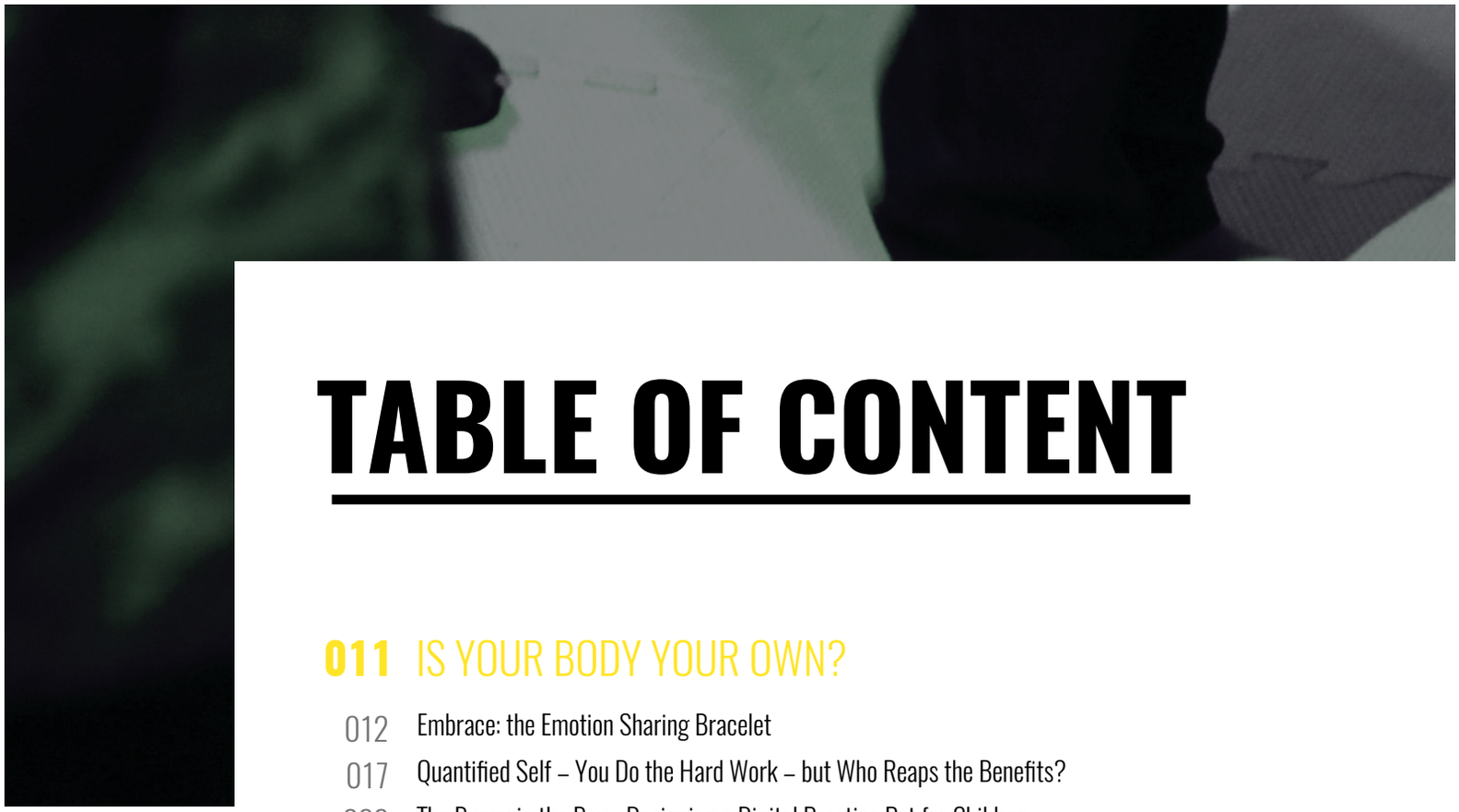

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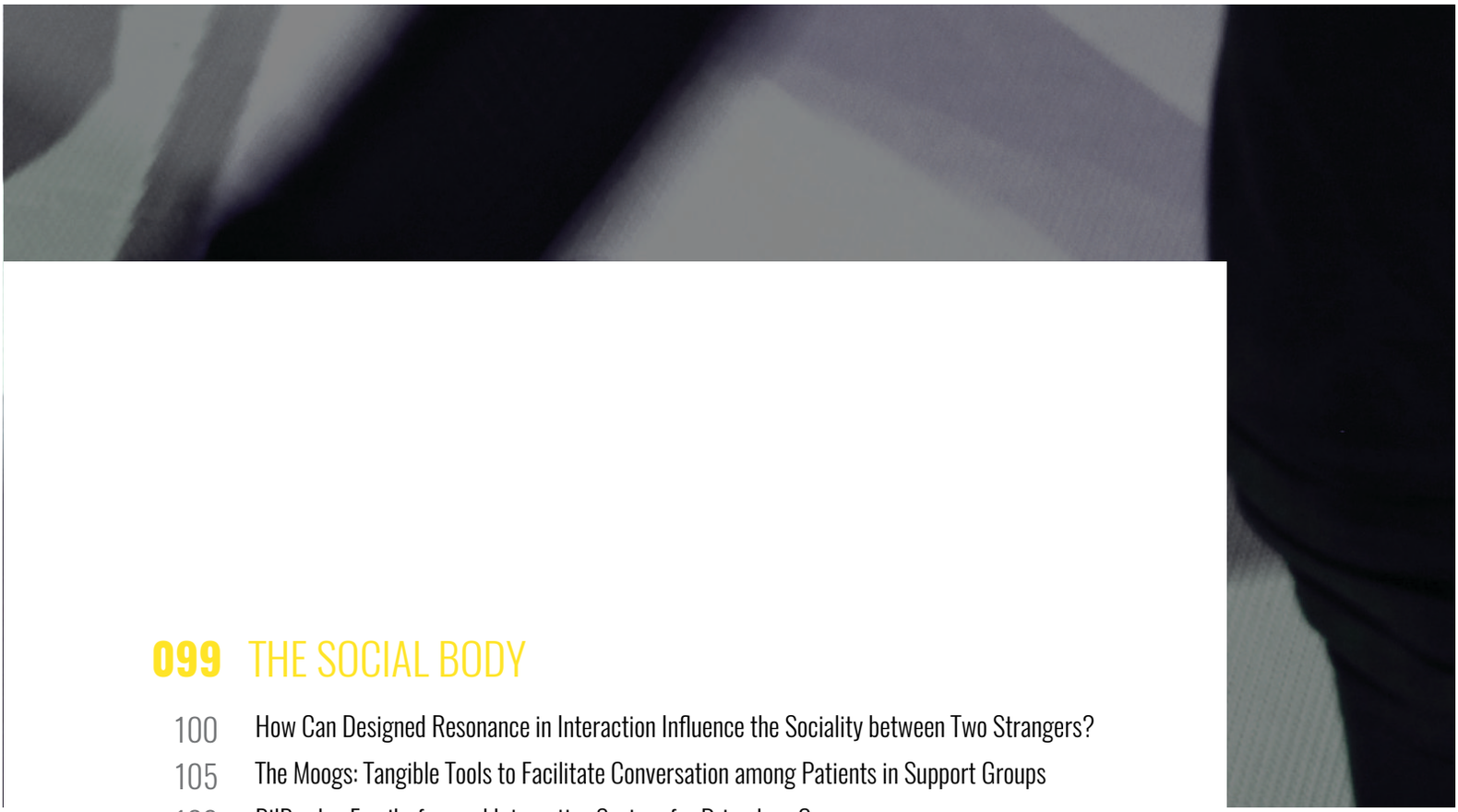

SIDER '15

IS YOUR BODY YOUR OWN?

EMBRACE: THE EMOTION SHARING BRACELET

ROBIN ANDERSSON, JONAS BERGLUND, NADIA CUOTTO, FANNY LINDH, ALEXANDRA LAZIC
DEPARTMENT OF APPLIED INFORMATION TECHNOLOGY, CHALMERS, SWEDEN
{ ANROBIN, JONBERGL, CUOTTO, LINDHF, LAZICA } @STUDENT.CHALMERS.SE

ABSTRACT

In this study we present *Embrace;* a wearable device that explores the potential of wearable technology harnessing the affordance of human form and deformable displays. We research new ways of communicating with loved ones in order to improve the experience of connectedness when they are apart. *Embrace* is a wearable device in the form of a bracelet that shares emotion between peers by providing both visual and haptic feedback. Other devices like smartphones and tablets have a rigid form and material. In contrast, the deformable display used in *Embrace* enables the user to wear the technology seamlessly on the body. The haptic feedback for sharing emotions is believed to provide a different experience since the physical sensation is more close to feeling heartbeats, hugs, and skin contact, compared to only visual information of today's mobile devices.

INTRODUCTION

According to research by Hiroshi et. al, current graphical user interface-based HCI-displays are restricting themselves to limited communication channels when it comes to human senses (Hiroshi et. al 1997). Hiroshi et. al writes: "GUIs fall short of embracing the richness of human senses and skills people have developed through a lifetime of interaction with the physical world" (Hiroshi et. al 1997 p.240). This indicates that there is much to explore in this area.

Figure 1: *Embrace* prototype with emotional cues.

In this paper we present *Embrace*, a wearable device that allows sharing emotions among peers through the transmission of haptic sensations besides visual feedback, see figure 1 above. We also explore potential use of bendable screen technology as opposed to regular (rigid) displays. In comparison, bendable screens are adaptable to the material and form of the human body which allows for custom fitted solutions when including such technology in wearable devices, i.e. wearable displays. We wanted to explore if using a bendable display in conjunction with emotion sharing could provide a more personal experience since the device becomes less of a foreign object, e.g. such as a rigid watch, and more part of the user's body.

A quick user study with a prototype showed great promise and suggests further research. The aim of this paper is to present our work which culminated in the concept of *Embrace*, where we used deformable display technology in conjunction with haptic cues to share emotions.

CONCEPT

Embrace is an emotion sharing bracelet that can be used to communicate feelings with people you care about. The device gives its users a richer communication experience, compared to texting, calls or video chats on mobile phones and laptops. It allows a sender to engage with the senses of a receiver – senses that are typically only possible to use when being physically close to another person. Calling on the receivers' visual (deformable display) and tactile senses (squeezing,

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vibration, warmth) we wanted the users to feel more connected to the other person.

Embrace allows you to send and receive a hug, share your heartbeat or a buzz. The cues that are perceivable are vibrations to represent heartbeat or a buzz, and a gentle warm squeeze to represent a hug. *Embrace* also gives visual feedback on a deformable screen by showing what cue was sent and by whom.

RELATED WORK

We wanted to explore if using a bendable display in conjunction with emotion sharing could provide a more personal experience, which is a significant difference from other related work. Of relevance to this paper is therefore both research in sharing emotion through technology as well as research of bendable displays and its applications.

EMOTION SHARING

Love, closeness, intimacy, social relationships in general are essential for humans to feel happy and satisfied according to several studies (e.g. Argyle 1987, Berscheid and Peplau 1983, Miesend and Schaafsma 2008, Myers 1999). This can become a problem for people who spend long periods of time apart from their loved ones. Hassenzahl et. al presented six strategies of mediating intimate relationships through technology which are: awareness, expressivity, physicalness, gift giving, joint action and memories (Hassenzahl et. al 2012). This toolbox of strategies guides the designer when addressing relatedness with devices, for instance it succeeds in giving hands-on advice applicable to *Embrace* prototype concerning the expressivity and physicalness.

Several studies have succeeded in communicating emotions through technology, artificially generating feelings of bodily intimacy through wearables or portable devices. Werner et. al developed *United-Pulse*, a device that allows couples to share their heartbeats between each other via a ring (Werner et. al 2008). Bales created CoupleVibe, a mobile application where users share their location by sending vibrotactile cues (Bales 2011), the findings shows that the information from your partner can enhance connectedness through tactile sensations which is similar to the haptic cues transmitted with *Embrace.*

When making a device meant to share emotions, it is important to consider the relationship of the users and how to best support their sharing. Kaye demonstrated with VIO prototype, how a single bit of communication between two people who share a context can leverage an enormous amount of social, cultural and emotional capital (Kaye 2006).

The Apple Watch, which has not yet been released, will have a similar feature to *Embrace* where the user can share his heartbeat to other users (Kastrenakes 2014). The watch records the user's heart rate and includes the option to send it to other apple watch users will be able to feel that heart rate on the arm with help of a vibrator.

BENDABLE DISPLAYS

Visual feedback is part of the concept and because the whole device has to be able to bend for wearability matters, studies of bendable screens have been a source of inspiration for possible interactions.

Research with bendable displays in the areas of HCI and interaction design have centered on taking advantage of its flexibility to leverage new interactive interfaces. One such research is that of Lahey et al that explores bend gestures in a general sense to interact with and navigate through the system of a handheld computer (Lahey et al 2011). Other research has focused on a more specific context, for instance scrolling by bending corners or sides (Schwesig et al 2004) or through twisting the display (Kildal 2012). There has also been research of utilizing foldable displays to change the size of handheld devices in order to make it easier to carry and handier when texting a message or navigating through a GPS (Ramakers et al 2014).

DESIGN PROCESS

The design process applied was based on J.C Jones's design process model following three main phases: divergence, transformation and convergence (Jones 1970). In this stage the problem domain was not defined. To come up with problems we defined fictional characters as well as context of use. Later we filtered the problems not related to our intended users – defined as people between 20 - 30 years old with good understanding of technology. We later used the generated content to develop a prototype.

DESIGN STUDY

To outline the problem domain we defined what we call *extreme personas* – essentially a mix of extreme characters following Djajadiningrat et. al's model (Djajadiningrat et. al 2000) and personas similar to how Nielsen defined them (Nielsen 2007). People engaging frequently in extreme sports were determined as our (extreme) personas in order to get us thinking "outside the box". These were used as sources of inspiration through consideration of their age, personality and attitude towards life as well as activities they might encounter in their extreme living. Four ideation methods were used (brainstorming 6-3-5, reverse brainstorming, error analysis and scenarios) in order to identify problems they might have. The problems were judged against their applicability to our intended users in order to determine the problems' relevance. The most relevant problems we found stemmed from the personas not being able to use their mobile phones, them having difficulties navigating the terrain as well as difficulties communicating with friends, all the while engaging in their extreme activities.

In the next step (transformation phase) we wanted to come up with ideas for addressing those problems to which we sketched and produced quick-and-dirty paper prototypes. The evaluation of these ideas was judged based on the feasibility of implementing the idea as a high fidelity prototype using bendable display technology.

The concept of *Embrace* eventually emerged from combining three main ideas: gloves with display, a smart bracelet and a heartbeat sharing device, see figure 2. The gloves with display's purpose were to ease the user's navigation by using gesture controlled interactions with a GPS-enabled map representation. The smart bracelet was a practical solution to normal wearable devices being in the way (e.g. getting tangled in climbing ropes) by making the display more a part of the user's body. The heartbeat sharing device was intended as an alternative way of communication, where the extreme sports user could invite friends to participate in the user's experience in a more personal way, i.e. to feel his heartbeat. From this last concept came the whole notion of sharing emotions through technology, which became one of the two central points of research in this paper.

PROTOTYPE

After defining the concept and its context of use (sharing emotions through a wearable device), we started to tamper with the technology and building a prototype. We wanted to research how sharing emotions by sending haptic cues with the help of actuators could enhance communication between loved ones. We chose three feelings and translated them into tactile cues: a hug (squeeze or contraction around the user's wrist), a heartbeat (vibration at a heartbeat pace) and a buzz (random vibration), as well as visual feedback consisting of a picture of the sender and text describing the event.

A *Dynalloy Flexinol* contracting wire measuring 1.5 mm thick and 25 cm long was used to simulate the hugging sensation while a vibe motor was used to simulate heartbeats (and simple buzzes). The contracting wire needs to have current flowing through it to contract, which would also heat it up – above as much as 90° Celsius after 10 seconds. The time it was activated was therefore thoroughly tested and finally set to 5 seconds to achieve an optimal contraction as well as heat emission (still hot enough to simulate human warmth). A fabric case was also used to protect users' skin. We also experimented with the vibe motor in similar ways to achieve the impression of actual heartbeats. Moreover, the *Beaglebone* was programmed to handle all the logic pertaining the events – meaning it was in charge of sending the images and the text to the bendable screen as well as controlling the contracting wire and the vibe motor with digital signals accordingly.

Figure 2: The three main ideas merged to create *Embrace*

Four events were programmed to occur during this time and the time between the events was set to 14, 8, 14 and 10 minutes from the time that the *Embrace* was switched on. A buzz occurred directly when the *Embrace* was switched on to ensure the functionality and was thereby not a part of the study. The diary of the study participant presented in Table 1 shows how she experienced the events and what the true (programmed) events were. During the study, the participant expressed a wish of being able to send an emotion.

EVALUATION

The prototype was tested through a user study where one person got to wear the device and experience the sensations presented earlier. The following sections describe the evaluation.

USER STUDY

The user study took place in an everyday context with one study participant and was performed in order to find out what kind of emotions *Embrace* could evoke. The *Embrace* prototype was only used as the receiving device during the study. Even though there was only one prototype, the study participant was told that she had one out of two devices and that her sister had the other device. The participant was also informed about the emotions she would be able to receive but not how this would manifest itself. The batteries in the prototype would only last for one hour but in order to not affect the participant's experience she was told the test would last for the whole day. The study participant kept a diary during the experiment, in which she wrote down her experiences.

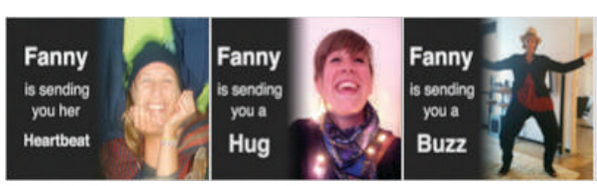

Figure 3: Different outputs from *Embrace*

During this time, the prototype was programmed to simulate 4 incoming signals by inducing a haptic sensation and showing images of the sender as well as an explanation of the event (see Figure 3). The time between the events was set to 14, 8, 14 and 10 minutes from the time that the *Embrace* was switched on. A buzz occurred directly to ensure the functionality and was thereby excluded in the study. The diary of the study participant presented in Table 1 shows how she experienced the events and what the true (programmed) events were. During the study, the participant expressed a wish of being able to send an emotion.

Table 1: Study diary

Programmed event: Heartbeat - vibrator buzzes to the rhythm of a heartbeat Feeling: I didn't feel anything, but the screen showed a message and a picture of Fanny, telling me that she was sending her heartbeats. Reaction: I felt surprised and happy, but a bit disappointed when I didn't feel any physiological change. **Programmed event:** Hug - contraction of the flexinol wire Feeling: What caught my eye was the image popping up on the screen, but this time I felt a very small squeezing sensation. The screen showed a message that told me that Fanny was sending me a hug, but it felt more like a very discrete tickle. Reaction: I again felt a bit disappointed, since I couldn't really feel the hug, and I start wondering if I'm doing something wrong. (I really appreciated seeing Fanny's picture while receiving the hug.) **Programmed event:** Heartbeat - vibrator buzzes to the rhythm of a heartbeat Feeling: I didn't feel anything, but the screen showed a message and a picture of Fanny, telling me that she was sending her heartbeats. Reaction: I felt happy, it felt good to be interrupted while working and seeing the face of somebody I like. **Programmed event:** Hug - contraction of the flexinol wire Feeling: I didn't feel anything, but the screen showed a message telling me that Fanny was sending me a hug. Reaction: It still feels nice when the screen lights up and tells me that I'm receiving something, but it feels sad, at the same time, when I don't feel anything.

During the test, one technical issue with the bracelet arose, as the buzzer did not work. The display and the contracting wire worked well and the study results brought new insights to the concept. These insights helped reinforcing that *emotion sharing* with wearables is an area for further studies.

The bendable screen turned out to have a positive influence on the participant. One of the comments written in the diary regarding the information on the display was "I felt happy, it felt good to be interrupted while working and seeing the face of somebody I like".

FINDINGS

By analyzing the information written in the diary, we found that the experience of receiving emotions through the bracelet was positive even though it interrupted normal workflow. This method could show how to give emotional support, provide motivation during work and generate a stronger feeling of connectedness.

The comment regarding the hug was that the study participant felt a squeeze and the visual information on the display helped her to understand the received emotion. The feedback regarding the prototype was important as it gave a direction of how to improve the current prototype and make a more purpose-fulfilling design. The diary also revealed that the participant felt disappointed when the display showed information about receiving a heartbeat, but she did not feel the buzzer due to technical issues. Having a lack of action from the bracelet reinforced the idea that people relate and interpret haptic sensations with feelings.

DISCUSSION

This paper presents the design and development of *Embrace*, a wearable device that explores the potential of wearable technology harnessing the affordance of human form and deformable displays and the ability to share emotions among peers.

Most computational devices like smartphones and tablets have a rigid form and material. In contrast, the deformable display used in *Embrace* enables the user to wear the technology seamlessly on the body. We believe that wearable displays allows for a more personal experiences as they can support both visual and haptic cues while being more integrated with, and accepted as part of, the human body. Where the human tissue ends and the technology begin is blurred.

Due to malfunction of the haptic feedback during the test, we could not find evidence strong enough to say with certainty that the haptic feedback provided an improved different experience of sharing emotions compared to communicating with text or pictures. We suggest to user test the idea further in order to validate this hypothesis.

Further research should also be conducted to the use of bendable screens for input. It would be interesting to implement selection actions such as being able to send a hug by squeezing the screen or sending your heartbeat by placing the device close to your heart. The final device would also need to run a system that the user interacts with, which is relevant to the gestures that are possible for the bendable display. In addition to that, it would be interesting to study how the receiver would react when receiving a heartbeat on his or her arm for longer periods of time. Would the heartbeat of the receiver change? Would the pace increase or slow down? Can this bring advantages to other fields of study?

Current studies of mediating intimate relationships through technology shows how important it is for physically separated couples to express their emotions on a regular basis (Hassenzahl et. al, 2012). It would be interesting to find out how an emotion sharing device can affect long-distance relationships (which is not that unusual today). Moreover, devices like *Embrace* can bring a way of reconnecting people and incentive those to be physically closer to their friends and loved ones. More recently, Apple announced an emotion sharing feature for their upcoming watch product line. Even though this device is different from *Embrace* regarding its rigid form compared to the flexibility of the bendable display, the availability of this technology allows for research to develop future emotion sharing devices.

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QUANTIFIED SELF – YOU DO THE HARD WORK – BUT WHO REAPS THE BENEFITS?

NINETT FISCHER JENSEN
UNIVERSITY OF SOUTHERN DENMARK
NINETTFJ@HOTMAIL.COM

ABSTRACT

This is a paper to provoke reflections on who benefits from the rising trend of people measuring their own health and wellness. Collecting day-by-day numbers on their body functions and personal behaviour by means of the new wearable technology; and saving these data in health social networks and so forth. This self-experimentation and self-tracking of our own body is called – Quantified Self – QS. I also argue that these data, in near future might be combined with other data from the Big Health Data cloud, and interpreted by others than the ”owners” of the data. And that the result of this interpretation might be used in a context, and with consequences, that raises important ethical questions, that will need to be addressed.

Based on the potential in the technological development, and based on some cases reported in the Danish media in 2011, I come up with a hypothesis - a speculative scenario. I claim that the social security system, in the near future, will require evidence of, that a patient in spe has been living a “healthy life”. This will determine if the patient in spe is admitted government paid treatment and sickness benefits, or not. And in case of a diagnosed and approved patient, this patient will have to ingest prescribed medication – voluntarily or involuntarily – to maintain approved government paid treatment or sickness benefits.

INTRODUCTION

There is a widespread agreement upon, that the era of Big Health Data has arrived. And with all the new hard- and software tools to collect, store and manipulate this huge amount of health data; a shift in the health care system seems unavoidable and necessary. But under which circumstances and how to respect the different stakeholders and their specific approach to this shift of paradigm has not yet been clarified.

Some of these data might be wellness- and health-data collected via the quantified self tools, and uploaded by ourself. And other data might be for example blood test results, prescription of medicines and diagnoses from our doctor and/or hospital. There is an ongoing discussion whether these data should be available for a wider circle of stakeholders, than today. Meaning that the laws and regulations regarding data privacy should be less restrictive.

The people that are for this kind of relaxation argue, that opening up access to the big health data, will support the medical industry in developing new medicine and treatments. This group is also keen on, that the patient shall bear more responsibility for his own health condition. Some moreover draws attention to the new possibility of calculating what an average “healthy life” means.

Whereas another group of people, that want to maintain the current level of data privacy, argue that patients should still be the owner of his or her private health data. Regardless of the origin of these data. And that the confidentiality based in this privacy is crucial to the doctor, who has, and should in the future have, the full responsibility of diagnose and treating the patient.

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In between these two groups some argue, that maybe we, as a society, are not yet ready to make full use of the new technological gains. We need at first to focus on further discussions about the balancing between the ethical obligations to privacy and confidentiality, against the social goals of public health and systemic efficiency. As author of this paper I join this latter point of view.

Grounded on incidents from our society of today I come up with the provocative hypothesis, **that the social security system in near future will require evidence of, that a patient in spe has been living a "healthy life". This will determine if the patient in spe is admitted government paid treatment and sickness benefits, or not.**

LITERATURE & SUBSEQUENT STRUCTURE

I will narrow in on the theme by focusing on the following subjects (bold text):

Health data that origins from **QS** by means of personal informatics. Personal informatics is a class of software and hardware systems that help individuals collect personal information to improve self-understanding. Among this hardware is the **wearable wristbands** that can monitor your health, wellness and behaviour. And some of this software is **health social networks** where the health data can be stored in the **Big Health Data** cloud**.** But what about data **privacy.**

After elaborating above subjects I will return to the aforementioned **provocative hypothesis.** I claim that in the near future demands on **"healthy living"** and **involuntary treatment** might influence the amount of health care granted by the social security system.
To support my hypothesis, and to narrow down even more, I will focus on **Denmark** and some former **cases from the Danish media**.

Finally the **discussion** and **conclusion** will sum up, and include my perspective on **who benefits** the most of the QS trend, for now.

QUANTIFIED SELF

This new trend is predicted soon to be embedded in our everyday life. Recently the media started to show interest in this rising phenomenon. The journalist Gary Wolf was one of the first to write an article - *"Know thyself: tracking every fact on life, from sleep to mood to pain, 24/7/365"*. If you don't know much about the QS trend, this article is worth reading.

Here are some quotes from Wolf: -*"Self-trackers seem eager to contribute to our knowledge about human life. The world is full of potential experiments: people experiencing some change in their lives, going on or off a diet, kicking an old habit"..... "These are potential experiments, not real experiments, because typically no data is collected and no hypotheses are formed. But with the abundance of self-tracking tools now on offer, everyday changes can become the material of careful study."....."Numbers may be useful for epidemiologists and insurance companies, school systems, the military, and sociology professors, but what have they to do with the fabric of our personal lives? "*

To track the self-trackers Gary Wolf created the web-page "Quantified Self – Self Knowledge through Numbers".

WEARABLES

There are many wearable products on the market. But we will focus on wristbands. The Jawbone UP-bands for example are packed with sensors, that combined with software on your smart phone or another smart device, is capable of monitoring your sleep pattern, eating habits, daily activities and exercises. And the latest model UP3 even monitors your heart rate.

Fig. 1. Display from UP software – Your numbers for today

According to "Science Video-online" the video "*Sugar rush in wearable devices*" shows, that Apple, Google and Samsung are working on embedding a feature in their wristbands to monitor blood sugar without any needle stick. The research firm "Global Data" predicts, that with 29 million Americans suffering from diabetes, the market value of monitoring glucose level in blood, could be 12 billion dollars by 2017. They assume that if this product is marketed to diabetics it might be regulated by laws to come. But if marketed to nutricians, regulations might be circumvented.

So I expect to see an increasing amount of wearable products, that are able to retrieve data from blood and other biomarkers.

I have tried out an UP-band over a period. And in this single case I found, that it did have a positive impact on personal behaviour regarding exercising to get more fit. I joined in a group, uploading my UP-band data, and compared with the other members. This embedded gamification worked for me. But according to some of the research literature (from 2012) [5 and 7] there are still no scientific research that confirms, if these QS tools affects the health of the user in a positive way. And in a broader perspective if QS can improve public health on the long run.

HEALTH SOCIAL NETWORKS

On health social networks individuals share their experiences regarding wellness and health. Uploading tracked data from wearables, sharing knowledge about illnesses, comforting and supporting other patients, crowd-funding money for research in special diseases, etc.

"Patients Like Me" is an example of such a health social network, where also doctors and nurses are affiliated offering online health services – telemedicine. And companies sell gene, blood and other biomarker tests. The drug industry is also represented in these networks.

According to Melanie Swan [1 and 3] the medical research is now, due to these health platforms, able to get in contact with plenty of suitable study participants much easier than before.

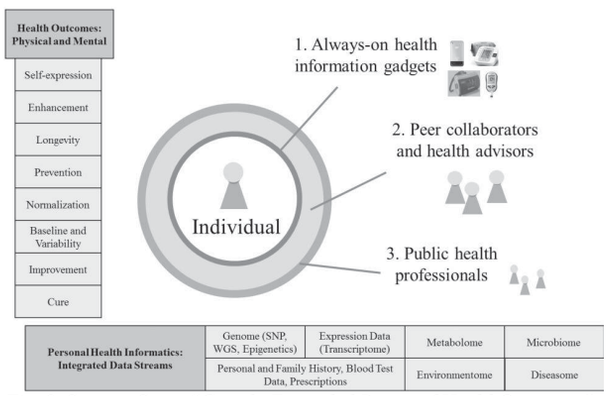

Fig. 2. Source: Swan "Greatly Expanded Range of HealthOutcomes"

Fig. 2 depicts Swans idea of a future health care. A system on the other side of an expected shift in paradigm. We will return to Swan in the discussion section of this paper. But for now the illustration is also a suitable approach to the next subsections about the "gold mine" of data. (See the horizontal barre at the bottom of the illustration.)

BIG HEALTH DATA

With Big Health Data as of today, most of this data concerns our physically wellness and health. But tracking and collecting data about our mental health is predicted to be the next big trend. Data is growing at 50% a year. And data originated from the Quantified Self tools constitutes only a fragment of the total amount of data in the Big Health Data cloud (fig. 2).

Download of health applications exploded from 300 million in 2009 to 5 billion in 2010. And according to the developers of personal informatics [5], they do not only develop the QS hard- and software with the intention of fulfilling the need of the individual self-tracker, but also with the intention of helping researchers conduct studies.

These developers also discuss how to "reappropriate" existing social networks as Facebook Timeline, WhereDoYouGo, TwitterAnalyzer, and LastHistory. I assume that the term reappropriate means that they intend to extract personal data across these networks to create novel personal informatics systems. At the same time they wisely ask questions on (quote):- *"What are the privacy concerns with sharing of personal data and how do we address them? How do these reappropriations change how users view these systems and does it increase or decrease engagement?"*

PRIVACY

The privacy of data originated from aforementioned platforms and from QS-data uploaded by the individual to a typical health social network, is not protected by transparent laws and regulations. In contrast traditional insurers and health care providers are duty-bound by privacy laws and regulations to protect personal data.

Our health data are literally becoming a "goldmine". Nikolaj Sonne, a Danish journalist in tech news, proclaims in one of his television shows - "*Privacy in the Future"* - that if services on the internet are for free, then you must expect to be the product.

It is commonly known, that individuals are worried about whether their data can be properly anonymized before handed over to third party. And researchers from Havard [8 and 2] have proved, that it is often impossible to anonymize health data if the person suffers from a rare disease and data is coupled with demographic data. So be aware that if you for example upload health data via QS tools to a cloud-based platform, then you should assume, that the applied laws and regulations concerning privacy are dependent on the nationality of the provider, or maybe of the geographical location of the server that stores all this data.

According to an article written by Daniel Solove [11] - "*On Privacy, Why Is the EU So Different from the US?"* there is a big clash between the US and the EU approach to privacy. US being much more liberal than EU. Quote:*"The new EU proposed regulation, released in January 2012, seeks to double down on the approach of the 1995 EU Directive on Data Protection, proposing a right to be forgotten, and more explicit consent requirements for data processing."*

Recently in Denmark there was a debate on a Danish web-page "Altinget.dk". Opponents upon the subject *"The drug industries access to health data"* [8] on-line discussed their different perspectives. Former Danish minister of health Astrid Kragh argues, that we need to open up for the drug industries and other relevant partners. This not to fall behind the positive development in the other European countries regarding growth in public health and research- and medicine- industry. In the summer 2013 she established at committee – STARS – "Strategic alliance pro registry- an health-data". This to find out how to achieve more openness to our health data, but within the limitations of the EU regulations.

As opponent to Astrid Kragh a member of the Danish Ethical committee Thomas Plough argues that (quote): *"To improve treatment and create growth based on the health data of the Danish people, is possible and worthwhile, if it does not violate or compromise our citizens democratic rights".*

The Danish Ethical committee is not represented in the STARS committee.

I think that Denmark is moving towards US in their approach to privacy, minimizing the clash.

PROVOCATIVE HYPOTHESIS

It is hereby my intention to prove the aforementioned hypotheses by conveying the following facts.

In 2011 the Danish news media brought evidence, that two Danish municipalities began to change their case-work practice regarding approval in cases of sickness benefits [9] . Struer and Aalborg municipalities forced stressed or depressed patients to ingest happy pills. If the patients disobeyed to ingest these psychotropic drugs, then they were not approved to have any sickness benefits. One of these patients would, if she denied the offered treatment, have a reduction on 3.000 $ in income. With the consequence that she, as a single mother to two children, would loose her home.

The Danish politicians [10] disagreed upon whether this new practice of the sickness benefit regulation was acceptable or not. Experts in social rights pronounced that the practice might not be legal. And doctors pronounced that other treatments, with less side effects, were possible. The case ended up in a trial. We do not know if this trial has ended. But for a period of two years until June 2016) the possibility for the municipality to refuse sickness benefits is withdrawn.

INVOLUNTARY TREATMENT

It seems reasonable to categorise aforementioned cases as intention of involuntary treatment. And researching that subject I came across literature [4 and 6], that referred to mentally ill patients in mental hospitals. The literature was about the use of involuntary medication and other restraining measures like holding, seclusion rooms, netbeds and belts. The researchers wanted to clarify the difference in practice across borders in Europe. The conclusion was that the practices were quite different; each having their own historical approach and bounding by local initiatives and limitations of funding.

TECHNOLOGY AND OUR HYPOTESIS

I predict that just around the corner the market will be flooded with wearables, packed with new features. Features to measure blood and so forth. In that way it is possible to measure if a patient on a given day, has digested the prescribed medication – voluntarily or involuntarily.

Around 100.000 health apps are on the market. And the developers are eager to incorporate more transparency and ability to collect and combine health data across different health social networks. It is predicted that the QS trend soon will be adopted by most of us, getting used to put numbers on our health, wellness and behaviour. I find it plausible, that a patient in spe by the authorities might in near future be asked to document a "healthy living". This by personal health data that he or she has voluntary tracked and uploaded to the Big Health Data cloud.

DISCUSSION

I was surprised that the subject from above - involuntary treatment in mental hospitals – was not evenly regulated or standardised in the EU. Typically this is a subject that talks to our emotions and feelings, engaging most individuals / voters. And I have been aware of this dilemma for many many years. But despite that, it seems as if something is missing – discussions on common guidelines, regulations and maybe laws.

There are some parallels that concerns us looking ahead on the public discussion that has to forego the necessary shift in paradigm regarding the health care. How long will this discussion take. And will it be a suitable base, effective enough to solve the problem regarding the big "grey zone" that arises because of the rapid and over-whelming development of IT technology.

Reflecting on our research literature I will comment on Melanie Swan [1 and 3]. She seems to be quite extreme in her point of view. In her article *"Health 2050...."*, she comes up with the concept of health-classifying the future biocitizen. And writes about predictive and preventive health care, where the patient is empowered to take over most of the responsibility for diagnose and treatment. She is also the one suggesting, that you as a future biocitizen could benefit from your health-classification when negotiating job salary or health insurance. I think that Swan's description of a possible future health care year 2050, does not rely on any speculative technology that is not already here today, or at least "just around the corner".

CONCLUSION

The purpose of this paper is to provoke you to participate in the debate concerning the ethical balancing between utilization of new technology versus the respect of humans diversity and rights of self-determination. And to bear in mind, that that might be an important point of interest, when you have to vote for your next candidates in politics. Because I also conclude that based on the Danish cases about sickness benefits we can not rely on, that all authorities and politicians will take moral an ethically decisions. Decisions that should corresponds to a democratic society where the citizens were supposed to have equal possibilities.

Finishing this research I will sum up who seems to get the most out of the QS trend. I did conduct a test and had a good experience with the use and outcome of an Jawbone UP-band. But in my research literature it was often mentioned, that scientific research on the subject was still missing. It appears to us as if the user is not the one that benefits the most. So I end up concluding, that for now the medical industry seems to be the ones who reaps the benefits.

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THE BUNNY IN A BOX - DESIGNING A DIGITAL PRACTICE PET FOR CHILDREN

JOHANNA GLEMBO
CHALMERS UNIVERSITY OF TECHNOLOGY
GLEMBO@STUDENT.CHALMERS.SE

MYLÈNE MENGUAL
CHALMERS UNIVERSITY OF TECHNOLOGY
MENGUAL@STUDENT.CHALMERS.SE

ABSTRACT

Testing young children's ability to relate to and take care of an animal - before actually having a real one on hand - is a desirable idea, but is it possible? The concept of "the bunny in the box" relies on creating the feeling that there is an actual pet present, using current technology and electronics (a tablet, vibrations, sound, LED lights, etc.) without the children being able to see an actual animal. Children were involved throughout the whole process, from co-design to evaluation, and their behaviour towards the bunny were observed. They reacted positively to its requests, and were able to take care of it as well as remembering the encounter for a long time period afterwards. The paper presents and analyses the design process and the prototyping sessions.

INTRODUCTION

Most - if not all - children that play exhibit patterns that involve nurturing and caring for others. It can be as simple as having a teddy bear that they tuck in at night, or more elaborate plays that involves different roles, and mimicking parenting skills from their own experiences. So it usually comes a time in every parent's life when the child starts asking for a pet, more or less intensely.

Even if the parents would want to accommodate the child, the reality is not so simple. It takes a lot of time and cost a lot of money to have a pet. It is also a large responsibility. If/when the child lacks the skill or interest to take care of the pet it falls back on the parents to do so - an animal is not something that can lay about in the home unattended. This is the reason why there is a value in having something to practice with, that doesn't have real feelings or needs; a "practice animal" that ultimately will let you test if the child is mature enough for the responsibility of an actual pet. This report presents and analyses the process that we used when designing an interaction module for this purpose, including co-design and evaluation done together with children in a group.

RELATED WORK

Building robots have been a human dream for a long time. Science has finally caught up to the science fiction and we are experiencing more and more advances within this field. If a robot is human-like, children deem it aggressive, but if it is clearly a machine with human traits, children say it's friendly (Woods 2005). When instead talking about robot animals the term is zoomorphism. According to Schmitz (2011) the keys that trigger zoomorphism are the visual appearance, the voice, and the behaviour. The behaviour should be proactive, autonomous or maybe even stereotypical (he mentions shyness as an example).

Robots are now also used for educational purposes. Gwo-Dong et al. list three types of educational robots: learning materials, learning companions/pets, and teaching assistants (2011). They also conclude that pets are good for catching the children's imagination. Robotics can be a way to enhance the learning experience. Pets are good for children's socio-emotional development and seem to be an emotional support for them in different ways, both as comfort during hard times and as facilitators in social situations (Hurley 2014). As stated in the introduction, there are also lots to consider before including animals in the family, and if it is possible to test if the family is ready to get a pet before actually getting one it would be a good thing.

On the subject of robotic pets, one example is the robotic dog, AIBO, which is able to behave much like a

In Lucero, A., Castañeda, M., Bang A.L. and Buur, J. (2015). Embodied Interactions, Proceedings of Sider 15, March 27-28, Kolding, Denmark

real dog would. When tested by Francis and Mishra (2009), children reported that they felt that the more interactive toys were considered more real. This could mean that a learning experience with a robot that the children can interact with will be more beneficial than a simpler robot. A more life-like experience will better serve as a scaffolding to help children acquire new knowledge.

CONCEPT

We started off by taking zoomorphism to an extreme, to see if children would care about something anonymous. Therefore we designed a "bunny in a box", based on the concept of the sheep in the book "The Little Prince", by Saint-Exupery. The idea is to interact with the bunny in many different ways without being able to actually see it: through a screen, with sounds, by petting it, etc. This concept was intended to answer the following questions:

How are the children's initial reaction to the box, and will they keep interacting after the initial contact?

Do they express emotions toward the alleged bunny in the box? If so, in what way?

Will the children use the box in the way that it is intended; i.e. are they reacting to the bunnies needs?

The process to come up with the final idea and to evaluate it is described in the next sections.

FIRST PROTOTYPE AND CO-DESIGN

To better understand how the children would respond to the basic concept, we involved them in an early stage using a low-fidelity prototype. The main interest was to find out how the interactions with the bunny should be designed to make the children relate to the pet in the best manner.

PROTOTYPE

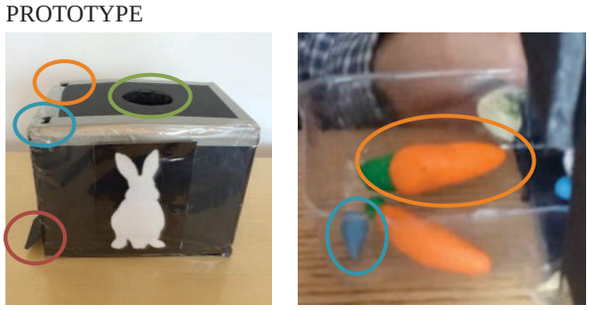

Figure 1: First prototype: (a) box with openings to feed (orange),give water to (blue) and pet/play with (green) the bunny and clean the cage (red), (b) loose parts (here drops of water and carrots) made of clay.

A simple card-board box was used (figure 1.a). We defined here six different kinds of actions: feeding, giving water, cleaning the cage, petting, playing, and sleeping. The first three actions were supposed to be realised by using objects made out of clay (figure 1.b). The children could pet and play with the bunny by putting their hand through a hole and feeling a stuffed animal. On the box itself there was a plastic pocket with a simple silhouette of a bunny, and cut-out symbols used to communicate. Then the children should know what the bunny needed and act accordingly.

CO-DESIGN: PROCESS

The experiment was intended to be conducted in Sweden. However only one of the two moderators was a Swedish speaker (A). Therefore A talked to the children while the moderator B was monitoring the "symbols" requirements.

Instructions were that there was a shy bunny in this box, and that it needed some help in order to be happy. Explanations about the items of food and water, the corresponding openings in the cage, and how to clean the cage from poo, were then provided. During the test pictures on the display were changed (manually) to see if the children could understand what the bunny wanted.

We wished to have an open design in the sense that we wanted the feedback from the children to be as simple as possible to integrate in our design. At the same time it needed to be presentable and a lot of choices had to be made initially. We made the cage pretty small, with just enough room for the tablet, thinking this would make it more believable concerning the size of the bunny inside and the bunny shown on the screen.

The method used to collect data from the tests relies on three basic principles: verbally-intentional (feedback that the children provide to the moderators), verbally-unintentional (children talking to each other) and physically (actions performed).

CO-DESIGN: RESULTS

The co-design group consisted of three children that all knew each other well beforehand, two boys of 2 ½ and 4 ½ and one girl of 3 ½ years of age. A larger group of children would have had a hard time to fit around the box at the same time and would therefore probably result in a lack of focus around the project. A smaller number of children would not have given us as much feedback, so three was considered an optimal number.

Overall, there was good group dynamics during the co-design. The test went well in general, since the children understood most of the symbols instantly and responded properly at the beginning. The children were engaged and collaborated together on figuring out the box. They spent a lot of time arguing about if there really was a bunny in there or not, before concluding that there must be, even if the stillness and the quietness of the stuffed animal were counter-arguments. At one point the 3-year old said "It's so cute" referring to the bunny. They understood the link between what the bunny asked for and the different clay items.

However, some problems occurred, mainly due to misinterpretations and unintended use. The symbol for cleaning the cage was a broomstick, which was understood as the bunny wanting to go out to fly "like a witch". The absence of reaction from the picture – as a visual feedback - was a bit disturbing to them. The loose parts were first put in the proper holes, but then in a lot

of places where they weren't intended to be (figure 2.a). They used the hole in the box to look for "treasure" and spent a long time "poo-hunting" when we showed them the picture with poo. Finally it was difficult for them to know how to respond to the "play" requirement. They were often trying either to pet the bunny or to get it out of the box. Freeing it quickly became a main focus of the exercise- and they nearly ripped the cage apart trying to do so. Several times they managed to get the bunny's' ears and/or head up through the petting hole and they displayed great happiness in doing so (figure 2.b). In the end, the 2-year old drifted off a bit, indicating that the interactions were maybe not catching enough for him (figure 2.c).

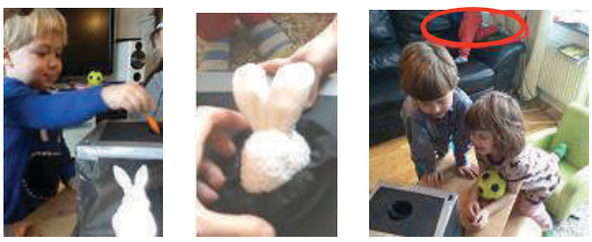

Figure 2: What went wrong in the co-design: (a) placing the loose parts where they didn't belong, (b) focusing on "rescuing" the bunny, (c) lack of attention.

EVALUATION

The high-fidelity prototype took all previous remarks into account. In order to answer the questions defined earlier, we decided to evaluate it into two steps: two sessions with the same children (the same as in the co-design) and the same settings and processes. The first one occurred five months after the co-design and the second one seven more months later.

PROTOTYPE

Figure 3: Second prototype with an app-solution and electronic interactions: feed (orange), giving water (blue), cleaning (at the back)

We did a large amount of changes between the first box and the second, regarding everything from materials to design solutions. The loose parts were removed and replaced with electronics. Therefore the new box was fitted with led-lights in different colours to symbolize the food, the water and the poo. The bunny was also able to vibrate. A tablet was fitted onto the box, so that all the interaction with the bunny was also done digitally by the children in the form of an app, with a clock regulating a limited amount of regularly appearing interactions. The children had to interact both using the app and physically touching the box in different ways.

The app still deals with communication with symbols from the bunny but also shows reactions when an action has been selected, while interaction with the box will result in physical input to the bunny, i.e. caring for it. Sound feedback was also added and the stuffed animal was fixed to the ground of the box to prevent it from being taken out.

EVALUATION'S PROCESS

Since the kids now had previous knowledge about the bunny in a box concept, and all three of them have played with tablets before, there was an opportunity to take a step back and observe, rather silently. Our strategy was to let them figure things out mostly on their own. This time A had to be a passive observer who took notes while B talked and communicated with the children by only using body language. So the children could not get any useful oral instructions from B.

FIRST SESSION RESULTS

As expected the children remembered the bunny and were very happy to see the cage. This time they did not argue about if the bunny was real or not. In general there was a good flow and the problems observed during the co-design were solved.

The children did not focus on freeing the bunny this time and didn't even mention it. The youngest one did have the patience this time to be there and to participate throughout the whole session. All of them were very much engaged in play (figure 4.a) and caretaking and they collaborated a lot to look after the bunny. It is probably due to the more relatable depicting of the bunny, which was more detailed and had some facial expressions, movements and reactions.

The use of haptic, light and sound feedback was indeed very valuable. The children related to them to understand what was going on. At one point during the evaluation, the vibration motors stopped working, so the 3-year old thought that the bunny was asleep and stopped petting it, but when looking at the display she saw that it was in fact awake, craving a carrot, so she stated: "It is awake! Then I can continue cuddling with it!", and then she did. This simple statement suggests three important things: she wants to interact with this "fake" bunny, she shows consideration toward it, and lastly she trusts the display to be giving her information about the bunny. It indicates how primordial the visual animation and adequate feedback are to young children. Removing the tangible items was also really helpful since it limited the possibility of creating a disorder and the children were better focused on the intended tasks. The duality of interacting with both the interface as well as the stuffed bunny in the box did not seem to bother them at all. They interacted both by touching it and pressing the right symbols on the interface.

They were very reluctant to leave the bunny alone when it was time to go. We also asked them about the bunny and they described it with adjectives like "kind", "cuddly" and "pretty". The two-year old even gave the

bunny a name (Massej/Massey). The children kept asking about the bunny for days after the evaluation.

Figure 4: Evaluation: (a) first iteration, the children are focused and explore the connection between an action and the coloured lights in the box, (b) second iteration, the children move around the box and play with it.

FOLLOW-UP SESSION

Encounters revealed that the children had not forgotten about the bunny. The 3 ½ year old, now 4 ½ year old, was continuously talking about the bunny, and moderator B whom she thought owned the bunny. This is a strong indicator of success, since it occurred spontaneously and after such a long time period afterwards. The oldest child also remembered the bunny, but did not express any excitement about the upcoming event. We interpreted it as a sign that he was grown out of the age category for this kind of play. Our guess was that the 2 ½ year old, now that he is one year older would be able to interact on a deeper level.

The assumptions were right for the two youngest children, but the oldest one was also very involved. In general, the behaviours were similar to the previous session. The oldest boy was continuously asking "What does the bunny want to do now?". Similarly to last time, the youngest child was the least engaged, but kept up the interest for a longer time period than during last test. All played longer with the prototype this time and they still talked about the bunny like it was living for real, very attentive to its needs and feelings. At one point they had to clean the cage and the youngest child shouted "Ew, I got poo on my hands!", which collected sympathies from the others. The event of cleaning the poo was the one where most collaboration occurred. This event triggered indeed both front and back of the box (figure 4.a), prompting them to watch both sides and letting the others know what was happening.

DISCUSSION AND FUTURE WORK

The project revealed promising finds about how young children can relate to an anonymous pet; they seemed to perceive it as real, wanted to take care of it, and kept being interested for months - even though they had not seen or heard about it in meanwhile. They also showed feelings towards it and responded correctly to the bunny's needs. Then another question can be raised: did the children relate to the bunny as an animal or as a toy?

To be able to answer that properly, the prototype needs to be improved. This could be done by making a more tangible bunny displaying life-like behaviour and spend time on making a "free" toy bunny that the children could touch and interact with, that would have some movement and be able to make noises. It would probably help younger children better apprehend the concept and connect to the bunny on a deeper level. We would also need criteria to evaluate if the child is ready. One suggestion is to measure the continuity of the care, which will have to be done by a continuous period of time instead of just two separate evaluation sessions.

Involving children in our project was the key of success which helped us adapt to their understanding. They don't think as adults and tend to have reactions that we wouldn't even have imagined. This is well illustrated by the tangible items. We imagined that the children would relate more to them than to lights but changing the interaction did not bother them. However the loose objects were also distracting and the children started using them for unexpected purposes. On the other hand, this led to a development in concept that we would not have reached on our own.

How does our design relate to Schmitz's findings? The visual appearance is unorthodox because the bunny is both visual and hidden at the same time. The behaviour is not proactive, but the repeating patterns makes it autonomous and its shyness can be viewed as a stereotypical behaviour.

CONCLUSION

This paper presents a project using design methods involving young children throughout the whole process. The collaboration with them enabled building a prototype that takes their understanding of abstract into account. The result is a hidden bunny in a box, which the children of the study have interacted with - in much the same manner they would with a real, live pet.

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DESIGNING PARENT-CHILD BONDING POSSIBILITIES FOR HEALTHCARE AND WELLBEING

STEFAN MANOJLOVIC
MSC IT PRODUCT DESIGN, SDU DESIGN
UNIVERSITY OF SOUTHERN DENMARK
STMAN13@STUDENT.SDU.DK

ABSTRACT

This paper describes the decision made of user-centred design methods, especially participatory story-telling in order to create possible design solutions to supporting parent-child bonding, for children presenting Prader-Willi Syndrome (PWS). In order to achieve the suggested intermediation of product-oriented interaction, there was a need of collaboration and high level of empathy towards the end-user through user-oriented practices. The user-centred design process with a participatory design approach was quite beneficial when designing for a specific focus group.

INTRODUCTION: BONDING AND NEED OF INTERVENTION

Looking at the market trends, healthcare technology is slowly moving from a hospital to home environment. Big companies like Philips, are re-directing their value in creating healthcare products for a wide range of users for a home environment: from monitors for elderly people to confident parents tools. These products are sometimes overwhelming for the user in an already distressing environment; to avoid that, designers in healthcare use different user approaches, such as a blended design approach that uses a combination of technology inspiration, consultation with experts and user-centred design (van der Linden, et al., 2012) or interaction analysis approach as described in the doctoral thesis by Kaipio (Kaipio, 2011). An approach described in this papers is participatory story-telling, when designing in close relation to the users' needs.

When designing for the user, the main focus was to facilitate the parent-child bonding experience. This is important, as stated by Cassidy, from an early stage in the attachment. The most fundamental aspect of attachment theory is its focus on the biological bases of attachment behaviour. Some attachment behaviours (smiling, vocalizing, crying) are signalling behaviours that alert the mother (attachment figure: usually a mother) to the child's interest in interaction, and thus serve to bring her to the child (Cassidy & Shaver, 1999). Whilst the syndrome, in its early stage, is limiting the infant to a lesser expression, the parents miscue on the attachment behaviour of the child.

While this project focuses on children with Prader-Willi Syndrome (age range from 0 to 2), who lack in psychical / emotional expression, this may cause a lack in parent sensing towards the child. Prader-Willi Syndrome (PWS) was first officially described in 1956 by Andrea Prader (Ward, 2000) and is a genetic disorder and occurs as a result of absence of expression of paternal genes from chromosome 15q11.2-q13 (Holm, 1993). Key features PWS (Ward, 2000) is neonatal hypotonia and feeding difficulties, moderate mental retardation from early childhood, behavioural disorders and hypogonadism during late childhood and adolescence. This also affects the environmental and societal context, since children are unable to express the need of interaction and, consequentially, parents are unable to read their child needs. A precocious multidisciplinary attitude is fundamental to improve quality of life, prevent complications, and prolong life expectancy (Elena, et al., 2012).

USER-ORIENTED PRACTICES

As facilitating the user bonding was set to be the main focus of the project, the process was set as a user-centred design. In user-centred design, the integration of knowledge of user is fundamental to success (Buur & Soendergaard, 2000). As the project required a high level of empathy and in-depth knowledge of the context,

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end-users were brought in to participate and contribute as co-designers using a participatory design approach.

This project recognizes the method to be efficient when designing for a specific user group with specific needs because it creates a high level of empathy and in-depth knowledge of the context, which is why participatory story-telling was considered. The project, nonetheless, was set on one-end user data collection. Not only the user involvement was consisting of the story telling session, but also the user together with the designer moved to a creative clustering session, where already made design solutions were discussed, nonetheless, new design solutions were proposed.

STORY-TELLING DATA COLLECTION

In order to protect the user's privacy names such as Anne* and Ruben* are mention in this paper. Choosing the approach of participatory story-telling, important quotes (future design considerations) from Anne were underlined, such as: "*parents need to understand the profile of the child*", "*important is the eye-contact; shared attention is a way of communication*", and "*the information comes slower*".

"Anne is a mother of a child presenting Prader-Willi Syndrome, her son Ruben is 7 years old. Just after she gave birth to Ruben, the doctors stated he was born with Prader-Willi Syndrome and had to stay at the hospital for few days for further medical examinations. Anne was very happy to have a child, and after a few days in the hospital, together with the husband, they welcomed Ruben in his new home. She explained that usually children born with the PWS are monitored for at least a couple of weeks after leaving the hospital, also, after that, they need to visit specialists such as: paediatricians, speech therapists, psychotherapists, endocrinologists, etc. Anne knew she had to research about the syndrome to know the aspects of it through the development. After some research and with the help of a therapist, she realised when interacting with Ruben the information was processed slower (the child was presenting a slight variation of autism). She strongly believed in the power of observation, for that reason a really important factor is to have constant eye-contact with the child while interacting. When looking at the child, parents need to observe and comprehend the profile of the child, the small and specific movements."

VIDEO ANALYSIS

For a more in-depth knowledge of the experience, a video was analysed and observed in order to understand better the context for designing. Moreover, the video was used, together as other material, as a visual guidance for the design solutions. During the video, the designer was exposed to the actual interaction between Anne and Ruben, videotaped by the husband.

From the video (Table 1), the clear image of the child's behaviour is portrayed. Anne is singing to the child, making long sounds such as *"Oah"* and *"Aah"* and as shown in the transcript below, follows a longer reaction break (longer processing time). The reaction of child can be noticed by a short sound. There is a minimal body movement (due to hypotonia, throughout the whole video the child presented a static facial expression, and minor body movement such as finger and legs).

Table 1: Transcript of the mother-child interaction

00:06	*Anne is singing to her child so she take a breath and makes a sound for 1.38 s.*
00:12 ***00:13*** ***00:14*** ***00:15***	*Ruben lifts up both legs and the right finer and makes a sound 0.50s. Anne makes another sound right after that for 1.10s. Ruben replies by moving his arm and lifting up his finer.*
00:16 ***00:17***	*Ruben replies with a sound that lasts for 0.56s. When Ruben finishes, Anne makes a sound that lasts for 2.56 s.*
00:23	*Anne changes her facial expression with a wide smile and lifted eyebrows, while still having constant eye-contact with Ruben. Ruben lift up his right finger.*
00:27	*Anne moves a little bit backwards.*
00:28	*Ruben lifts up both legs in the air for a second and reacts with a sound for 0.10s.*

DESIGNING THE INTERVENTION MODEL

As a parent, not being able to understand the child increases the stress, which causes them to become less sensitive to their child (Howe, 2006). This might cause a risk for the bonding process between parents and their child with PWS (Frederiks & Misha, 2014).

When talking about emotion in many evolutionary / functionalism theories, it is described as organized by the Autonomic Nervous System and other psychological systems (Levenson, 1988). Biological signals can be measured from the brain (neurofeedback) or from the body (biofeedback) (Rovers, et al., 2009). Together with the stakeholders, the bio-feedback system was designed for parents, who unsuccessfully sense their child. The bio-feedback system counted the galvanic skin response (GSR) and the heart rate variability (HRV) sensor.

GSR is the relationship between sympathetic activity and emotional arousal, although we cannot identify the specific emotion being elicited. The HRV is a measure of heart rate changes over time. In a term, positive stimuli are correlated with an increase of the heart rate, negative stimuli decrease it rate instead. (Cacioppo & Berntson, 2007)

DESIGN GUIDELINES FOR THE BONDING EXPERIENCE

Based on literature research, first design iterations, user's story-telling, video analysis and stakeholders feedback, the following design guidelines were formed for possible design solutions.

Because of constant eye-contact, the design should be a wearable that informs parents about the child's biological processes. The wearable itself would not interfere with everyday activities nor be a distraction in the interaction. The amount of information that the parents receive must not exceed their needs (not vast amounts of data: numbers or graphs). One of the discussed outcomes would be lighting LEDs. Correspondingly, the outcome should not be overwhelming and not restrict the parents' autonomy – it is preferable to have a confident / natural parent-child interaction. The design should be safe for both the child and the parents. The wearable wouldn't influence the arousal level of the child, which is why the light should be a smooth transition not noticeable by the child.

BABYTALK

Building upon a model of emotion measured by sensors, through Russell's Circumplex Model of Affect (Russell, 1980) there can be distinguished upon 28 emotional states on a two-dimensional model. On one side there is the level of arousal, on the other the scale of valence levels. The project was aiming at the four distinctive emotion spaces: excitement (0° - 90°), distress (90° - 180°), depression (180° - 270°) and relaxation (270° - 360°).

As a result, a tangible product was made in order to support the parent-child bonding: babyTALK (Figure 1). BabyTALK consists in different layers of textiles, sewed on a baby suit with a light source underneath the layer. The decision upon layers is to give with the RGB LED a smoother effect on the light source. Four different light colours (based on the Plutchik Wheel of Emotion (Wu, et al., 2006) would light up corresponding on the child's biological processes: white (yellow) for *excitement*; green for *calmness*; blue for *sadness*; red for *tension*.

A framework was designed for a graphic representation of the bonding experience (Figure 2).

DISCUSSION

As a user-centred designer, the validation of the appropriateness of the design for the target group is quite relevant. This project had an end-user involvement and a positive validation of the stakeholders.

This paper reflects upon the importance of the methods and approaches used when designing for a specific target group. When designing for a general public purpose, it is complicated to create design solutions suitable for everybody but it is more accessible to find participants involved in the process. Separately, having a specific target group makes the participation challenging or not existing, but design solutions can be often applied on mostly everyone. Moreover, the environment created is more intimate and crafts a high level of empathy towards the parents, the child and the design solution.

Figure 1: babyTALK suit for children with PWS

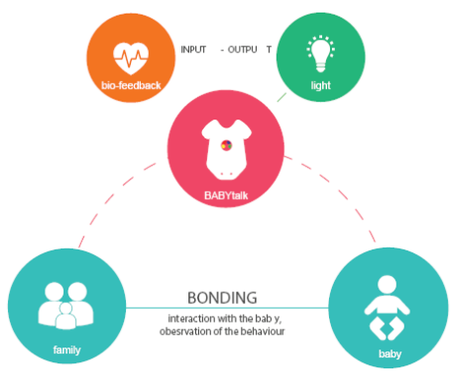

Figure 2: Design framework

Moreover, the environment created is more intimate and crafts a high level of empathy towards the parents, the child and the design solution. Finally, when managing an open storytelling session, the end-user shares experiences shared with other parent-child with PWS, creating indirectly a community, which can be material for further studies. Due to an extremely limited amount of users (children with PWS in age range from 0 to 2 and parents) babyTALK was not tested on real users, but a baby doll was used as simulation of the design context. The wearable was evaluated by experts, students and stakeholders during demonstration day at the Technical University of Eindhoven (not a user-test controlled environment). The evaluation was extremely positive, while most of the concerns were about the wearable itself: if the chest is the right position for the light, if the wearable is washable and if creating an arm light is a better solution. The designer together with end-user and stakeholder discussed about several proposals. The light on the chest is a strategic point, since arm or legs could be moved during a child activity and wouldn't interfere since the child is mostly laying down and the chest is not a disturbing point. When children are presenting a rare variation of autism in the PWS (which, the user states, can be seen in the child's repetitive behaviour) parents should learn from body movement and corresponding light source: connecting for ex. the finger of the left arm with the red light means that the child is state of tension.

The wearable is only one of the many possible design solutions, the designer hopes this will trigger more research about the topic: how can design go beyond light solutions? When interaction is triggered, is the wearable still a source of information or is the point of overwhelming? If the children are slower in processing the information, should the light source power up right after the measured emotional state or it should be combined with the child's response? How can designers benefit from other user-centred design approaches, such as co-design and co-reflection? Can the system trigger the creation of an eco-system with correspondent services and innovation methods?

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Also, for more information about the project visit http://www.stefanmanojlovicshowcase.co/babt%40home.html

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FINAQUA — WATER SAVING IN THE PRIVATE, THROUGH UNOBTRUSIVE AMBIENT FEEDBACK AND EMOTIONAL MOTIVES

CECILIA BOSTRÖM
CHALMERS UNIVERSITY OF TECHNOLOGY
CECBOS@STUDENT.CHALMERS.SE

OLIVER CARLSSON
CHALMERS UNIVERSITY OF TECHNOLOGY
OLIVERC@STUDENT.CHALMERS.SE

NANNA NAUMANN
CHALMERS UNIVERSITY OF TECHNOLOGY
NAUMANN@STUDENT.CHALMERS.SE

ISAK STRÅVIK
CHALMERS UNIVERSITY OF TECHNOLOGY
STRAVIK@STUDENT.CHALMERS.SE

DANIEL STRÖM
CHALMERS UNIVERSITY OF TECHNOLOGY
STROMD@STUDENT.CHALMERS.SE

ABSTRACT

Building on research in cognitive science and interaction design, this project addresses the issues of privacy and environmental responsibility in an eco-feedback frame. Starting from the position that privacy is a luxury worth defending even in a more cramped future living, the possibilities of combining this privacy with an eco-feedback system is explored. The design concept is a shower that visualizes water usage for the user. To motivate behavioral change, emotional arguments rather than logical are used, as emotional arguments are less likely to initiate reasoning and contemplation in the user, and instead more likely push fast, visceral responses. A virtual aquarium full of fish is screened on the walls of the shower, and as water is consumed, the water level of the aquarium diminishes. The concept is explored in a high fidelity prototype.

INTRODUCTION

There is a shortage of housing in Sweden today. Building laws set up a lot of restrictions upon building new housings, making it difficult to make a profit. However, when building apartments smaller than 54m2 there are less restrictions to consider. What would the consequences of living a family of four in 54m2 be? One thing is clear: space that we take for granted today might need to be restricted in order for the shortage of housing to be remedied. In the 1920s it was common for workers to live very cramped (*Trångbott på 1920-talet,* 2011). In an essay entitled "A room of one's own", Virginia Woolf puts the finger on one of the problems with this: "... a lock on the door means the power to think for oneself…" (1929). A room of one's own, she writes, is a necessity for the free and creative thought. Over the years, private space is something that has been accommodated to all classes, and is today seen as not as luxury but more of a necessity. Introna (1997) argues that perhaps in our modern world of technological

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evolution, privacy is a scarcity, and therefore even the more important. He recognizes different definitions of privacy, including a personal space or realm with no access from the outside, and the freedom from judgement and scrutiny of others. Reiman (1976) even states that: “Privacy is an essential part of the complex social practice by means of which the social group recognizes and communicates to the individual that his existence is his own. And this is a precondition of personhood.” It seems as though privacy is a value we cannot afford to lose. But is there room for privacy in tomorrow’s cramped living?

The perhaps last bastion of privacy in our modern home, where even parents can hope to be alone, is the bathroom. This is the one room in our homes that usually has a lock on the door, to preserve this privacy. Central to the bathroom is the water; washing and showering. These are actions we often perform without thought to the consequences at large. An old feminist adage in Sweden states that “the private is political”. By this is meant that the actions we perform in private have political consequences that cannot be disregarded. This is certainly true for many of the actions we perform in the bathroom, as they use up common-pool resources. There is an interesting tension between these two concept — the notion of privacy as a necessity, and the social dilemma that it is to use common-pool resources — that is accentuated in the bathroom. Our question is: *Can we enable a behavior that satisfies both the need for privacy and the society’s need to save resources?*

LITERATURE AND THEORY

WATER AS A COMMON-POOL RESOURCE

In many parts of the world, there is an acute lack of safe freshwater (thewaterproject.org 2014). Water scarcity is not the case in most of Europe, however the heating of the water requires energy and the use of shampoo and other chemicals are a potential threat to the environment, which means purification is yet another problem. As for some examples, in 2005 the consumption of shampoo in Sweden went up to 10 465 tons, liquid soap to 11 694 tons and shaving products to 784 tons (SCB 2009). This is an indication of the amount of chemicals that are mixed with the freshwater from our showers.

Water is what is called a common-pool resource. Common-pool resources are resources that are owned by no one, but used by many people (Ostrom 1994). An example of this is the fish in the sea. When worked by a few fishermen, the fish population recovers easily from the loss of fish caught. More fishermen put a bigger pressure on the population, and together with better tools in the fishing industry, it might be drawing closer to extinction. The common pool resource simply cannot take the pressure of everyone using it maximally. It is the same thing with freshwater: if it is used too much by too many, we will run out.

BEHAVIORAL CHANGE

An extensive body of research discuss how to promote a change of behavior. According to Vidmar (2012) people change either because they have to, or because they want to. The problem with a common-pool resource is that the sense of responsibility for the consequences of exploitation of the resource is diluted in the group, making room for individualistic, short term thinking. This is called the Tragedy of the Commons (Jensen 2000). It can easily be imagined that there would be some difficulty in making people understand that they have to change, which leaves us with the possibility to make them want to change. Turning to research on persuasion, it is shown that emotional arguments are often stronger elicitors of change than logical arguments, as personal experiences are better motivators than statistical data (Aronson 1994). Using emotional arguments is a way of choosing a peripheral route to persuasion, as opposed to a central route relying on logic. An example of an emotional incentive for change is a picture of lung damages caused by cigarettes on cigarette packages. This argument for a change in behavior is not based on statistics of how likely this disease is to affect the user, but instead of the feeling of disgust invoked.

Markovitz & Doppelt (2009) provide some steps that can be used in order to motivate behavioral change, which can be summarized as: (1) Catch attention, (2) Provide feedback, and (3) Enable goal-setting. Feedback providing is exhaustively researched in interaction design, and it is a general conclusion that feedback motivates changed behavior in energy conservation and lessens energy consumption (Buchanan et al. 2014; Darby 2006; Strengers 2011). Most feedback systems used are either statistical (showing numbers and trends) or ambient (using abstract values such as colors), thereby using the central route of persuasion, relying on logical arguments. However, psychological research tells us that for behavioral change, perhaps emotional arguments are more persuasive. As Strengers (2011) notes: people are not resource managers. The theory that people will always act as rational beings even in their own home is far from the real truth. Instead, our home is a place for habits and shortcuts, making emotional arguments a more suitable force than logics and statistics.

RELATED RESEARCH

Strengers (2011) studied how residents react to eco-feedback from systems in their homes. She concludes that the feedback needs to be appropriate to the usage at hand, and that designers have to study the specific task in order to understand the underlying reasons and expectations, if the feedback is to have any potential of changing the user’s behavior.

As water consumption is closely related to energy consumption, this section will cover both of these topics. Energy consumption has been visualized by Gustafsson & Gyllenswärd (2005) among others. Their

‘Power-aware cord’ points the user’s gaze to how power is used and distributed by the use of an electroluminescent wire lighting up as power goes through it. Nisi et al. (2011) tested using a virtual forest which could give feedback per family, and found that eco-feedback systems were only getting attention for about four weeks, followed by a decrease of interest from the users. Trinh & Jamieson (2014) formulated heuristics for designing eco-feedback, highlighting that visceral influences are important for changing behavior, but underused in eco-feedback design.

Water usage has been studied by Kappel & Grechenig (2009), with a focus on water conservation in the shower. They have developed a prototype called ‘Show-me’ that provides immediate feedback through a number of LEDs vertically aligned on a stick. The goal of the design is to present the information in a visually attractive way that is easy to remember, and avoid showing numbers on a display. By lightening up LEDs when water is consumed, ‘Show-me’ gives the impression of the water level increasing in the drain. The ‘Uji Shower’ (2014) is another take on making water usage visible for the user, using a shower head that lights up the water via LEDs, changing colour from green to red as more water is used. On a more tangible note, ‘Waterpebble’ (2014) also make use of the traffic lights system and turns to red from green when a certain amount of water has passed on the shower floor where the ‘waterpebble’ is situated.

Figure 1: Prototype on display in the Visual Arena.

Many of these designs however focus on elegant visualizations of energy consumption, and neglects to see the strength of emotional arguments when it comes to behavioral change. In abstracting the visualizations, they activate the central route to persuasion and thereby pull the user’s thoughts to the outside world and the wider consequences of water usage. We believe that the private space of the shower is worth preserving, and that this can be done by reframing the problem of water usage to a personal problem by the use of emotive incentives for the user.

METHODS

A good amount of time was spent in the beginning of the project trying to produce a viable concept. Three productive brainstorming sessions were carried out in between sprints of research in order to develop the concept. At the end of this phase the research question presented in the introduction had been formulated.

Since showering can be an intimate and sensitive topic, we knew very little about how other people actually behave while showering. In order to get a sense of how people use their showers, 11 semi-structured interviews were carried out to explore the area. After discussing the results of the interviews, a second ideation phase was carried out in order to develop artifacts that support identified showering behaviors. One of these artifacts, the ambient feedback shower wall, was selected for development as a physical prototype which could be put on display in the Visual Arena.

Work was parallelly distributed over several activities and team members. An extensive literature survey was carried out, work began on the final report, an exploration of the electronics needed for the project was started and an implementation of the aquarium visualization was developed. We contacted Ifö, a large company focusing on furniture for bathrooms, and they offered to sponsor us with a shower from their line, which we used to build our prototype. The shower was connected to a cyclic water system, controlled by an Arduino. Our initial standpoint was to determine the virtual water level by use of a flow meter, but for the scope of this project we decided that a simple timer switch would do.

RESULTS

Our final design is called FinAqua, and centers upon a shower with screens showing a virtual aquarium full of fish swimming around. As water is used, the water level of this virtual aquarium is lowered until it finally reaches floor level, leaving the fish flouncing and ultimately dying. The time it takes for the water level to sink will be adjustable by the user, as there is no ‘right’ amount of water that is acceptable to use: the less, the better is the simple rule. By allowing the users to set the

time, we empower and incentivize the users to challenge themselves.

FinAqua captures and highlights the existing tension that there is between enabling the private and taking social responsibility for actions. It gives the user a virtual refuge from the crampedness of a 54m2 apartment, as the aquarium creates a heterotopia open to the imagination of the user.

At the same time FinAqua motivates the user to lessen their water usage, by reframing the problem of the Tragedy of the Commons into a personal problem of saving or killing the fish. We use emotional arguments to achieve a behavioral change, an approach supported by research in cognitive science. In a way, we use the fish as a privacy scapegoat: it enables people to stay in the small private space mentally. and not stepping out into the public world of water shortage and environmental problems.

DISCUSSION

By using the psychological research available, FinAqua motivates the user to use less water, without having to think about the consequences at large. The aquarium fish will keep the focus in the private, thereby providing the user with the much needed private space that might become a luxury in the near future. The concept is still under development, and as such it needs to be properly tested by actual users. Earlier, similar research gives a good support for the argument that it would work: the Uji Shower reports an average shortening of shower times by 12% (Andler et al. 2014).

Connecting a flow meter to control the visualization would be an uncomplicated thing to do. For the scope of the project, the flow meter was deemed unnecessary as it would only add complexity and no further experience of fidelity. It is however an essential part of the concept, and needs to be incorporated.

We have spent some time and effort into researching the proper amount of water that can ethically be used in a shower. There is no easy answer to this question, since there are more variables to take into account: how often does one shower, how hot is the water etc. There is room for improvement here, and threads we would like to pursue include the actual energy used by the shower. The screens we have put in place will also use energy, adding to the heating and purification of the water. We believe that in time, the evolution of screens will make sure that this energy use can be motivated, but we are not sure that it is as of yet.

As for future work, a longitudinal study where the possible impact FinAqua could be tested would be preferable. We would expect an initial impact, but to know whether the emotional arguments presented here can be helpful in lowering water consumption, the long term impacts also have to be tested. Actual water consumption before and after implementing the use of FinAqua could be compared. Participants should also be encouraged to fill in a self-report on how they experience their privacy in relation to the shower, to know if there is a trade-off between the experience of privacy and the lowering of water consumption.

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USING INDIVIDUAL MEMORIES TO DESIGN AN EMBODIED AND IMMERSIVE COLLECTIVE EXPERIENCE

SARAH HOMEWOOD
INTERACTION DESIGN,
MALMÖ UNIVERSITY
SF.HOMEWOOD@GMAIL.COM

ABSTRACT

Immersive experiences can affect how we perceive our relationship with the world around us. This paper is based on the participatory installation “Who Are Tina?” that used individual memories of a collective experience to prompt questions about whether collective memories could exist between us. Specific design aspects that this paper will focus on is the conflict between the need for the element of surprise within the experience and the design led requirement for user tests, and how we used phenomenological concepts such as empathy and the use of artefacts to fulfil that requirement as designers.

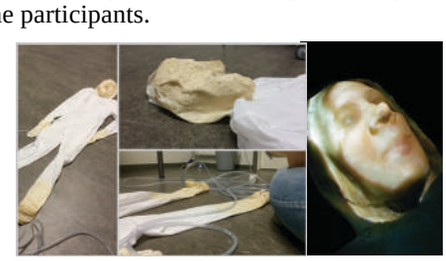
INTRODUCTION

Throughout the process we only had one goal. This goal was to create what would be an embodied, immersive experience in an interaction design context to fulfil the brief “Archiving the Intangible”. To do this we wanted to design an experience that asked participants to access their individual memories of a collective experience and compare them to other’s memories to explore what kind of collective memory existed between them. This brief came out of our findings from embodied storming exercises.

Our design team worked with the phenomenological idea that memories are influenced by, and in turn influence, our present state. This meant that we felt great responsibility when deciding how to prompt the individual memories of the collective experience. We worked with the presentation of artefacts relating to the collective experience to do this. We considered carefully the manner in which the artifacts were presented. This could be described as an example of the use of dramaturgy. We propose that the resulting installation “Who Are Tina?” was an example of embodied interaction design grounded in Phenomenological concepts. We also propose that our process could represent a focus area for the future of designing embodied experiences.

PARTICIPANT’S EXPERIENCE OF “WHO ARE TINA?”

- The participants enter the small, dark room. There is a white bundle in the middle of the room with tubes attached.
- A recording is played of a list of student’s names.
- The tubes are handed out to five people. Someone begins to blow into them and the others follow suit. The white bundle unfurls and inflates into a life-sized body. As the body inflates, a fan sporadically blows air over the participants.



- A projection of a face appears on the inflatable body’s head. It is of a woman and it is blinking. Some of the participants help gently reposition the body’s head to correctly fit the face projected.

- A recording is played of two female voices giving information about somebody called “Tina”. This fades

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into increasingly abstract sounds. The participants stop blowing and the body slowly deflates.
- One of the participants has a box and some others help manoeuvre the deflated body into the box and place a lid on top.
- The door of the room is opened and the participants follow the first people out of the room and allow the corridor and into another room which is papered all over with handwritten posters about individual students.
- The box is labelled “TINA” and placed on a shelf.
- A group photo is taken of the participants amongst the posters in front of the box.

THE ORIGINS OF “WHO ARE TINA?”

The process that resulted in “Who Are Tina?” began with explorations into trying to question how we remember. We did this by using embodied storming techniques with ourselves as the participants. According to Schleicher et al., embodied storming focuses on “… immediacy, and tacit experience” (Schleicher 2010). This meant that we could focus more on the nuanced results of these experiments within our own bodies before we could cognitively distance ourselves from a concept or idea. During our explorations we played with the amount of time between experiencing an event and then seeing a recording of that event visually from a different perspective. For one of our experiments we used an Oculus Rift (Oculus VR 2015) to screen a slightly delayed feed from a camera pointed at us from a 3rd person perspective. We filmed from a bird’s eye view and from a short distance over our shoulder. This extra information about our placement in the wider context of our environment made us all feel disorientated and out of our bodies. Experiencing these different perspectives with different time delays made us discuss what we each thought was our true position in time and space during the experiments.

QUESTIONS ABOUT TRUTH

Whether is it possible to have one true position within space and time could be described as a philosophical question. The philosophy Phenomenology is described as “the study of structures of consciousness as experienced from the first-person point of view” (Stanford E.O.P., 2015). One of the key philosophers in Phenomenology described our conscious state as “being-in-the-world”. He says that we cannot distinguish our position in time and space from our surroundings. All our understanding and sense of self comes from our perception of the objects that make up our environment. This concept inspired our design group to consider artefacts as a material to use within our immersive experience. We defined “artefacts” as objects that related specifically to a past event. We wanted to explore if an artefact was once part of an environment that created somebody’s consciousness, what would happen to their consciousness if we presented the artefact to them again, in a different time and place.

HOW WE DESIGNED “WHO ARE TINA?”

OUR USE OF ARTEFACTS

We found out through general research that new experiences form the strongest memories (Phelps, 2004). We decided to focus on the first day of our Masters course in Interaction Design and in particular to use the memory of one student called Tina, who came for the first day but then never came back, as the focus of the experience. The particular artifacts that we chose were posters that were made on the first day explaining each students’ background, photographs taken of the students and the register of the students’ names.

Our aim then became to re-enact, through the presentation of artifacts, the collective experience for the rest of our class whilst respecting that we had all had individual experiences and therefore individual memories of that day. It became really important to us not to impose a didactic (Hughes 1991) experience. Didactic art is instructional and uses emotive tools and references to teach a viewer how to perceive and learn from the artwork. To get away from this we wanted to attempt to create an environment that could prompt our classmates’ memories without imposing any structure or form that could influence or change the way they remembered the first day of the course.

OUR USE OF DRAMATURGY

In order to reveal these artifacts to our classmates in a way that avoided being didactic, there were certain things we needed to consider and control. This could be described as working with the dramaturgy (the art of dramatic composition) of the re-enactment. We needed to consider:

- How to keep the artifacts secret before the time in which we wanted to reveal them, and the implications of using secrecy and surprise.
- How to manage the narrative that lay in the order and materials we chose in which to reveal the objects.
- The experience as a whole being choreographed to be as immersive and understandable so as not to distract our classmates from concentrating on introspectively remembering the first day.

SECRECY , SURPRISE AND EMPATHY

The artifacts needed to be kept as secret as possible before they could be revealed in the controlled environment of our re-enactment. The revealing of the artifacts would then be a surprise for our classmates, as they had no knowledge of

what to expect beforehand. Surprise also featured as a way of enhancing the experience of the re-enactment as after a surprise people take in more details of their surroundings in order to make sense of the situation that they are now in that challenged their expectations of what they expected was going to happen (Kagan 2002). The parameter that the artifacts must be kept hidden meant that we were unable to follow a transparent iterative design process. We could not ask our classmates to test and give feedback on anything. To design the environment we therefore needed to try to put ourselves into our classmates' shoes. To do this we needed to be "empathetic" (Stein 1989). We proposed that we could say that as our classmates display traits more or less like us, they will generally perceive things from an egocentric viewpoint. We therefore gave ourselves the licence to make iterative decisions on their behalf about the different components within the installation.

MATERIALS

In order to present the artifacts from the first day, we had some choices to make about any materials that we were going to use. We decided to recreate our missing classmate Tina through the use of inflatables. This physically represented our concept of our classmates collectively sustaining the memory of the first day. We wanted them to literally breathe life into the memory of Tina. We used some latex to give her some more human, skin-like features but she was mostly made from and white plastic sheeting that give her also an ambiguous, doll-like form so as not to be too evocative of a real human body. The photographs from the first day were used to create a projection of an animation of Tina's face that blinked. This was then mapped onto the body's head. The projection only fitted the face once the body was fully inflated via the tubes given to a selection of our classmates. In order to get away from only visually re-enacting the artifacts from the first day we decided to use sound samples. We re-recorded our course leader reading out the register and reproduced a presentation of Tina that one of our classmates gave on the first day that was part of a group bonding exercise. We also used a new recording of one of our classmate's memories of Tina. This deliberately juxtaposed our method of presenting only artifact material but was an experiment used in order to provoke our classmates to compare this person's account of Tina with their own memories of her from that day. Either they would reject or accept this new information within their memory of Tina.

DRAMATURGY

In order to reveal our artifacts to our classmates we needed to control the dramaturgical order in which they were revealed and how we proposed that our classmates interact with them. Ritual was something we were interested as a tool to create an immersive experience so we attempted to ensure the experience of the re-enactment had the feeling of something that had an accepted order and shape to. As we could not reveal the artifacts beforehand, we could not give explicit instructions on how they should act and move around the space. However, there were some things, like inflating the body, which needed their participation. This is where we used techniques to instigate what Dourish and Chalmers call "social navigation" (Dourish and Chalmers 1994). This is where people trust and follow the actions of others around them. We used our own movements and actions to influence where our classmates positioned themselves in the room and, for example, when and how they were to blow into the tubes to inflate the body. We also employed some of our classmates as undercover agents, or moles. This extended the boundaries of the re-enactment to include those that our classmates thought had the same role as them. We prepared the moles beforehand by giving them abstract tasks such as "there will be a box given to you, you must open the box and help pack an object away". Using moles was a way of attempting to distract our classmates from seeing us, the designers of the re-enactment, as performers. We hoped that by seeing their own classmates apparently automatically knowing how to act in this new situation, the feeling of being inside a ritual would be strengthened.

RESULTS OF THE RE-ENACTMENT

We held discussions with our classmates after the experience where we openly asked them to raise any questions or points of interests. These discussions brought up the following interesting points.

THE EXPECTATIONS THAT SECRECY BRINGS

Trying to keep the artifacts secret before the re-enactment proved to be more challenging than we thought. We were working in a studio environment with our classmates so everyone was very aware when they were told that they were not allowed in certain areas that we were preparing something secret for them. This led to speculation about what we were working on and raised expectations of what we had waiting for them. This may have affected the way that they experienced the re-enactment. Some said that they were expecting the experience of the re-enactment to be more conventionally entertaining because of the build-up.

THE INFLUENCE OF MATERIALS AND THE ETHICS OF REPRESENTATION

Our choice of materials proved to be much more evocative than we had designed them to be. Some of our classmates described the body that Tina's face was projected onto as "ugly" because of the texture of the latex. These particular people's concerns were that others would read Tina's character as "ugly" because of the form she was represented by. This led into a long discussion about the ethics of re-enacting and representing a body and character that only lies in other people's memory and has no power or ability to represent themselves. We initially felt some trepidation about using the memory of Tina, but as we used only photographic and written material that was produced that particular day with her consent, we felt that we were

not overstepping ethical guidelines (ACM 2015). We also realized after the re-enactment that some of our classmates had not recognized Tina within the artifacts. This was either because they did not remember who she was or what she looked like or because our representations were not representative enough. This perhaps countered the beliefs of those with ethical concerns as it showed that our classmate's interpretation of the artifacts was totally individual and subjective to their memories of Tina.

Many read the ritual of the re-enactment as being funereal. A funeral ritual was not one of our design goals, but perhaps the fact we were following a narrative of remembering, archiving, and introspection, naturally evoked that connection with how we treat the dead. On further questioning, those who had concerns about the ethics of how funereal the experience was, in fact revealed that their emotive reaction came from putting themselves into the living person Tina's shoes. It was uncomfortable for them to think of their own image being used in place of Tina.

CONCLUSION

At the beginning of the process we had one brief: "Archiving the Intangible", and one self-chosen goal: to create an immersive experience. We believe that the brief was fulfilled as the memory of the first day represents the intangible, and the archiving was in the experience that the installation provided. Whether we provided our classmates with an immersive experience is difficult to judge. We at least provided what was intended to be a meaningful experience, and we did not dictate what the meaning should be. We could say that just having the goal of designing a re-enactment of a collective experience, we had created a rich and powerful experience for each of our classmates individually. For us, it was a moving experience to be part of and to create, and the image of us collectively breathing life into Tina was a very strong one. The concerns about the ethics of way we represented Tina gave us some confidence that we had achieved our wish for the experience to prompt our classmates to question whether there existed one collective memory of Tina and the first day of the course.

We believe that the physical result of our process, the re-enactment, is an example of embodied interaction design. Dourish says "Embodiment is about the fact that things are embedded in the world, and the ways in which their reality depends on being embedded..." (Dourish 2001). We could even propose that this project as a whole goes some way to fulfil Dourish's wish for a greater "focus on the production of meaning in interaction" in the future within embodied interaction (Dourish 2013).

To conclude, we were very focused on the power that our re-enactment had to alter the reality or the truth of the first day for our classmates so we designed with empathy, only using remaining artifacts. What qualifies the design of the installation as an example of embodied design especially, is that our process was designed with the acceptance that each individual had a different bodily experience of the artefacts that we revealed to them during the re-enactments and that they all had different memories and thoughts that were prompted by it. I feel that designing with this level of respect for our individual, subjective experiences within each of our worlds, brings results weighted with good intentions.

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FEAR DIVISION; ARCHIVING THE INTANGIBLE

DORIEN KOELEMEIJER
LINA ALVIS
RODRIGO JIMENEZ
FRANZISKA TACHTLER
DANAI TSOUNI

INTERACTION DESIGN MASTER,
MALMÖ UNIVERSITY
INFO@DORIENKOELEMEIJER.COM

ABSTRACT

This paper describes the theoretical grounding, the concept and the construction of an embodied interactive installation about fear. The processes in the brain when exposed to fear, the memories related to it and the triggering of these memories are taken as a starting point. The goal of the installation is to give people more insight in the subject of fear, by offering them an interactive experience which is based on the archiving and retrieving of emotions and sounds related to the subject.

INTRODUCTION

There are multiple regions in the brain that take part in processing the emotion of fear. Two medial temporal lobe structures, the amygdala and hippocampal complex, are regions in the brain that are linked to two independent memory systems, each having their own distinctive functions. In emotional situations, these two systems interact with each other in important ways (Phelps 2004). The fact that these two systems cooperate when emotions, like fear, meet memory, were taken as a starting point to build an embodied interactive installation, and thereby aim to archive the intangible. The stories and memories about fear are the intangible aspect of this project, and are being archived and shared in the installation. The installation provides an audiovisual experience and makes the visitor more aware of fear and different stories related to these fears. The fear memories and the sounds triggering these memories are stored in the installation and can be retrieved by the visitor, by interacting with the installation. After experiencing the installation, visitors get the opportunity to record and share their own stories related to fear.

THEORETICAL GROUNDING

NEUROSCIENTIFIC RESEARCH

Fear arises whenever we feel threatened. However, there is a distinction between biologically prepared threats and threats based on experiences in our lives. Evolution has caused humans to feel fear when encountering recurring and common danger as a way of handling them and to be able to make fast decisions in life-threatening situations. However, there are also threats that are not genetically programmed, but are determined by experiences (Debiec 2004). For the concept of this project, threats and fears determined by experiences of the past seemed especially intriguing, because they are presumably more personal and might cause the user to think more about the concept of fear.

There are two systems in the brain cooperating on processing fear, depending on memory, that were compelling for this interactive installation; the amygdala and the hippocampus. The amygdala regulates the encoding and the storage of hippocampal-dependant memories. The hippocampal complex is responsible for episodic representations of the emotional understanding and interpretation of events. Therefore, its connections to the amygdala may influence the response when emotional stimuli are encountered (Phelps 2004). When being confronted with a threatening situation, the amygdala reacts by giving the fight or flight response (Suresh 2014).[1] The body state could be altered by freezing or performing escape responses (defensive behaviour), there could be changes in blood pressure and heart rate (autonomic nervous system responses) and it could be altered by releasing hormones (neuroendocrine responses). The responses to threats are innate and species-typical, and are expressed automatically in reaction to different stimuli (LeDoux 2003). The processing of danger or fear in the brain is the same for every threat or dangerous stimulus. The distinctive functions of the amygdala and the hippocampal complex were important for the concept of the installation, because they deal with the memories of fear and the triggering of these memories. Furthermore, they were relevant for the making of several design decisions.

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Another aspect related to fear and memory is the phenomenon of music or sound being able to trigger fear memories (Platel 2005).[4] Therefore, hearing a fragment of a song or an (abstract) sound can also bring back memories of fear. The fact that sounds can trigger fear memories has greatly influenced the decision-making regarding the auditory aspects of the installation. The lateral nucleus of the amygdala plays an important role in the processing of auditory fear memory. It receives projections from the auditory thalamus, and the amygdala, as a consequence, reacts by giving a specific fear response. In a research on mice, conducted by Han, J.-H., Yiu, A. P., Cole, C. J., Hsiang, H.-L., Neve, R. L., & Josselyn, S. A., an originally neutral tone is paired with shock. Consequent to playing the tone consecutively, the animals expressed conditioned fear responses, including freezing. The research has proven that modifications in the amygdala have an effect on the long-term memory and enhances memory for conditioned auditory fear (Han 2008).

CULTURAL PROBES

To dig deeper into the aspects of fear and to broaden our scope, cultural probes (Gaver 1999) were created and distributed to ten different people in order to compile personal stories about fears from external sources. The cultural probes consisted of a small notebook, a pencil and a dictaphone (see figure 1). The notebook contained a few tasks related to fear, which were inquired to be recorded with the dictaphone. The participants were requested to describe their biggest fear and the memories connected to this. Furthermore, they were asked to describe the setting with which they associate their fear and the colours and sounds that came to mind when thinking about fear. Additionally, the participant had the opportunity to write or draw anything related to the task in their notebook. The participants proved to be willing to share a lot and, therefore, the results of the cultural probes were surprisingly insightful.

Figure 1: The cultural probe package that was distributed

One of the stories was about someone who is afraid of becoming an evil person and the sound of the piano triggers this fear. "I'm most afraid of becoming somebody I don't want to be, an evil person. … Unfortunately, it's the sound of the piano [that reminds her most of this fear], because it was my grandmother, who is one of the persons who hurt me most, and affected me in the way that I'm afraid of becoming the same as her. … When I think of the sound of piano, it's the most beautiful sound I've ever heard, but it makes me afraid of becoming the same as her." The fact that the sound of a piano is often perceived as a beautiful and positive sound, but triggers fear in this case, was an important aspect in the development of the concept. It signifies that sounds that trigger fear are entirely personal and are based on previous experiences.

THE CONCEPT

The concept for the embodied interactive installation was formed, based on the theoretical research and a selection of the recordings obtained by the cultural probes (five stories about different fears were used). The aim of the installation was to archive the intangible. In this respect, the intangible were the feelings and memories related to fear and the triggering of these memories. There were numerous powerful stories and memories recorded, that would be compelling to use for the installation. The knowledge acquired by the neuroscientific research has made it possible to make design decisions for the installation, especially regarding the encoding of the stories. The functions of the amygdala and the hippocampus were an inspiration with regard to the division of the audio. For each fear story, the audio was divided in three categories: the recorded memories, the sounds triggering these memories and abstract sounds. To symbolize the hippocampal complex, fragments of the recorded stories were used. It was decided to preserve the original voice recordings from the people participating in the cultural probes, in furtherance of keeping the installation personal and realistic. To symbolize the amygdala (which triggers the fear reaction), sounds that trigger the specific fears and abstract sounds, connected to the recorded memories, would be used. It is important to state that the scientific research is only used as inspiration for the installation. The team was aware of the fact that the processing of fear in the brain is extremely complex and there are more parts involved than the amygdala and the hippocampal complex, which were used as starting point for this project. Therefore the installation offers a poetic, yet abstract approach into the mind of five people with distinctive fears.

There are five different fears being addressed, in furtherance to make it more likely that many users will relate to certain fears but also make them aware of some fears they were not familiar with before. Although the concept is about the feeling of fear, it is not the aim of the installation to make people feel scared. The purpose is to make people more aware of different fears and the role of sounds influencing the triggering of fear memories.

Moreover, the feeling of fear is a very private emotion and is difficult to decipher. It's not easy for people to talk about what they are afraid of and fear is something people generally want to overcome. Therefore, it was decided to make the installation a personal experience and allow only one person to enter the installation at a time.

Furthermore, the participants of the cultural probes stated that they were grateful to get the opportunity to reflect on their fear and to share it with other people (but have the opportunity to record it in a private setting). After leaving the installation, the visitor might feel the desire to share his or her memories about fear. Therefore, the visitor has the opportunity to share a fear story by writing on the side of the installation. More importantly, packages similar to the cultural probes (that were distributed for the research) can be found outside the installation for the visitor to take home, in order to record their memories about fear in private.

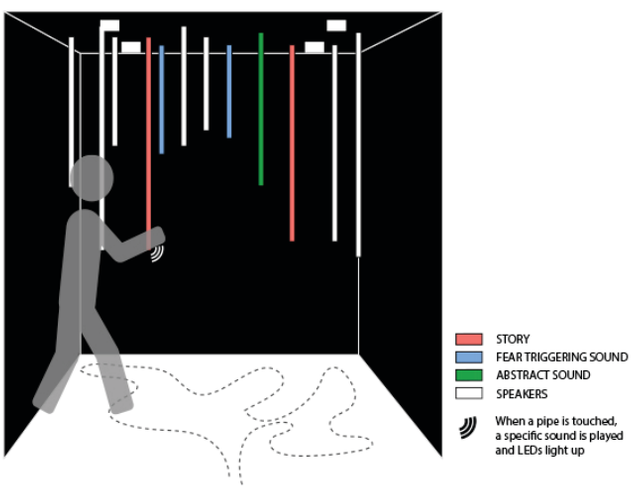

Figure 2: Sketch of the installation

THE INSTALLATION

Based on the cultural probes it was determined that the installation should be a dark cube, with thirty wires or tubes, initially inspired by the neurons in the brain, hanging from the ceiling. The thirty tubes are divided to represent the five different fears, retrieved by the cultural probes. The tubes are evenly spread throughout the cube. Whenever one tube is touched, it lights up and a sound or story is triggered to play. Furthermore, the other tubes related to that specific fear light up, in order to guide the user through the installation (see figure 2). In the installation a whispering sound is played, until one of the tubes is touched, to give the visitor a sense of intrusion. The whispering makes the user realise that personal stories are shared and gives the user the feeling of being inside someone else's brain and listening to their thoughts. The distinction between the recorded stories and the sounds is made visible by using tubes of different lengths and different colours of lights inside them. The tubes that trigger the recorded stories are longer than the tubes that trigger the natural and abstract sounds. Moreover, the tubes contain different coloured LED lights. The tubes that trigger the stories have red light, the tubes with the sound that triggers the fear have blue light and the tubes with abstract sounds have green light. (see figure 3)

Figure 3: Tubes light up whenever they are touched

On the outside of the cube, copies of the diaries from the cultural probes are being displayed to provide the visitor with more information about the stories that are shared inside the installation. Furthermore, the packages for visitors who want to share their own fear stories, can also be found at this place.

EMBODIMENT

There are several examples of embodiment being addressed in the installation. First of all, the participants of the cultural probes record and share their memories and stories about fear. Subsequently, these recordings are being archived in the installation and can be retrieved by the visitor, by literally using their body (see figure 4). The visitor goes into the installation and, by touching the tubes, is able to trigger specific stories to play and tubes to light up. It is very probable that the experience causes the visitor to react emotionally, therefore the installation does not only alter the bodily state, but also changes the emotional state. Furthermore, fear is not only experienced in the brain, but felt in the whole body. Even if fear is an emotion and therefore intangible, it is embodied. Ultimately, the visitor gets the opportunity to record his or her own memories about fear, which are then archived and can be shared in the installation afterwards.

Figure 4: First functional prototype

TECHNICAL SPECIFICATIONS

The size of the installation is approximately 214 x 211 x 225 cm and is built out of wood and cloth. Inside the cube, two sets of speakers are mounted and thirty PVC tubes are hanging from the ceiling. Inside the tubes different coloured LED lights are placed. Every tube is provided with a conductive material (aluminium). Two Arduino Mega boards are used, in furtherance to prompt action when the tubes are touched and to make it possible for the LED lights inside the tubes to turn on and off. One capacity sensor for every tube was set up, using a 10MΩ resistor which is connected to the conductive material on the tubes. The Arduino software and Processing software are used for the programming of this installation.

FUTURE DIRECTIONS

The LED lights currently used in the installation have different colours to make a difference between the recorded stories, the sounds triggering the fear and the abstract sounds. However, this difference is already made by using tubes of different lengths. Therefore, it would be favourable to experiment with using monochrome lightning. It would make the inside of the installation seem calmer and less playful.

Furthermore, the tubes currently used in the installation are PVC tubes with conductive strips attached to them. The conductive strips are easily damaged and the aesthetics are not especially appealing. There could be more research done, in order to find tubes or wires that are conductive by themselves, but still let the light of the LEDs through.

Finally, the current way of interacting with the installation is to touch the tubes. Experiments could be carried out to determine if there are more interesting ways of triggering the stories and sounds, for example by connecting different tubes or wires.

CONCLUSION

Even though there is a lot that can be changed, the installation provides the anticipated atmosphere and offers the visitor an experience which opens up the subject of fear in ways it was envisioned. Generally visitors will find that they are informed and are more aware of different fears, by experiencing the topic of fear in a unique way.

Additionally, some visitors might feel the desire to share their own memories about fear after experiencing the installation. This connects strongly to the fact that participants of the cultural probes were thankful for having been given the opportunity to share their fears in a private setting. The purpose of the embodied interactive installation can therefore be described as informative, but more than that has the potential to be therapeutical.

NOTE(S)

[1] The fundamental response to physical and emotional threats is called the fight or flight response. It is an elemental survival mechanism, occurring in response to a specific stimulus such as the threat of danger (Suresh 2014).

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SIDER '15

EMBODIED DESIGN

INSPIRATION CARD WORKSHOP AS A WAY TO EXAMINE QUALITIES OF DIGITAL DESIGN ARTEFACTS

BONNIE HVILLUM
AARHUS UNIVERSITY, DENMARK
BONNIE.HVILLUM@LIVE.DK

ABSTRACT

In this paper I investigate how an Inspiration Card Workshop works as a digital version in comparison to earlier research based around physical design artefacts. Specifically, I focus on dynamics and interactions that arise throughout this participatory design event, as well as how the idea generation worked and the possibilities as well as limitations the table created. The paper is based on a digital version of the workshop performed in our research lab, with references to other earlier work on physical design artefacts and materials. Through the research I found that the interactive table I) Supported flexibility in the interaction and collaboration, II) Resulted in concepts of precarious quality, III) Worked as a communication-tool caused by the functions in the interface, IV) Sealed the written words as conclusions rather than externalizations of thoughts, and V) Upheld a setup interpreted as a game which limited the interaction. These findings are discussed from the perspective of using cards as mediators with the aim of generating ideas as well as what the tactility of design artefacts, materials and tools means when developing these ideas.

KEYWORDS

Inspiration Card Workshop, design artefacts, idea development, participatory design events, interaction design.

INTRODUCTION

When working within the field of interaction design, a user-oriented approach to idea development is highly affordable as the user's experience comes in focus and the interaction becomes the main part of the design. The materials that interaction designs are formed by has been categorized by Vallgårda as 'Computational Composites', dynamically constructed upon three forms: the temporal, the physical and the interactive (gestalt) [8,9]. Despite the fact that the physical part only takes on one third, more or less, of the interactive design artefact in Vallgårda's argument, we still mainly use physical materials as artefacts in design work. Hansen & Dalsgård points out the productive role of these artefacts in participatory design events considered from a workshop orientated around future scenarios expressed on physical blueprints and personas created by the participants [5]. They argue that the physical design artefacts including paper, pen, post-it's, blueprint etc. enables 'rapid transformations' and helps the participants to document their decisions during their work. Furthermore they point out, that the artefacts have a collaborative function and forces the discussions into more concrete and detailed relations to ideas of future use [5; 670-672]. On the other hand, Bardram et al. argues for a mixture of both physical and digital 3D objects while working with 'Virtual Video Prototyping' as a way to combine elements from prototyping, mocking-up, making future scenarios and conventional video production [1]. By approaching idea development and generation in other forms than only physical may support the complex aspect of interaction design in addition to Vallgårda.

From this background this paper investigates the idea development method 'Inspiration Card Workshop' [3,4] executed in a digital version at the iCard Table in our research lab. The research is focused on the qualities and influences that digital artefacts and materials have when used in Inspiration Card Workshop as a participatory design event. This research is based on research around physical design artefacts [5] and physical versions of the workshop [3,4]. The work is formed as a micro-study analysis of the iCard Table as a

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digital mediator of the workshop to better understand 1) the dynamics and interactions that evolve throughout the event, and 2) the generation and transformation of ideas that emerge from the digital inspiration cards and table.

CONTEXT

Building on the philosophy of Heidegger and Merleau-Ponty's approach to our understanding of the world as interactive and influential in contradiction to a more dualistic frame understood by Descartes [2; 32]. This leaves us with the term 'distributed cognition', as a concept of using the world around us in solving problems. By these means, the context for setting up an Inspiration Card Workshop is emphasized as a way of investigating how design artefacts and tools may 'come to life' and support a transformation.
This research is based around studies in the course 'Advanced Interaction Design' with an overall focus placed on design artefacts, externalizations and representations as well as tools used in design work.

THE DESIGN BRIEF

The theme of the workshop was based on 'Instructions', and the aim was to investigate how the experience and functionality of instructions at bus stops could be improved with an interactive approach.

INSPIRATION CARD WORKSHOP

The event was performed as an Inspiration Card Workshop as a method to facilitate idea creation and idea development. The method is to be used in early stages as a way to include possible future users to combine inspiration cards in new ways that can be used directly to narrow down potential ideas into future designs, or to be used more indirectly as inspiration for further development within the design group [4]. An Inspiration Card Workshop involves two types of cards - domain cards and technology cards. Domain cards represent areas, places and situations whereas technology cards represent different high or low-tech technologies that can be used in different contexts. Both designers and participants with knowledge around the design brief work together in collaboration to combine these cards in new ways as a way to create design concepts and ideas. There are no turn-taking rules in the session and participants can combine the cards in ways they find most useful. Multiple numbers of cards can be used, and the participants decide in collaboration how long they want to work on a specific concept.

The design brief was introduced to the four participants as a starting point and soon after the cards were introduced and explained [10]. From here, the participants were introduced to the table's functionality. It is to be said that the participants were all familiar with the table, and before we began, we tested out alle the functionalities of the table. Hereafter the workshop started and during 50 minutes the group worked out eight different design-concepts, which were manifested as digital posters and being presented in the end by the participants themselves.

ICARD TABLE

The table used for the workshop is an interactive table with a touch surface programmed to run the Inspiration Card Workshop. The interface includes writing and drawing facilities, as well as zoom and layering. Furthermore, a touch screen is connected to the table to display an overview of the cards as well as show the final design-concepts when saved.

FIG. 1. Co-facilitator introducing the screen and table's functionality.

OBSERVATIONS AND ANALYSES

In the context of developing and generating ideas the following explains our observations and analyses that arose following the participants use of the iCard table in the workshop.

FLEXIBILITY RESULTS IN RAPID QUALITY

In observing the participants we noticed a rapid use of the iCard table enabling flexibility in moving the cards and the text-boxes around, expanding them and modifying them quickly. This made it easy to put together an idea, give it a headline, save the poster, clear the table and move on to the next idea. At the same time we observed a variation in the level of details, and some of the design-concepts were very abstract. One example is the 'Graffiti Bus', where the idea was to draw on the bus while it was holding for red light and thereby make the bus colourful and personalised in an interactive way. There was not established any specifications on how this interaction actually should work or happen, and no actual future scenarios around the idea was expressed neither any further discussion nor reflection upon the user situation. As so, the flexibility of the iCard Table also expresses a more sporadic approach to idea development and final design-concepts.

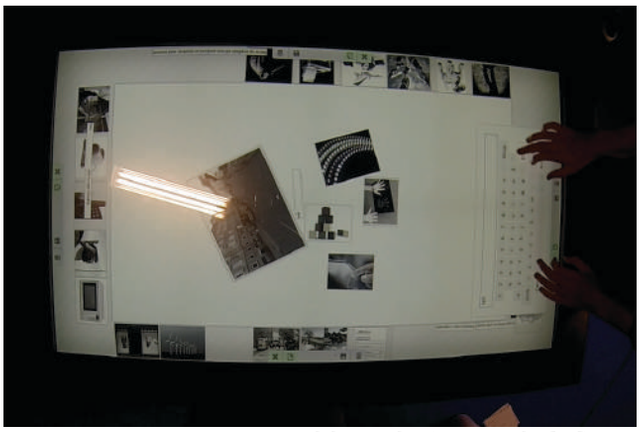

FIG. 2. Participants setting up a rapid design idea (see appendix [10]).

THE ICARD TABLE'S INTERFACE AS A COMMUNICATION-TOOL

The participants used the table as a visual way of communicating by dragging the cards around with the fingers, expanding and zooming. The movements of the cards were often connected to a verbal expression, as when one of the participants dragged out the 'Bus Stop Shed'-card from the range simultaneity stating "This one!" and expanding the card so that it filled out half of the table. The participant adopted the possibilities in the interface as a communication tool. Also, the function of placing the cards on each other worked as a way to connect and fixate the cards to each other in an attempt to explain how the cards have been combined.

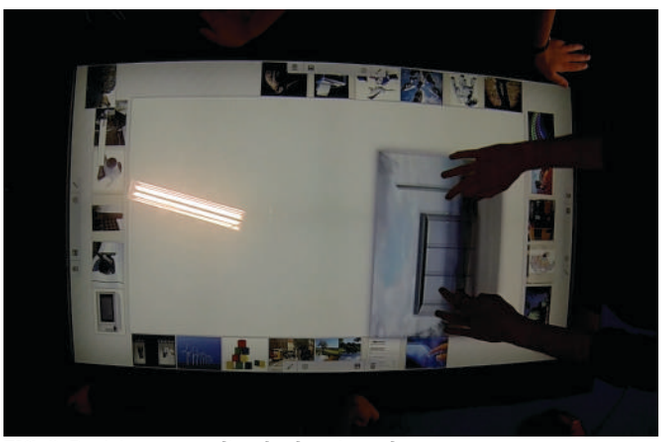

FIG. 3. Participant expanding the domain card.

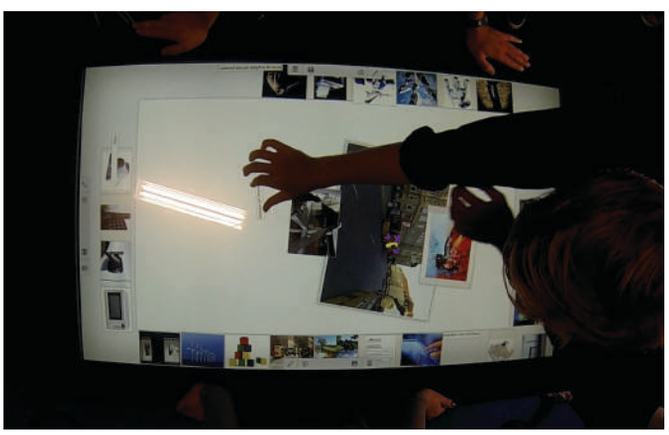

FIG. 4. Participants placing cards and text on each other as a way to fixate the combination.

THE WRITTEN WORDS AS MANIFESTATIONS

The pop-up writing tool was mainly used when the participants wanted to manifest or conclude something. The words were carefully chosen which could be because all the other participants could follow the writing process. Written words were thereby used more as a headline for the idea-concept, than to express or form fuzzy thoughts and feelings of more personal character. This was observed at almost all of the idea posters.

FIG. 5. Design idea on table showing the written 'headline': "Interactive direction-guide".

LIMITATION IN INTERACTION

It was observed that the participants felt obligated to pull in a card from the range at the side from where they each were standing. The set-up of the card ranged up around on the four sides of the table interpreted an ownership from each side. This worked as a constriction for the interaction, and the placements of the cards meant that the participants tried to 'play in' cards from within their range, that haven't been in play yet. It was to be seen when one of the participants said: "We haven't used this card yet. Let's try to use this!" The table represented a frame for a game, where the participants consciously and unconsciously settled fragile game rules and worked their way through in a playful way. It can hereby be said that the participants forced themselves to a development instead of letting the cards work as representations for novel thoughts.

DISCUSSION AND PERSPECTIVES TO PHYSICAL ARTEFACTS

LACK OF TACTILITY

The results from this workshop revealed both a minimum of idea generation from the inspirations cards, and the ideas, that came out the workshop, was in average very abstract and in lack of details. The lack of idea generation and development can hereby be questioned, whether it is because the digital version is in lack of any tactility, meaning no sensing or feeling of the actual cards as well as the physical feeling of

holding a pen and writing, likewise fixing the cards together with real glue instead of placing the cards on top of each other digitally. This discussion around the tactility is firmly connected to Dix & Gongora's argument of a 'transformational function' [2], leading on a process, where the material or artefact would talk back to the participant, and, as in Schön's terminology, create a conversation between the material and the designer [7]. Kyng points to this quality as the non-representational aspects of the representation, meaning the inspiration card [6]. As for example, a physical map of a city is representing the city in its representational quality, but the maps non-representational quality is what it is made of, meaning the paper and ink. Hereby, it could be an argument, that the digital inspiration cards does not function nor is experienced by the participants fully as an actual material because its non-representational quality is digital. It could be an argument from here that the digital quality is less experienced or familiar as a tool on how to work with, or simply do not represent the same qualities as physical artefacts have, pointing the possibilities of drawing on the paper with an actual pen, creasing the paper and feeling it in the hands. The sensing of respectively the physical and digital card is much different, and the whole experience is closely related to what generative possibilities the quality arise in its non-representational aspect. As Hansen & Dalsgård point out, the level of detail in their workshop is closely related to the fact that the artefacts used in their workshop forced the participants into discussion and detailed agreements [5; 671]. In this perspective, the level of abstraction may be because the participants did not feel forced to come to agreement in the idea development process, because the card was not physical but digital. The digital version thereby does not obligate the participants in the same way as a physical workshop would do. Though, it is still left to conclude, whether the abstract ideas could have been caused by the limited time of the workshop, or other social dynamics enforced by the table.

FURTHER WORK

From these discussion points I see an interesting opportunity to further investigate the level of abstraction and what connection it has to the tactility and quality of material, artefact or tool used to work with. In addition it would be interesting to explore any differences relating to a time or stage within the design process where it might be preferable to work with digital or physical materials, tools or design artefacts.

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CREATING BETTER EXPERIENCES WITH MASS CUSTOMIZATION TOOLKITS: OPTIMIZING THE DEGREE OF FREEDOM AND WEB-BASED CAPABILITY

HESAM YAVARI
LOUGHBOROUGH UNIVERSITY
H.YAVARI@LBORO.AC.UK

ABSTRACT

Better customization experience and valued products are two important factors for encouraging customers to pay the premium price for mass customized products. It seems that many toolkits for Mass Customization have no well-designed structure, which impacts on the experience of users. In this paper, the author is encouraged to motivate customers to pay the premium price by improving customization experience, focusing on the user interface of the toolkit. This is reflected on the degree of freedom and web-based capability of these toolkits, from a user perspective. The findings are based on quantitative data from a study and experimental data from implementing mass customization toolkits on different CAD and 3D-enabled systems. The results show that people prefer medium to high degree of freedom, and a web-based toolkit. Enabling web-based experience requires using modern 3D-enabled programming languages, such as: WebGL or THREE.JS. Based on the knowledge of the author, these systems are the best choices for not only creating a web-based toolkit, but also implementation of almost any frameworks with different features.

INTRODUCTION

Empowering customers with variety of options to make their product more functional and aesthetical, Mass Customization (MC) usually comes with higher prices than Mass Production (MP). It is a method to fulfil customer needs and desire as precisely as possible, with the efficiency as close as possible to mass production's (Tseng & Jiao 2001). The manufacturer gives the customer the opportunity to choose between varieties of utilitarian and aesthetical predefined options. In essence, there is a need for interaction between customer and manufacturer. This is where MC toolkits facilitate this communication and give the autonomy to the customer to create or modify their desired products by themselves (Hermans 2011). This is often done by using software-based tools known as toolkits, online configurators, etc., provided by the manufacturer.

Although the cost to consumers for mass customized products is dropping to the cost for mass produced goods (Tseng & Jiao 2001), mass customized products generally demand a small price premium and require longer waiting times for delivery Evaluation of data (Huffman & Kahn 1998). The issue is that customers may not pay the premium price due to their poor customization experience on toolkits. A revised structure for MC toolkits improves customization experience. Consequently, with better toolkit's structure, customers get motivated to buy more customized products, even with higher prices or waiting time. Each MC toolkit interface shares typical elements (see Figure 1)

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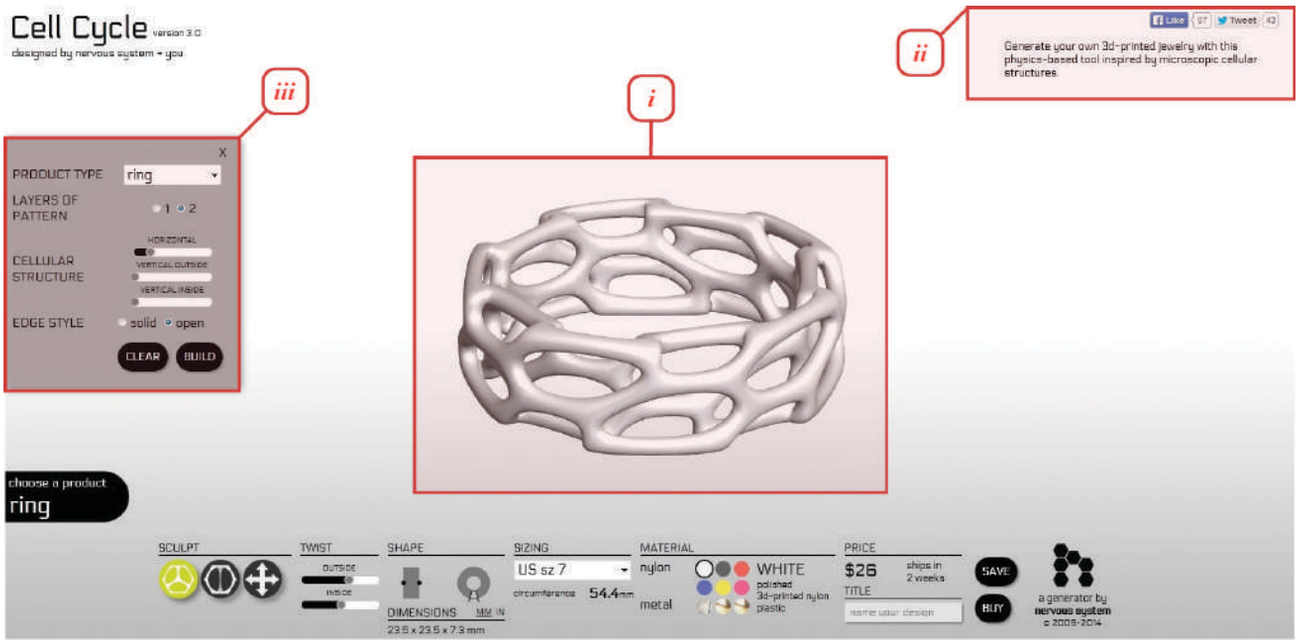


Figure 1: Cell cycle toolkit: a typical example of a MC toolkit (Nervous System 2014)

such as: feedback (i), guidance (ii), navigation (iii), etc. More detail collection of those elements/features is available in Hermans' article (2011). This paper deals with the importance of degree of freedom and web-based capability, from a user perspective, of these toolkits as a part of their structure.

DEGREE OF FREEDOM

While design space is infinite in general, in mass customization, design space is narrowed down to finite and constrained one, named Solution Space (Hermans 2012). Adjusting customer autonomy with some predefined options to control the brand image, manufacturability, satisfaction etc., by designers summarizes the task of solution space of MC toolkits. What makes solution space important is that there is a balance between customer autonomy (the customers' freedom), and designer authority (the constraints imposed by designers). Degree of freedom is a reference for solution space's size which is determined by the number of options and the variety of those options. For example, the navigation section (iii), shown in figure 1, has six options to be manipulated, so the solution space has 6 degrees of freedom.

Previous research has examined the extent to which degree of freedom is preferred by users. Schwartz (2009), for example, found that students asked to rank varieties of chocolate were more satisfied when presented with 6 varieties than those presented with 30 varieties; in addition, they were four times more willing to have chocolate rather than cash for their participation. As a part of the design process of the structure, one needs to verify if the same logic is dominant for degree of freedom of MC toolkits.

WEB-BASED CAPABILITY

One of the fundamental characteristics of MC toolkits is web-based capability. This is necessary for the customers to access and manipulate their data easily and conveniently. For a toolkit in which a representation of a physical product is customized, this pre-supposes the use of Computer Aided Design (CAD) programs or 3D-enabled programming languages. While a number of experiments were conducted to implement different MC toolkits within existing CAD systems, the necessity for web-based capability convinced the author to investigate more appropriate systems, namely 3D-enabled programming languages. From the start of the experiment, software programs (SolidWorks API and Grasshopper), and later on programming languages (THREE.JS and Processing) have been investigated.

TOOLKIT IMPLEMENTATION EXPERIMENT

This experiment is based on creating a MC toolkit in each CAD and 3D-enabled system, mentioned above, and comparing them in action. Based on this investigation, six specifications are devised as explained below:

Automation: allowing automation means that similar products based on specific input parameters can be created through running a set of commands. This facilitates building similar products that only differ in a few details automatically.

Real-time update: real-time update enables that any changes, made to the parameters, to take effect as they are happening. For example, the real-time visual update of a 3D CAD model of a product would show any small changes made to the shape as it happens. This eliminates the frustration of pressing 'build' or 'run' button each time.

Common CAD tools: commonly available CAD tools such as: extrude, revolve, and loft make modelling easy for experienced users. The construction and modification of solids and surfaces without such tools can become burdensome.

Web-based capability: the ability to access and manipulate data online through a web-site is named web-based capability. Web-based capability allows customers do the customization by going through all the options and configurations conveniently.

No installation or add-in: this specification means that there is no need to install any programmes or add-on to have the 3D graphics shown on the screen. Technologies such as WebGL provide such functionality, but currently are incompatible with some older browsers.

Feature integration: MC toolkits typically contain features such as: visualization feedback, price update, side-by-side comparison, material selection, etc. With feature integration, it is possible to have these features in the interface along with the solution space.

Table 1 below summarizes the characteristics of each CAD and 3D-enabled system tested.

Table 1: summary of the characteristics of the CAD and 3D-enabled systems

	CAD/3D-enabled system	Characteristics
CAD program	SolidWorks API	Automation Common CAD tools
	Grasshopper	Automation Common CAD tools Real time update
3d-enabled programming language	Processing	Automation Real time update Web-based capability
	THREE.JS	Automation Real time update Web-based capability Feature integration

DATA AND METHODS

Using self-completion questionnaire and discrete choice modelling, the study was conducted in order to find out more about the importance of degree of freedom, and web-based capability. In order to familiarize participants with degree of freedom and web-based capability, a presentation was given to each participant before they were provided with the questionnaire.

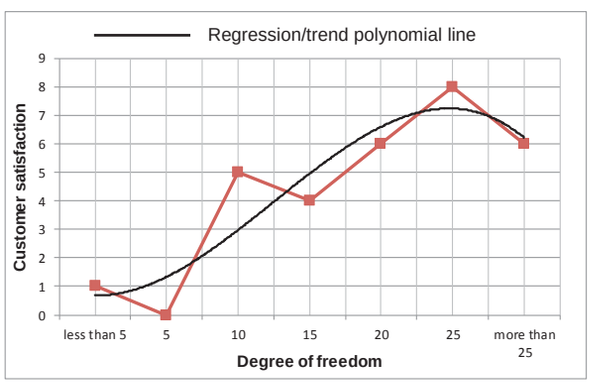
The questionnaire required participants to choose between different numbers of degree of freedom, and in the second one between web-based or store-based toolkit. The degree of freedom choices include: less than 5, 5, 10, 15, 20, 25, and more than 25 (see Figure 2).

The study recruited a convenience distributed sample of younger and older participants (N=30). The criteria for choosing participants were firstly computer literacy and secondly inexperience as designers (due to the fact that actual users of these toolkits are not trained as designers).

RESULTS

After data collection, all the participants' data were put into a Microsoft Excel file, and the sum of each choice was calculated. Based on the acquired numbers, graph 2 was generated, showing how customers' satisfaction changed according to the degree of freedom of toolkits (see Figure 2).

Analysis of the questionnaire shows that most of the participants indicated their interest in a relatively high number of degrees of freedom for a MC toolkit. Figure 2 below shows customer satisfaction against the number of degrees of freedom with 25 degrees of freedom being seen as the most popular number (26.6%).



Furthermore, most of the participants voted for a web-based toolkit (27) in comparison to store-based (3).

CONCLUSIONS

From an intuitive point of view, there should be an optimum number for the degree of freedom for any given product. When the customers have too few choices, then they are unsatisfied with their purchase because they need more choices for their shopping. When they have too many choices to choose from for their purchase, they are again annoyed due to effort they need to put into choosing the best product. Schwartz (2009) confirms that there is an optimum number for the choices a customer may have, due to the positive effects of autonomy, control, and liberation, that variety brings about.

More satisfaction with a relatively high degree of freedom with 25 degrees of freedom as the most popular number emphasizes on the balance required between customer autonomy and designer authority. I believe this can be a win-win situation. A relatively high degree of freedom means that there is a relatively high chance

of radical and complex customization. Therefore, companies have to be cautious about the manufacturability of the final products, and its time and cost efficiency. However, it is still alleviating for them meaning that making all the available options accessible to customers is not a requirement.

Participants greatly preferred web-based customization (90%) to store-based customization (10%). This confirms that the advantages of web-based toolkits, such as going through all the options and checking the price conveniently, and experimentation with different configuration options; overlap the advantages of store-based toolkits, such as handling the product, seeing the colours and textures from closer and get a sense of final product. Furthermore, it is predicted that 3D-enabled programming languages will be used increasingly in the future, not only because they enable web-based toolkits but also because of other capabilities, such as feature integration (see Table 1).

In conclusion, the importance of degree of freedom and web-based capability has been discussed. Subsequently, future research will deal with the importance rating of features of MC toolkits, configuration of those features, and relation of them to one another, as steps toward revising these toolkits' user interfaces.

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LEVERAGING THE STRENGTH OF DELFT DESIGN METHODS: THE BENEFITS OF INCORPORATING ENTREPRENEURIAL THINKING

DEBORAH SUMTER

STUDENT OF INDUSTRIAL DESIGN FACULTY
AT THE DELFT UNIVERSITY OF TECHNOLOGY

DEBORAHSUMTER@GMAIL.COM

ABSTRACT

When analysing entrepreneurial methods that were introduced in the last five years it became apparent that these methods use design-thinking tools to their benefit. The Delft Design Methods on the other hand hardly seem to incorporate entrepreneurial thinking. Comparing the different types of thinking resulted in a match in certain characteristics. Therefore there is argued that applying entrepreneurial thinking to current Delft design methods could leverage the inherent strength that these methods already have. This inter alia results into more efficiency during idea finding, less subjectivity in decision-making and spotting opportunities that could be used later on.

KEYWORDS

Entrepreneurial mindset, design thinking, design methods enhancement.

INTRODUCTION

While designers and entrepreneurs operate in two different domains it is apparent that there has been interest from entrepreneurs in the design field. When analyzing a selection of entrepreneurial methods that have been introduced in the last five years – The Golden Circle (Sinek 2009), Business Model Generation (Osterwalder and Pigneur 2010) and The Lean Start Up methodology (Ries 2011) – I observed that incorporating design thinking tools is a much used technique to enrich these methods. Design methods from the Delft Design Guide[1] (Boeijen and Daalhuizen 2010), in contrast, do not seem to integrate entrepreneurial thinking. Mainly for designers, who are interested in becoming entrepreneurs it would be beneficial to understand how applying an entrepreneurial mindset to these design methods can benefit their work in the business context. Design literature does not offer information on what these benefits might be and how current design methods can be changed to include an entrepreneurial mindset. This paper will provide first directions on how to implement this type of thinking in design methods.

METHOD

When starting a literature review, such as this one, the outcomes are unknown. Therefore an appreciative searching technique was applied. Relevant papers were selected based on what resonated with my thinking logic. During the search for papers new and interesting lines of thoughts were discovered, which eventually helped to form this paper.

METHOD

First, to understand why designers and entrepreneurs are so similar both domains will be described through the use of prominent sources in both industries, respectively Brown (2008) and McGrath and MacMillan (2000). These sources focus mainly on the way people from these two disciplines think: design thinking and the entrepreneurial mindset. By establishing what the characteristics of the thinking styles are and subsequently comparing them common ground can be found. Based on that I will show how design-thinking tools are successfully applied in three separate entrepreneurial cases. In contrast design methods are

[1] This guide from the Industrial Design Engineering program of the Delft University of Technology offers a collection of design methods and is therefore used as a source to select design methods from.

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placed next to that and there is argued how they could benefit from applying an entrepreneurial mindset and techniques will be proposed to do so.

DESIGNER'S MINDSET

Thinking about design might trigger thoughts about different domains: fashion, industrial products and even architecture. Simultaneously big names like Gianni Versace, Steve Jobs and Antoni Gaudí pop up. While in this paper the focus lies on industrial designers, they all have their way of thinking in common: design thinking. This comes down to innovation that is powered by profound knowledge about what people want and need and what the same people think about current solutions (Brown 2008). The author suggests that while design experts mostly do have some design training, non-experts are also able to use design thinking. According to Brown (2008) design thinkers have the following personality traits:

- *Empathy* – Through the "people-first" approach, they can look at the problem from different perspectives and find out latent needs of the target group.
- *Integrative thinking* – Ability to see the whole picture and apply radical innovation
- *Optimism* – Positivism that a better solution is out there.
- *Experimentalism* – Curiosity for exploring radical new solutions for current problems.
- *Collaboration* – Openness to work in the large, diverse ecosystems, necessary for creating new products and services.

ENTREPRENEURIAL MINDSET

In the entrepreneurial landscape there also are a wide range of business-minded individuals, who seem to have gained success by applying entrepreneurial thinking. A few popular names are: Richard Branson, Mark Zuckerberg and Bill Gates. McGrath and MacMillan (2000) suggest that as soon as entrepreneurial thinking becomes second nature the individual will have a sense for identifying new business opportunities and know how to quickly take advantage of such opportunities. Two important notions that McGrath and MacMillan (2000) make are the action-oriented nature of entrepreneurs, their ability to make complex situations simple and their readiness to learn from taking thought-out risks. Habitual entrepreneurs – having a focus on starting businesses - are people, who posses the following characteristics (McGrath and MacMillan 2000):

- *Opportunity spotting* – Sharply exploring the industry, looking for new opportunities at all times and ready to change current business models
- *Discipline* – Being well informed at all times and keeping track of unexploited opportunities.
- *Focus* – Only looking to work on the best opportunities and keeping their strategy in mind when choosing and working on a certain project.
- *Adaptive execution* – Proactive executing ideas and open to the solutions changing (direction) along the way.
- *Use of energy* – Rather working in a network than alone, building on the power of others.

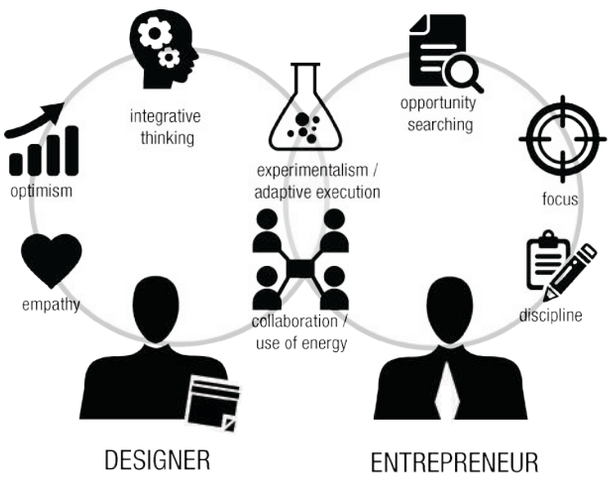

Figure 1. Overlapping areas of designer's mindset and entrepreneurial thinking

FINDING COMMON GROUND

Differences; when comparing designers and entrepreneurs there seems to be a difference in focus within the product development process. On the one hand designers are crafting a product, service or product-service system and are focused on the process of how to get it to work. Designers seem to thrive during what Brown (2008) calls the ideation phase. They benefit from their aptitude for *integrative thinking* and *optimism* resulting in blossoming creativity and a (first) concept that can be used to start the implementation phase with. Entrepreneurs on the other hand are more focused on the implementation of solutions. They are concentrating on working efficiently towards an end-result that has a commercial relevance. With their *discipline* and *focus* the projects can be brought to a good end, which is crucial in what Brown (2008) calls the implementation phases.

Similarities; on first sight it is apparent that both designers as well as entrepreneurs are action-oriented and have an aptitude for creating – either a business or a product, service of product-service system. Through the frameworks provided by Brown (2008) and McGarth and MacMillan (2000) more similarities pertaining to the thinking style of the two domains are found (figure 1: Overlapping areas of designer's mindset and entrepreneurial thinking):

EXPERIMENTALISM VS. ADAPTIVE EXECUTION

The action-oriented nature results into interest in trying to pursue radical ideas to solve current problems, being open to finding out that this doesn't work and having to

change direction. This overlaps with a high tolerance for ambiguity and ability to cope with uncertainty. Through the use of (rapid) prototyping tools both designers and entrepreneurs can experiment with the new concepts and test assumptions quickly. The visual representation of the future solution provokes the user to give feedback, which in turn can be used by the designer or entrepreneur to make iteration and improve the solution.

COLLABORATION VS. USE OF ENERGY

When it comes to finding partners, both designers as well as entrepreneurs prefer to work in network. This gives them the opportunity to leverage resources of others. Next to that it is essential to be able to work in an ecosystem of stakeholders to deal with the wicked problems[2] (Buchanan, 1992; Rittel and Webber, 1973) of today. Due to the fact that not one partner has the breadth of knowledge required to solve these complex problems, different stakeholders have to provide pieces of the information. Therefore, both designers and entrepreneurs in such networks increasingly have to rely on integrative thinking and need to have skills in simplifying complexity.

COMPARING METHODS

Now that the similarities in mindset between designers and entrepreneurs are established the methods that are used in the two domains can be compared. In the last five years there has been a lot of development of new entrepreneurial methodologies: The Golden Circle (Sinek 2009), Business Model Generation (Osterwalder and Pigneur 2010) and The Lean Start Up methodology (Ries 2011). These methods are based on design thinking. In this paragraph each method will be explained, followed by the recognized design thinking tools that are applied and an explanation of how the mindset of designers is leveraged within this method. Subsequently design methods of the Delft Design Guide (Boeijen and Daalhuizen 2010) will be scrutinized in the same manner and the benefits of applying an entrepreneurial mindset when using these methods will be shown.

ENTREPRENEURIAL METHODS

New entrepreneurial methods aim to tackle a variety of problems, such as learning how to be a front-runner, rapidly creating new insights in business models and efficiently testing assumptions.

THE GOLDEN CIRCLE (SINEK 2009):

Introduced in 2009, this method suggest to explain in a similar manner how big leaders think and how they use their thinking to communicate and act, which in turn inspired others. This resulted in what Sinek (2009) calls the Golden Circle. While in general people think 'outside in', the front-runners have a reverse thinking pattern. They start with the most abstract form of thinking and end up with a concrete product proposal: why they do it (intrinsic motivation), moving to how they do it (capabilities that result in a sustainable competitive advantage) and resulting in what they do (activities). It's about the reason, why and not what.

Storytelling - In this method there is a clear use of storytelling, one of the design thinking tools described by Liedtka and Ogilvie (2010). Instead of presenting concrete facts or benefits, a story that includes these facts is presented. Through storytelling experiences can be unlocked and people can identify with certain situations. This in turn helps in unlocking people's (latent) needs.

BUSINESS MODEL GENERATION (OSTERWALDER AND PIGNEUR 2010):

The main tool presented by Osterwalder and Pigneur (2010) is the Business Model Canvas. This tool gives entrepreneurs the ability to understand a new business model by visually prototyping. During the brainstorming the individuals can constantly change different aspects of the Business Model Canvas, which gives freedom to continuously design a different business model. For first time start-ups it is beneficial to get an overview of what would be necessary to create, capture and deliver value.

Prototyping - By working with for example post it's the new, envisioned business models could be formed on paper. The concept in this model can be tested and based on that different iteration steps can be taken to test different assumptions. Through learning from the iteration steps the business models can be detailed.

Rapid Concept Development - On the one hand this method is focused on understanding the customers: *Is this the right value proposition?* On the other hand there is experimenting with a certain solutions in mind. This coincides with the design thinking nature of wanting to experiment and learn, based upon this. Using the Business Model Canvas stimulates entrepreneurs to come up with a new business model, while they can develop an aptitude for experimentalism.

THE LEAN START UP (RIES 2011)

This method is mainly focused on getting minimum viable products (MVP's)[3] to the customers quick so as a way to quickly test assumptions within a start-up. It pushed engineers, who mainly focus on full embodiment, to go out and talk with potential customers. Within this method the use of assumption testing and learning launches were recognized.

[2] Wicked problems are defined as: [a] *"class of social system problems which are ill-formulated, where the information is confusing, where there are many clients and decision makers with conflicting values, and where the ramifications in the whole system are thoroughly confusing."* (Buchanan 1922. p.15)

[3] An early concept that only incorporated features necessary for testing. This product can be tested with early adopters, since they are more understanding when it comes to products being unfinished and they can give a lot if valuable feedback.

Assumption testing - Through the use of this tool a hypothesis regarding a new business concept is tested. This happens by making clear what the exact assumptions are that support the believe in success of a certain business concept and subsequently testing these assumption through either gathering new data by doing field research or using existing data and doing an analytical thought experiment (Liedtka and Ogilvie, 2010). Meeting an assumption determines if the project can move on in development. A similar step by step learning process is used in the Lean-Start Up method.

Learning launches - The goal with learning launches is mainly to experiment in the marketplace and learn from it. It is deliberately called a learning launch, because there is a focus on trying to make the test as real as possible. Besides, since this takes place in the market place it's the real deal. *"In contrast to a full new-product rollout, a learning launch's success is not about how much you sell but how much you learn"* (Liedtka and Ogilvie 2010. p.23). Through this tool the critical assumptions get tested and the managers learn more about why a new business idea works. Both design-thinking tools evidently are building stones of the Lean Start Up.

DESIGN METHODS

Since the emergence of design as a practice there has been a lot of development of methods and tools to guide designers-in-training through the different phases of the design process. At the Industrial Design Engineering faculty of the Delft University of technology the Delft Design Guide (Boeijen and Daalhuizen, 2010) is used. This guide includes a collection of design methods, which can be used by design students as a backbone during the design process. While the students are free to use a method whenever and however they want, the authors have made the following classification: 2.1 Creating a Design Goal, 2.2 Creating Product Ideas and Concepts, 2.3 Decision and Selection and 2.4 Evaluation of Product Features. This classification can be compared to the phases described by Brown (2008): Inspiration (2.1) Ideation (2.2 and 2.3) and Implementation (2.4). While there are more methods that could benefit from the use of entrepreneurial thinking, three design methods occurring in the Ideation and Implementation phase will be used as an example on how to leverage their inherent strength by applying an entrepreneurial mindset.

HOW TO (H2) (CREATING PRODUCT IDEAS AND CONCEPTS):

The How To-methods invites designers to phrase open questions in such a way that different angles of the problems are addressed. Due to the openness a wide range of solutions can be provided. Like other design methods this results in a wide range of solutions, which eventually don't seem to fit with the strategy. While on the one hand this seems a method that can be used to come to innovative solutions, this also leads to 'waste' (figure 2: Waste in the New Product Development funnel). When looking at the new product development funnel, discarding many ideas along the way does not qualify as an efficient process. By keeping the *focus* in this solution-finding space, this waste can be prevented. Note that this doesn't mean that there cannot be room anymore for creativity. Designers have to apply more focus to this diverging technique so at the end there is a choice between a wide range of good ideas. A way to achieve this when using the H2-method is to make two-folded H2 statement: the first part is a question for a certain problem and the second part focuses on how the solution would contribute to the (company's) strategy.

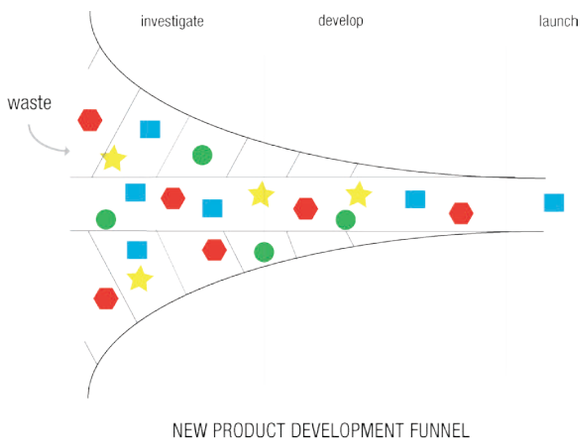

Figure 2. Waste in the New Product Development funnel

HARRIS PROFILE (DECISION AND SELECTION):

When it comes to decision-making regarding which ideas or concepts to continue with the Harris Profile method can be used. The designer can graphically display what the strengths and weaknesses of each alternative are by rating them for each criterion. Rating can be done from -2 to +2. This method at first glance seems to be a way of rationalizing why a certain concept is best, but since a designer himself has to fill in the Harris Profile the method is exposed to subjectivity. By letting others be part of the decision-making – *collaboration and use of energy* – this subjectivity can be partially dealt with. Furthermore, a way to leverage the strengths of visual representation of the Harris Profile is by using concurrent test trails of different concepts. This builds on the *discipline* that entrepreneurs have. Through the trails designers can be well informed at all times and quickly find out which concepts to pursue. In combination with designers' aptitude for *experimenting* this will lead to more valid comparisons. The designer benefits by directly seeing how each concept would deal with the listed criteria in reality instead of only on paper. Based on that the Harris Profile could become a more valid tool that can be used by designers wanting to become entrepreneurs.

PRODUCT CONCEPT EVALUATION (EVALUATION OF PRODUCT FEATURES):

This method is used to evaluate the concept that is created by the designers up till than. A group of potential customers is invited to review selected concept(s) in a controlled environment. Using this method doesn't provide so much valuable information as it would be more interesting to test the products in real life situation and see what features are interesting to the consumer. Applying entrepreneurial thinking would mean that the aptitude for *opportunity spotting* would be used. Richer insights would be gained by testing the concept in different real life settings with a wide range of potential target customers to see what current problems are and get marketing insights. The designer might see new opportunities for the solution that he came up with which in turn could lead to spotting new opportunities that can be exploited later on This also draws on the entrepreneurial *discipline*.

CONCLUSION

While the Industrial Design Engineering faculty of the Delft University of Technology teaches its students about the existence of wide range of design methods, these methods themselves could be updated. In order to prepare the students to work in a entrepreneurial setting it is important to focus more on incorporating more of an entrepreneurial mindset in these methods. After all it's evident that newly developed entrepreneurial methods also use design-thinking tools to their benefit. So, why not do the same in design? Mainly in the phase of ideation and implementation it seems to be valuable to use entrepreneurial thinking. This means: being ready to spot opportunities, have discipline, focus on working with the best opportunities while keeping the strategy in mind, being open to have adaptive execution and use energy of other stakeholders. While designers have the last two characteristics in common with entrepreneurs, they can leverage their aptitude of being empathic persons, having an ability to apply integrative thinking and being optimistic by complementing that with entrepreneurial thinking. This specifically means keeping strategy in mind during diverging in the ideation phase, so during converging in creativity the business is kept in mind. For decision-making it seems interesting to look at including the other stakeholders in the network or work on concurrent development to stimulate use of energy and adaptive execution. It looks like evaluation of concepts on the other hand could benefit from an entrepreneurial mindset in the form of opportunities that can be spotted and pursued later on or in another project. Future empirical research is necessary to compare the design methods as they are with the design methods that incorporate the suggestions proposed in this paper to see whether the expected benefits will be evident and learn how to best incorporate entrepreneurial thinking in design methods.

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MATERIALS AND EMBODIMENT IN CO-CREATION

PERNILLE GRAND

DEPARTMENT OF AESTHETICS AND COMMUNICATION, AARHUS UNIVERSITY

PERNILLEGRAND@LIVE.DK

ABSTRACT

This paper explores how materials and embodiment support the co-creation methodology. It is based on a co-creation workshop, which took place during an internship at Designit, Spain. The paper argues that the materials and embodiment during the process is important; firstly, it creates a focal point for the participants, and secondly it helps the designers adapting to the participant level of creativity. Lastly it encourages the participants when stuck in the design process. The paper exemplifies these conclusions and establishes that the use of physical materials and embodiment should be strongly considered in co-creation.

INTRODUCTION

The field of interaction design is changing and changing fast. Trends like the Maker Movement and DIY transform how people look at design and what they are expecting from it. This has put an enormous pressure on the business driven design process, which in response has put the spotlight on participation in the design process. Participation is an ambiguous word, and participants can be perceived as customers, end-users, users, experts or even more modern, co-creators. This paper focuses on the kind of participation that have found momentum in design disciplines such as Participatory Design and the more recent discipline of Co-Designing. Here participant are considered experts of their own life and are therefore of big value in more than just the research phases of the design process. An example of this is the methodology of co-creating, which will be presented in this paper. There are different approaches to the term co-creating, one of which has been applied in a project as part of a 6-month internship done by the author. As a result of this project, I argue that materials and embodiment play an important part in involving the participant meaningfully in the co-creating process. This paper takes a concrete example and look at how the materials and the embodiment in a co-creation session helped the participant in the process.

BACKGROUND

Co-creation was first introduces by C.K. Prahalad and V. Ramaswamy in 2004, where they take a business and market approach to the term, though always keeping the user's experience in the center. And important here is that's it is not just about creating the experience FOR the user, but WITH the user. In that sense, co-creation becomes a fundamental approach and they see it as a new market strategy for businesses to evolve with a market of users who are already creating on their own. With this as a growing business strategy it opens up for much more participation in the design process.
Another condition that creates momentum to co-creation activities is, that in today's market, innovation no longer comes from market pulls (what people ask for) or technology push (what is invented) but also from a contextual push (Sanders & Strappers 2014). This means that the understanding of the context moves up the hierarchy. Researchers and anthropologists have been looking in to this field for many years, and design traditions have adapted many of their methodologies. This move, along with the gaining appreciations of the materials role in the design process as something with the ability to become an accelerator for new ideas and create bridges between the designer and the participants (Hansen & Dalsgaard 2012) has paved the way for interesting new methods such as co-creation.
This paper doesn't seek to define co-creation but instead to put emphasis on the importance of materials and embodiment when using this method. Materials are here physical materials the users can touch, feel, interact with

In Lucero, A., Castañeda, M., Bang A.L. and Buur, J. (2015). Embodied Interactions, Proceedings of Sider 15, March 27-28, Kolding, Denmark

or even change if wanted. Embodiment is here doing something physically active with the materials in the co-creation session.

CO-CREATION

Sanders and Strappers define in their text from 2008 co-creation as the act of collected creativity. Their focus is on the first part of the design process, which they call the fuzzy front end and what is characteristic is, that here the design situation and challenges have yet to be defined. They predict that the roles in the design process will change even further in the future and that this fuzzy front end "will become populated with hybrid design researchers and research designers", (Sanders & Strappers 2008) and this is where co-creation as a methodology becomes relevant. The outcome to be expected from this kind of approach is by international strategic design firm Designit said to be: "people are empowered to work together to unfold their expectations, explore future scenarios and generate new opportunities based on their knowledge and experience" (Designit 2013) The key idea to the methodology is not only involving the stakeholders and the users but provoking their creativity to add value in the process. Designit has created some thumb rules for how to use the co-creation in a more concrete sense in a design process still bearing the fundamental idea of co-creation or co-designing as a mind-set.
Designit has refined the methodology into four phases. The first one is shared understanding with the client of the needs. The second is making a co-creation plan, thirdly conducting the co-creation sessions (which will be the focus in this paper) and lastly analysis of findings. The phase of the co-creation sessions they spilt into three stages. The first being the contextual immersion, the next one is to use the collective creativity to create and generate ideas, mock-ups or other artefacts with the ability of representing and illustrating future use scenarios. The last stage is to identify insights and challenges based on previous stage to develop and refine ideas and potential concepts for further work (Designit 2013). The co-creation session phase does not necessarily take place in a specific part of the design process and the 'readiness' of the outcome may therefore wary depending on the objectives. The co-creation session itself can also take many different shapes and use many different materials. Designit has been working with anything from Velcro Boards to Paper Cut-Outs. The argument of this paper will be based on a specific co-creation session held with an innovation department of a large Spanish company.

CO-CREATION WORKSHOP

The object of this paper is not to give pros and cons of the approach to the co-creation session held, neither is it to identify if the methodology in fact is beneficial – Designit's results will speak for themselves in this matter. The point is instead to look at what role embodiment and materials play in order to better understand future work within this methodology.

To do so, the specifics of the session will first be briefly explained. The involved participant had already been through a process of research and interviews on the subject of the project and thereby brought a lot of knowledge to the session. Here they were split into groups and in these groups, they were given a matrix in which to fill the behavior on the subject today, and the desired behaviors of the future. To do this they were given stickers with images representing both concrete and abstract matters and stickers with different words also varying in abstraction. These stickers along with post-its were used to fill the matrix.

Stickers with pictures and words

When finished they presented their matrix to the other groups who commented on their findings on post-its. After this, the groups were asked to gather the most important insights from the work and findings. From these insights they were asked to create challenges or 'what if'-questions. This part was crucial for them to gain new perspectives on the possibilities within the subject. The last part in the co-creation session was to decide on a challenge and start to ideate upon it with the goal of later being able to analyse the outcome.

MATERIALS AND EMBODIMENT

In this paper the embodiment and materials is approached from three different angles with different examples to illustrate. The problem is, that designers often can forget to pay attention to it because it's something they automatically do. As a designer, we are used to it - it is our tacit knowledge (Schön 1987). And in cases where we lack this insight in the process it often results in reflection-in-action (Schön 1987). Which is fine, but in working with this project I discovered how much it means when you work with someone who is not used to it. Especially within the specific method of co-creation. Because cooperation and creativity is so important, materials and embodiment becomes an essential focus point.

THE TACTILE AS FOCAL POINT

The first important notion is the stickers they used to fill out the matrix. It meant a lot that they had something they could touch and take in their hands. Pictures and words pre-selected by the designers were printed on sheets of paper as illustrated on the picture above.

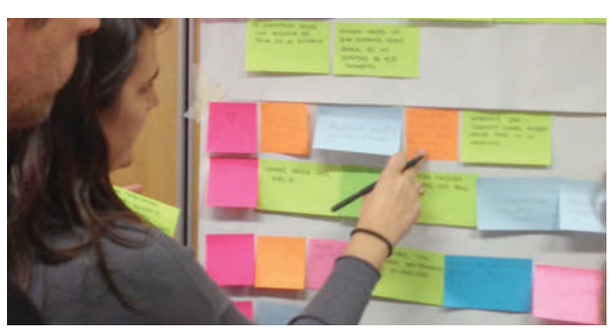
In this case it played a big part that the stickers remained on the sheet they were printed on because it meant that the participants only took those they needed and felt no need of having to place all of them. What happened was, that they were using the materials as focal point, for the teamwork. They didn't have to create anything physical themselves first, and it was clear to us that this made it easier for the participants to get the process started -- all they had to do was to place a sticker. When presented with a blank canvas and no experience, it can be difficult to draw the first line. This became somewhat evident because of the stickers feel of 'permanentness' giving the same vibe of hesitation. But still in the end, the fact they had the stickers as tactile materials help the participant getting started.
In the end, the outcome was that it helped the participants that there was something 'creative' already there, to help them start, here in the form of the selected stickers and pictures.

DO'ERS AND THINK'ERS

In this project, it was clear that there were two kinds of approaches. Some groups were very guided by emotions and intuitive/instinctive reactions. These groups basically just plotted in the stickers, pictures and words however they felt like and then afterwards worked to create a meaning out of it. This initially created some problems in making a kind of narrative out of it, which made it harder for them to tell the other groups what their thought behind it was. The other kind of approach was very calculating and reflective. These groups talked and rationalized a lot before deciding where to place different elements. They got the narrative down first and then build up the matrix.
This correlate with the idea within psychology that there is a dual set of modes in which humans process information and knowledge: there are automatic, fast, and high capacity processes, which relate to the unconscious; and other processes that are slow, controlled, and limited capacity, which relate to the conscious (Bargh 2014). This paper is not focused on the psychological processes which happens in the process, but the distinction is interesting in the way that it is natural for people to lean more towards one or the other, of course without ever being able to separate them completely. In other words, based on this we can separate them into a kind of 'think'ers' and 'do'ers'.
The do'ers – the ones who reacted immediately and instinctively – had an easy time working with the materials and the materials seemed to be helping them work together because they helped them put their actions into words and visualizations they could explain to the others, and thereby improve the collective creativity and teamwork. The think'ers however were very focused on the rules of the materials and asked many questions about this, for instance if they could use the same picture more than once. For them, having the physical materials meant they didn't get completely stranded in the planning of the matrix, but the pictures especially, because they 'say more than a thousand words', helped them keep an open mind-ness that was crucial in the co-creation session for them to explore. In this part of the co-creation session the materials thus laid the ground for an open creative process for both kind of groups. Here Sanders focus on people's level of creativity within co-creation becomes clear (Sanders 2005). Sanders describes four levels of creativity, all which can be accomplished at different times within different fields. One can have a high level of creativity within one field and another level within others field. This means, that it becomes the designers task to push the participant, and provide them with what is necessary for them to reach a higher level of creativity because that way they will get much more value from the materials. The four levels of creativity is doing, adapting, making and creating (Sanders 2005). The motivation in the adapting level is to make something on your own and the requirements are some interest and some domain experience. In this example the participants in both groups were rising from just doing to adapting, which is what in the end motivates them to emerge themselves in the subject. The physical materials help the do'ers rise because it provides the interest in working with in materials when the expertise is already there (the expertise here being the act of doing or creating). And the other way around, the materials help the think'ers because it becomes the base of the domain experience (their high level of reflection before creating initially refrain them from creating with the materials). In the end, the materials were important to both kinds of groups in order to get started with the session and in order to make meaningful content.

EMBODIMENT

After presenting the matrix to the other groups and getting feedback, the groups were asked to go back to their matrix and extract insights from it. Group 1, who were least systematic in their approach from the start, seemed to get multiple perspectives and instead of reorganizing their post-its like other groups, they were forced to create a new matrix with the insights to get an overview. The result was that this group had an easier time finding meaningful insights than other groups.



Group 1 creating a new matrix with insights

The other groups all had in common that their visual thinking was very limited. They were very caught-up in the post-its that they themself (and the other groups) had added in the feedback session. The post-its were very

heavy with text and this meant that the visual aspect of the original matrix was lost. The groups got stuck trying to categorize the post-its instead of looking at the big picture and extract insights. The problem was that the groups locked themselves in these categorized clusters, which made the information way too heavy for them to abstract enough to find usable insights. The 'insights' they created did not differ from the fact-like findings from the creation of the matrix part of the co-creation session. To help them overcome this they were told to lightened up the clusters – removing repeating parts – and reorganize them in they way group 1 did. In retrospect to this exercise it is clear that what they did was more like card sorting than analyzing their findings. What happened was that the groups sat by tables trying to make sense of all the information they had. When they were told to 'start over' organizing it, we also told them to do it over on a 'blank sheet' hanging on the wall. This very small gesture of getting up and doing it from the top while standing, made a big difference. It is the action of physical embodiment with the materials that works more efficiently for the participants, also as concluded by Knight and Baer in their research on how collaborative knowledge work works better in physically active environments. (Knight & Baer 2014) Another point to this was that it made the participants feel they were doing the act of creating something new and not 'destroying' what they already had made. It was clear that the participants felt it was very destructive to change the original matrix and the fact that they didn't see it as a progress held them back from changing too much, which in the end was the reason they kept card sorting instead of using the findings to create insights. Basically they were afraid they were loosing data. In the end the solution became to get them out of the chairs and their comfort zone and get them to work actively with the materials, both physically and mentally. This got them to understand that what they are creating is a dynamic process where nothing (at least in this stage of the design process) is final, and this in turn means that the outcome not is too heavy to work with, which creates better results and makes it easier for them to create insights.

What ultimately happened was that the participants became very unsure of themselves and their abilities. The reason behind this might well be, that there initially was produced too much text on the post-its, which the participant attached themselves to. The participant became focused on sitting quietly at the table creating very deep and meaningful insights in long and explanatory sentences. Instead they should have been asked to stand up, using their bodies actively and embodied the process, making the insight generation less heavy.

CONCLUSION

When working with a method relying so much on the participants as co-creation does, you are never guarantied the same result twice. That said, the experiences from this project I can see n resemblance to other projects I have done and papers I have read. Co-creation can be discussed on many levels; as an approach, a methodology, and some would consider the example here giving co-creation the role of a design technique. The way Designit uses co-creation, their focus is not to define the specific tasks, but to use the participants to create designs they are sure make sense to the end-users and/or clients. The tactile materials, here in form of the different stickers and post-its, become important for the participants to start the creation. If they had to make the content from scratch, the process would be more focused on this because of their initially level of creativity. This would take focus away from creating meaningful data. The embodiment – working and interacting with the materials, helped the participants lighten up the process, helping them when they were stuck, as in the example as simple as them standing up to find meaning in the insight. In the end the materials and the embodiment help guide the participants toward the whole point of co-creation, which is to give the power to the participants.

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THE BOOKCUBE: DESIGNED FOR AND WITH THE USER

CHRISTINA JENSEN
IT UNIVERSITY OF COPENHAGEN
CHJEN@ITU.DK

KRISTINE KORNUM
IT UNIVERISTY OF COPENHAGEN
KKOR@ITU.DK

MAJ SANDER ERSTRUP
IT UNIVERSITY OF COPENHAGEN
MSAE@ITU.DK

ABSTRACT

This paper gives a practical insight into involving users in the design process and exploring the body as a useful resource in this context. Based on a specific case, The Bookcube, the paper explains how an interactive design concept can emerge from a process based upon a participatory design method, embodied perception, and capture the role of the lived body when designing within the field of human-computer interaction. Our design research revolved around young people's declining interest in reading, which led us to cooperate with our users in a workshop, where they co-designed an artifact that defined how reading could become a more social activity. The paper elaborates the process and the reflections in regards to the method of working with participatory design.

INTRODUCTION

The BookCube is a physical interactive reading platform created to add a social dimension to the reading experience. The main method used for developing the concept of the BookCube is a participatory design workshop with a class of 8th graders. In this paper we will elaborate on this design method.

The predefined design theme of this project was reading and writing. We chose literature and young people as our topic of interest, as it was a subject that displayed not only the problems and challenges in relation to digital and new vs. the analogue and old, but also possibilities and potential in useful symbiosis utilizing the advantageous traits of both.

The reading skills of Danish students in elementary schools are declining and research shows that there is a link between passion for reading and reading skills (PISA, 2009, p. 9). This challenge in young people's reading habits motivated us to examine the problem field. The digital design solution we developed was mainly influenced by a participatory design workshop. In the following we will elaborate further on the practical aspect of this part of our design process. We will also introduce some of the main theories used as inspiration for the process.

THEORY

Inspired by Dag Svanæs' study on embodied perception elaborated within the field of human-computer interaction and the ideas related to Merleau-Ponty's concept of the lived body, we have focused on embedding kinesthetic creativity as part of our participatory design method. Dag Svanæs describes Merleau-Ponty's kinaesthetic creativity as the body's ability to relate to interactive products during the design process. You could say that kinaesthetic creativity makes it possible to use the body for acting out proposed design solutions. To Merleau-Ponty, users are living, intelligent bodies. And these living bodies have a large potential for creative problem solving using what he calls abstract movements. Both before and after the participatory design workshop we recognized that embodiment played a central role in the design process. (Svanæs, 2013)

Doing participatory design with 8th graders, who can still be considered children, is of course different than

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working with adults. Some of the most important research done in the area of participatory design with children is done by Allison Druin. She has developed a method for developing new technology for children with children called cooperative inquiry. (Druin, 1999) The method is grounded in HCI research and theories of cooperative design, participatory design, contextual inquiry etc. Cooperative inquiry includes three aspects: (1) a partnership with children; (2) field research to understand context (3) iterative low-tech and high-tech prototyping. We did not use these specific steps for this project, however during the process we were inspirered by Druin and her notion of participatory design with children (ibid.).

In developing the participatory design workshop we were furthermore inspired by Bill Buxton and his thoughts on sketching and designing with the user (Buxton, 2010). We will elaborate further on this in the section Participatory design workshop with 8th graders.

INTRODUCTION TO MEHTOD

Our initial design research based upon ethnographic methods such as desktop research, qualitative interviews and a focus group gave us a range of insights about the users and their relation to the activity of reading. From all of these insights we defined an opportunity statement in which the participatory design-session was based:

The reading of fiction among young people (7th-9th grade) has difficult conditions in the competition with other media and social situations. Social reading is one way to increase the young people's commitment towards fiction.

How can the experience of reading become a more social activity among young people?

MEHTOD: PARTICIPATORY DESIGN WORKSHOP WITH 8TH GRADERS

Our workshop took place at Holmegaardsskolen in Hvidovre, a suburb to Copenhagen, and involved 25 8th graders in the age 13-14 years, who for the assignment were divided into groups of three to four. The workshop was conducted in four hours.

Doing a participatory design workshop with our users as part of our early ideation phase and not letting the sketching of the participants be restrained to just pen and paper was inspired by Buxton (2010). According to Buxton it should be granted that the user "...is both considered and involved throughout the process" (Buxton, 2010, p. 143).

To make sure the process was as fruitful and efficient as possible, we did a storyboard on the session as preparation (see Figure 1). We divided the sketching session into two main parts: sketching in groups on a defined topic using different material such as books, paper, wire, magazines, markers etc. and presenting the product through a short roleplay (see Figure 2). It was important to us that we gave the students a defined topic to sketch from bearing in mind that sketching is more about exploring, questioning and proposing than prototyping (Buxton, 2010, p. 140) The defined topic, we asked the students to elaborate on, was: Design a book that several people can read at the same time.

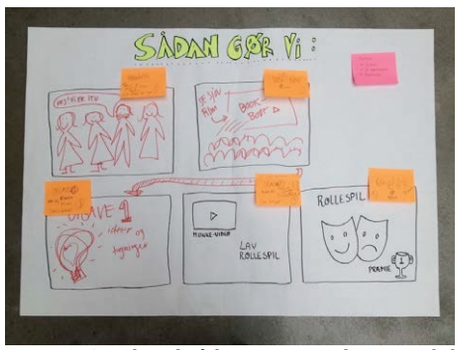

Figure 1: Storyboard of the partipatory design workshop

We were impressed by the results that came with working with a participatory design method (see Figure 3). The creativity and energy demonstrated by the 8th graders took us a bit by surprise. Before the workshop we had agreed on not guiding the students too much, and thereby not affect the results with our own assumptions. This turned out to be easy as the students were very self-reliant. One thing to be aware of is the physical context of the workshop, in this case the setting of school, which might have impacted the 8th graders' level of participation.

Something that could have turned this participatory design workshop even more rewarding would have been to do a roleplay session later in the process. That way we could have used the insights from the participatory design workshop to develop a prototype and then used roleplaying with this prototype to further develop functions. But due to the time scope of the assignment this was not possible.

The participatory design workshop provided us with many great insights and sketches that we used in the ideation phase of narrowing down ideas to the final concept.


Figure 2: Participatory design workshop with 8th graders at Holmegaardskolen in Hvidovre

Figure 3: The results from the workshop

MAIN INSIGHTS

- The artifact is something you can look at from different angles
- A hologram-function can play a part in the design
- It is something physical you can walk around mainly with your friends (or other people)
- Interactivity between the users and the content is important

THE PRODUCT

Our design research and participatory design workshop resulted in a concept called the BookCube. It is an interactive physical reading installation as high as a human with access from four different angles. A patchwork of touchscreens containing information from the capturing universe of literature is provided to the users. The concept is both situated and distributed, as the main artifact is located in the physical context of school but lives through content that is generated and sent to the installation from mobile devices using the BookCube app. From the app, users can share their reading experience with others through either quotes or reviews. In that way the activity of reading is the focal point of the concept. With content being user-generated, the users are urged to take ownership being co-creators of the BookCube instal- lation that they build together. To join the community of the BookCube you will both have to share as well as read, which led us to the tagline: “Share. Inspire. Experience.”

Please enjoy the video that briefly tells the story and functions of the BookCube: http://youtu.be/28IP8tH550Y.

DISCUSSION AND REFLECTIONS

Seen in retrospect the project could have benefitted from a participatory design approach to an even larger extent, especially with the reflections of embodied interaction and Svanæs’ ideas on "kinaesthetic creativity” in mind. As we saw to some degree in the participatory design workshop the role-play part proved to be especially interesting in relation to “the feel dimension”.

When bringing design problems to the surface we saw that the participants, in some cases, would try to solve it using their body in interacting with the artifact. Through abstract movements they would seem to invent new functionality spontaneously, inspired by the mock-up that they had created. One of the participating groups had developed a spiral-shaped reading station that would rotate and in that way allow more people to read at the same time. When evaluating on the idea collectively in class, and by bringing design problems to the surface, we saw how the participants would use their body in interaction with the artifact to solve an occurring problem. A problem that came up in regards to the mentioned group's solution was related the moving pages of the reading station which would most likely influence the reading experience negatively. In actively demonstrating how to read from the station, one of the participants proposed the need for a chair that would adapt to the movements of the pages. Although this was not a fully thought out concept, it did take the idea one step further. In that way we saw the potential of the body as a problem-solver in design. Embodiement and kinaesthetic creativity was in this case explored to some extent, which was something we had not explicitly thought about, when planning the workshop, as our focus was more on ideation and sketching.

By integrating a design-in-action approach in the later stages of the project we could have combined concrete functionality ideation with the building of a low-fi prototype while testing ”the feel of it” on real users.

One could argue that design process of the BookCube partly followed Druin’s method of cooperative inquiry. With our initial design research we got an understanding of the context, then we decided to focus on an area - young people and social reading - which we pursued with a participatory design workshop. But if we had followed Druin’s method we would have worked more in cooperation with the students and the students would have been part of the whole process as equals to the design group.

CONCLUSION

This study gives a practical insight into involving users in the design process and exploiting the body as a useful resource in this context. User participation played an important role in our project as users took active part of the ideation phase.

The structure of the design process in that sense had large impact on the final concept, which in return was rooted in our insights of the end users. It seems from our point of experience, that the participatory design method, in our case with the use of sketching, is beneficial when working with the specific age group of young teens.

The physical context in which the workshop took place, a school, is furthermore an accessible location when it comes to the conduct of participatory design activities, which can be useful for other studies as well.

Designers can benefit from thinking out of the box and of the office when planning design processes and from remembering the active use of the body when structuring these practices, Using the words of Tim Brown president and CEO at Ideo sums it up very well: “Design may have it’s largest impact when it is taken out of the hands of the designers and put into the hands of everyone. Design is too important to be left to designers.” (TED, 2009).

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EXPLORATION OF MATERIALS FOR SUPPORTING ARTICULATIONS OF EXPERIENCES

RAGNA-LISA MÖLLER
UNIVERSITY OF SOUTHERN DENMARK
RAMOL10@STUDENT.SDU.DK

ABSTRACT

It has shown benefits from several research fields, that materials can provide a better articulation about tacit knowledge. This paper sets out to be inspired by these methods and implements them in a new context like expressing abstract concepts as colors.

This paper presents an exploration of different materials and setups and their value of articulations about this topic. Data has been gained through several activities where the participants have been asked to explain their thoughts of six colors. Furthermore it is reflective on challenges and their improvements.

INTRODUCTION

Using Material for articulation of experiences, feelings or opinions has been used in fields of example psychology and design. In psychology a known method for psychological evaluation has been the Ink blot test or also called the Rorschach test which has been named after the Swiss psychologist Herman Rorschach. The test helps psychologists to reveal psychological value material from their patients. (Sloane 1970) It is mainly in use for analyzing the patients' personality or emotional state. It is formed by a set of cards picturing an ink-blot and the patient has to describe what he sees in those ink-blots. According to this method it is a tool to make the patient articulate himself with the help of a picture.

Another interesting aspect in order to use objects for expression is mentioned by Sanders who describes that generative tools can increase the co-design strategy. (Sanders 2000) The participants in our workshops became creators of their own design and how they want it to look like in order to represent their perception about the color they have been working on. We as facilitators gave them a toolkit of materials, which mainly should support to summarized the experiences the participants had with the color.

With these two examples in mind there are some similarities within the method. Both use material with the intention of helping the other persons evaluate their knowledge and articulate it while thinking about a shape they see in front of them or create a collection of objects.

Among the design research in IT Product Design (ITPD), which is a programme at the University of Southern Denmark, it has shown that objects and tinkering with them triggers articulation about tacit knowledge by the people who are interacting with those objects. It has also shown benefits for participatory innovation by using Tangible Business Models (Mitchell & Buur 2010) or video analysis methods (Buur & Ylirisku 2007). Those models do "*facilitating in systems, create simplicity, […] provoke new connections and associations, support storytelling, work across language barriers and provide recollecting experiences*" (Mitchell & Buur 2010)

An example of these models can for example be the Video Card Game (Buur & Ylirisku 2007) where the focus is on bits from videos, recorded through user sessions beforehand and cut into interesting pieces from the researchers. Then novices select sequences of those videos they find interesting, write them on a card which afterwards will be clustered during a game of collecting themes within a group session of all participants. Both Tangible Business Models and Video Card Games include objects that could facilitate the articulation between novices and experts within a field or work area.

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The original project frame I enrolled in had the following description:

"Color by Forms for Blind people", an experimental trial based on the Kansei approach. *(Lee & Harada 1999)* The purpose of this project is, to make blind people feel the colors with textures. These blind people have never experienced colors as we know them but they have their own structure of color groups in their mind, through the experiences of daily lives through people around.

Based on this approach the research group did the first two workshops of people trying to create sculptures with clay based on their experience and knowledge about colors. These participants did not have any disability in their sight and has been asked to close their eyes during the exercise. The aim was to expand the participants' concentration on shaping the material and not getting influenced by the color of the clay. Furthermore we practiced the think aloud method which is a method the facilitator of a session might use in order to get a verbal report from the participant to help the facilitator to reflect on the participants cognitive processes. (K.A. Ericsson 1993)

Inspired by the research groups work until this point I wanted to explore further if the materials do a difference for the participants in sharing their experience. Is some material better to improve those expressions than other? How does it affect the subjects if just one material is given compared to multiple materials to choose from? This curiosity led me to a new research question saying how materials can be used as a tool to describe abstract concepts as colors?

THE PRACTICE

The specifications of the material we were about to choose were simple: it has had to be flexible in order to manipulate it quickly; it needed to be neutral as possible so the participants won't get influenced by the original shape or the raw materials' color and (but not necessary) it had to be transported easily for practical reasons afterwards. So as the research group chose white, air-drying clay because it is really flexible in creating shapes and objects, which it has been assumed, will help to concentrate on the articulations instead of the material.
The Group wanted the workshops to be as open and public as possible, so the participants would volunteer for this activity and hope others would get curious trying the activity by seeing people work with clay. When the day came for the workshops, people dropped by or we asked them to participate randomly based on their appearance at the university. They have been asked to imagine a color and create a shape with the clay based on their imagination. A session were a participant had to create six different shapes with six pieces of clay took 5-10 minutes.

WORKSHOP 1 "Creating Objects with Clay"
In order to explore the value of material and to make the participants describe their concept of colors, two different workshops were conducted in the beginning. For the first workshop 11 participants were present, which were partly related to design. Seven of them have been asked to close their eyes, handed them a piece of clay and asked them to think of six different colors (blue, red, green, yellow, black & white). The participants did have a prior experience from working with clay but they didn't have any experience in using the clay within this perspective. But it has to be mentioned here, that they didn't felt equally comfortable with shaping objects with clay. The participants who did have had a design background or experience in design, where more likely to express their emotions about a color, than non-designers had. On the other hand one might distinguish between genders, since it seemed to be easier for woman than the man to shape an object with clay.

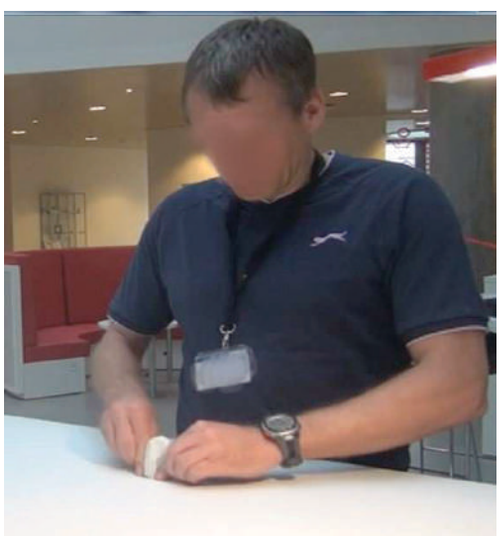

FIGURE 1 Participant creating an object with clay, workshop 1

While the participants did these exercises, one member of the research group made notes of the words they mentioned. (Figure 1) In the end we had six different objects that represented one color each. From those 11 participants each color-object has been separated and categorized into those colors. So there were six categories with 11 objects. The aim was to see, if there were any similarities between those objects or their articulation.

When the first session was finished the research group wanted to explore, if the expressions or experience changed if the next three participants could do this exercise with open eyes.

This session was really interesting. Beside the participants interacting with the clay much more and with the objects look they also expressed them more detailed which, I believe, came from them seeing the material and sensing it. It seemed to be more important

for the participants to concentrate on the shape of their objects as they went along with trying to articulate themselves.

WORKSHOP 2 “Sensing Objects”

Figure 2 The collection of objects used for workshop 2

After the objects from workshop 1 dried, we had the second workshop where new participants tried to guess the color by touching the objects, created from workshop 1, with their eyes closed. In three cabinets with six shelves we collected the objects, so one color was on one shelf. (Figure 2) Then we asked the people to go through those shelves and explore the objects to find out which color was represented on each shelf. (Figure 3) Like in the workshop before we applied the think-aloud method again. The participants were randomly picked, from the university, for each session. Here it was difficult for each subject to define the color and it mainly ended in them guessing which color was lying in the shelf.

FIGURE 3 Participant sensing the objects, workshop 2

Through both of the workshops and their sessions the research group assumed, that describing colors is a really subjective matter. Workshop 1 worked well so far in order to make the participants create their expressions. Richer articulations had been done though, when the participants did the exercise with their eyes opened, because they went along explaining the color by interacting with the clay. The differences between black and white and the other colors have been remarkable. Blue, Red, Green and Yellow has mostly been connected to metaphors and emotions linked to those. While on the other hand black and white where expressed in actual attributes of the color. With regard to this outcome, Workshop 2 has been difficult for the participants. The participants were more likely to guess black and white than the more complex colors blue, red, green and yellow.

REFLECTIONS ON WORKSHOP 1 AND 2

Based on these two workshops I found out, that people react differently to the material. They never made an exercise like this before and had a hard time to express their experience through clay. But now they did, it was interesting that nearly all participants didn’t take longer than 2-6 minutes for creating their shape in Workshop 1. This might be based on them being busy with work and because we picked them randomly it might have insulted them in their plans and they felt maybe disturbed in their workflow. If I would do this kind of exercise again, I would also prefer to interview the participant after the session in order to get a better impression of if those factors mentioned did have an influence in their attention to the session or if they just couldn’t make any sense of this kind of exercise. It seems the clay did just have some sort of touch-sense activation. With this in mind I was wondering if I would collect different materials to work with or even the selection of those would be larger and if it then would have an impact on the participants’ articulation. At this point I changed the former research approach into a different viewpoint: “How can materials be used as a tool to describe abstract concepts as colors?”

WORKSHOP 3 “Creating Objects with Various Materials”

For this session two ITPD students agreed on doing this exercise and got a suitcase full of materials i.e. from several types of paper with various textures, fabric, metal and other objects. They have been asked to do the same exercise as in workshop 1, just with open eyes. The difference from this exercise and those before was, that I also interviewed them when they were done with a color and afterwards on what they thought of the exercise and what they thought of the materials lying in front of them. Overall was it interesting to see if the articulation changed for both participants while interacting with the materials.

Joan did always start to explore the materials before she decided to go with one or more of them. She touched several objects first, while she was thinking out loud about the color. She has been able to use the material in order to create something with a dimension, most of the time.

When she had to explain the more complex colors, like blue she tended to use material with the same color in order to create something she is connecting with blue like a wave or the ocean.

Remarkable here was that she actually described the feeling of moving through water, that it was soft and floating. So she actually chose material that had these attributes as well.

In the interview Joan expressed that the materials did challenge her more than actually helping by being limited through the shapes of the objects. But she thought also that it was more beneficial than workshop 2 to explore colors with various materials and values to articulate those, than with words – it gave a more exploratory and common base to talk about colors in this way. Joan was actually also one of the participants, who has been part of the sensing workshop (workshop 2) and compared to this exercise it was way easier to express herself through this material, than the objects that have been created by others expression of the colors.
Mike did like Joan gestures with his hands; explored the objects' texture, shape or weight by touching or lifting them.

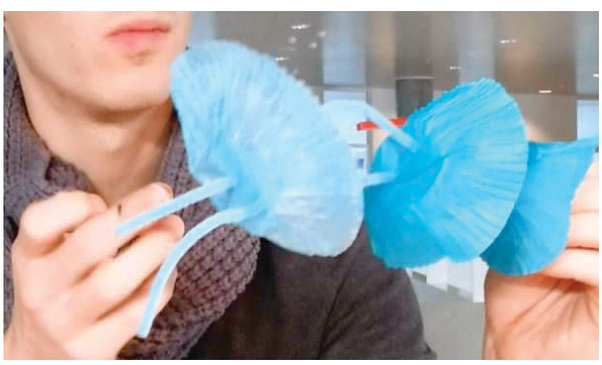

Figure 4 Mikes construction of Blue, workshop 3

Attention-grabbing in Mike's session was that he for example for blue constructed a constellation defined by its physical functions. He mentioned blue is connected to something airy and water and he created this object, which could possibly float or fly for a while. (Figure 4)

In the interview afterwards Mike talked about the limitation of material in order to express himself. He mentioned that he had to improvise with the present material to do the right constructions of his objects, which wasn't a bad experience for him.
Notable through those two sessions was also, that both of them actually fiddled with their hands before they touched the material.

REFLECTIONS

Through all these workshops I explored, that the perception of colors actually is highly subjective and the only common base they had, was using metaphors related to those colors. But beside those metaphors the participants explored their memory they had together with this color and that made it difficult to distinguish the explorations in between them.

I explored the value of combining material, gesture and articulation in order to create a good experience is necessary. In the late process I discovered, that the participants needed their hands just to do gesture and motions of examples (moving the hands like a wave) they wanted to explain.

Things I would have done differently: The exploration through this process made me think that I've could have improved workshop 2 and made the participants talk about their perception of colors before they got their hands into the shelves and touched the objects. Maybe instead of exploring what others have made it would have changed their perspective in order to see what kind of similarities would have been linked to their own perception of the objects they sensed on the shelves.

It would also have been interesting how this approach will affect blind people, since this was the original research question. But I moved away from it, because it was really hard to get in contact to blind people.

Reflections on further steps: With the intention of shaping a bigger contrast within my research question it would be interesting to investigate how participants would articulate themselves about abstract concepts as colors without materials.

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http://theinkblot.com/

THE AESTHETIC'S LIBERATION OF THE MEDIA

JULIE ROSE MALSKÆR
DIGITAL DESIGN, AARHUS UNIVERSITET
FINLANDSGADE 25, 8200 AARHUS N
JULIERM@LIVE.DK

DIANA BJERREGAARD KRISTENSEN
DIGITAL DESIGN, AARHUS UNIVERSITET
FINLANDSGADE 25, 8200 AARHUS N
DIANA.KRISTENSEN@HOTMAIL.COM

ABSTRACT

This paper examines, in a Post-digital perspective, the different qualities of analog and digital cameras and how a combination of the two may result in a new aesthetic expression in a camera. We have through our practice combined these qualities into a design, which has proven to be controlling yet uncontrollable in its expression, tangible in its physical form yet fleeting in its expression. The interior process of the system is made visible and as result draws attention to the media itself and becomes independent.

GENERAL TERMS
Design, Experimentation

KEYWORDS
Post-digital, glitch aesthetic, camera, analog, digital

1. INTRODUCTION
In order to study our thesis, we have through our design examined analog and digital qualities of cameras and compared the two in an aesthetic analysis and in that way are able to create a linked expression into a camera. In the view of our discussion, which is based on a speculative design perspective, we discuss the consequences of inserting our design into our living world.

2. BACKGROUND
2.1 POST-DIGITAL
The term post-digital is a way to refer to this new rising of the analog media. It describes the messy and paradoxical condition of art and media after digital technology revolutions [1]. It is not the end of the digital, but it is a way to look in other

directions. To put new life in old media is not enough, but instead functionally repurpose them in (critical) relation to mainstream digital media technologies.

As Florian Cramer describes it: "Post-digital: a term that sucks but is useful" [2]; which underline the complexity in the post-digital as a technical term and as a subject. The post-digital is not an attempt to go back to analog, or even make a distinction between analog and digital. Instead it does not divide old and new media, but use the technology most suitable to the job, rather than automatically 'defaulting' to the latest 'new media' device.

2.2 ANALOG VS. DIGITAL
The main point we discovered, during our pursuit of finding different qualities between analog and digital medias, was that analog has an uncontrollable element to it and digital a controllable element, which links to its desire to be transparent as a media and to be user-friendly. By uncontrollable we refer to analog camera's simple technique, and as a result the images are influenced by many external factors beyond the control of the camera and of the user. The digital camera is controlling in its design with all the pre-settings, autofocus, which result in the camera doing and controlling everything for the user.

The German cultural critic Walter Benjamin criticized the technical reproduction with the new technological artefact for example the camera, which made it possible to reproduce art [3]. Today the problem does not seems to be reproduction as much as variability, which makes it possible to alternate data, manipulate and customize it and meet the user's input in a way, which means that nothing can not ever be fully embedded [4]. The analog camera appears to be more authentic compared to the

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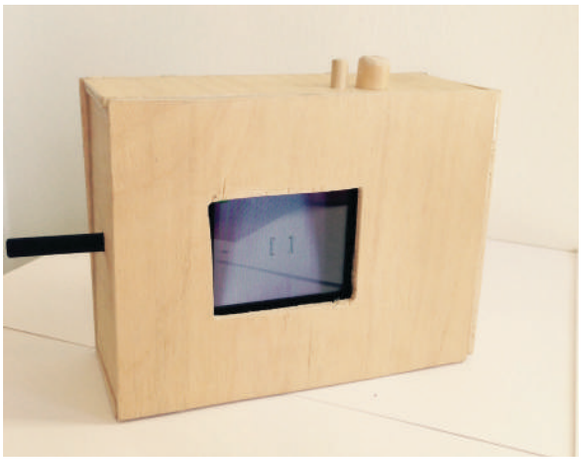
digital because the interface and the camera's technical possibilities are very limited. The light is let into the lens and creates an inverted image, which become permanently retained in the film due to the chemical process. In comparison to the digital camera where the creation of an image undergoes a process, the input is converted to electrical charges, which become pixels. The many options such as photo settings, filters and editing of images etc. causes a different handling of the images, the way they are formed and this difference is manifested by their physical form as well.

3. CONCEPT

Our concept is based upon an attempt to analyse the qualities of analog and digital cameras and finding a way to combine the best and most suitable of those. So, our concept consists of a digital camera, which we have succeeded in hacking its CCD-sensor. This means the light, which would normally be converted into electronic charges, now has been disrupted and affects the outcome of the images. The images no longer mediate the representative world in front of it but instead it is a combination of what is in front of the camera mixed with the electronic charges you see, which create an expression in form of a glitch image. We have chosen to place limitations where images only appears on the screen as the users takes the image and afterwards disappears, and is stored inside the camera's memory. It is not possible for the user to edit the images. The other limitation is limited storage in its memory - only 24 images.

The interaction and interface is simplified in a way, which allows the user to once again to take an active role in how and what to take pictures of. The user would not be able to edit the images or delete them and the limited memory causes that the user would not automatically click on the camera and take a bounce of images. The user has an active role in deciding what the limited memory will consist of.



Picture 1 and 2. The interface of our camera

4. GLITCH ART

Mark Banzhoff is an interdisciplinary artist who works with both videos, sound, photography and live performances. He works with the relations between human being and technology in relation to what he calls Error Theory [5], and the link in this relation is glitch and errors. In digital cameras he manipulates the CCD-sensor by leading volts through and creates glitch images. This process between artist and the limitations of the machine arises and together become art.

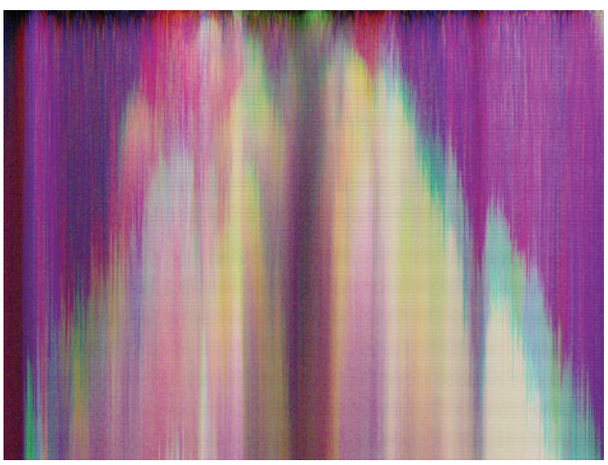
Picture 3. The hacked digital camera inside the box

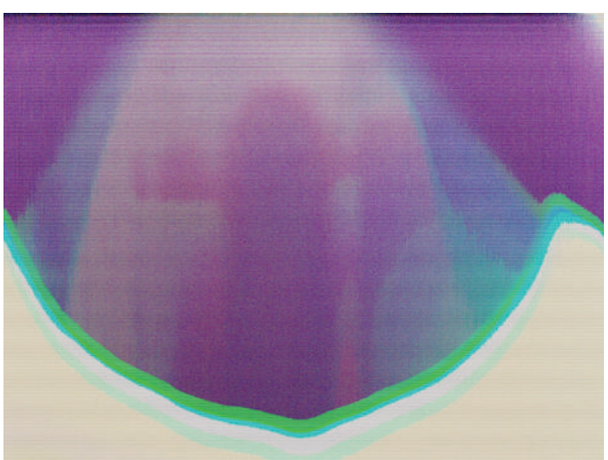
5. GLITCH/AESTHETICS

The camera physical form is important in term of how the user relates to technology and how it becomes tangible. Our camera does not have a film to be produced but instead it only has its own internal memory, which create this limitation of 24 pictures to be stored. The images are physically stored in the camera, which creates a direct connection between camera and images. The images disappear and become representation of moments captured with the camera. They are not tangible in their form but become fleeting and something that are experienced within the moment. We believe that this causes a new aesthetic in the fleeting with a loss in how the digital camera's internal system is showcased and causes a new expression where

the images disappears and are stored in the memory of the camera without any opportunity to revisit them.

The glitch effect and colourful expression may be associated with technical errors or unexpected stop, as we know from other digital technologies. It becomes digital in its expression, which shows in the enlargement of the pixels in the images. It may be interpreted as the camera's noise, where its internal process is seen as something rather aesthetic. As our images are based upon the camera's system and control it means there are not any in scripted messages or a specific reading of the images – it is simply up to the user to interpret the various expressions [6]. We have given the camera the full control to create the glitch images – it is however in combination with what is presents in front of the camera. The controlled part of the digital camera has become aestheticized, which is in great contrast to its expressions that seems as something uncontrollable.





Picture 4 and 5. Images taking by our camera

Jay David Bolter and Richard Grusin describe the digital photography as what they call *Immediacy* in relation to how it strives to obtain perfection and a realistic expression with an attempt to obtain a transparency of the construction and media behind. The point being that it will always be a representation of the reality but never the actual reality. *Hypermediacy* is when the constructions is shown and breaks down the illusion of immediacy and instead become an aesthetic experience of the media [7].

Our camera is Hypermediacy because it shows the process within the camera through these glitch images, which creates this new aesthetic. As a part of their artistic practice artists have commonly used glitches in their practice. New Media artist and professor Nick Briz define glitch; "as an unexpected moment in a system that call attention to that system, and perhaps even leads u to notice aspects of that system that might otherwise go unnoticed" [8]. By hacking the digital camera's CCD-sensor it creates glitch images but the outcome of the glitch is created within the process of the camera and the outcome will be different each time. The images will never be the same, which means that every image is unique. This causes a contrast to what the digital camera as a technology actually allows within the context of reproduction and regulations. The camera's technology has been limited to experiences of the moments that cannot be reproduced. The glitch images create an aesthetic in the fleeting with the limitation of the camera as a technology.

6. DISCUSSION

In art, the artists such as Mark Banzhoff are speculative and critical, and we ourselves may allow us to be free and experience some emotions within a context that we would not be ordinarily encounter, and to think of ourselves in ways that we usually do not. By taking this feeling and this perspective, which the artist have already examined, and implement it in a design, we suddenly see it in a new perspective; the users.
We live in a network society, and we endeavour to the perfect, flawless and to re-create this reality in the digital media. But the media itself, the data, information and the process must be hidden - instead everything strives to appear perfect. This is not a critic of the digital media itself, but rather the human beings need for control and to fit the digital into the world, we already know. Through our design, the world would have to let go and make room for the media to become-other. By allowing glitch and errors to arise, we cannot control everything - and perhaps should not. Perhaps it is time to give the technology its own expression and voice - and not just make use of it to the purpose of the society.

In the analog we find the quality of the media may fail, and we cannot always control it.
Indeed, "failure" has become a prominent aesthetic in many of the arts in the late 20th century, "[...] reminding us that our control of technology is an illusion, and revealing digital tools to be only as perfect, precise, and efficient as the humans who build them" [9].

Through a speculative design perspective [10], it is possible to open up for new perspectives on what a camera is and what it can be. We do not take a position

to a specific user or anything, but it gives us a chance to go deeper, and see the consequences of entering this design into the world, as we know it. By doing so, we would change the way we use a camera and the main purpose has changed. Normally, we use a camera capture a realistic moment of reality - it has to be as realistic as possible, the striving towards immediacy [7]. The media itself is hidden and does not appear in the image, but in our camera, the media and technology is the dominant part of the image.

7. CONCLUSION

By allowing glitch and errors to be a part of the photo, we settle with the striving towards immediacy. The technology and the process by converting from analog to digital through the CCD-sensor is a part of the media, and is now clarified. So, we conclude that by designing this camera, the use of the camera, as we know it, is now fully changed. The consequence of inserting it into an actual context of use must be that we may realize the reality we see *is* through technology/machines, and will never be actual reality. We have to let go of the control and let the digital technology become its own.

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SIDER '15

THE PLAYFUL BODY

INITIATING DISGUISED LEARNING WITH MUSIC

MADS LAURBERG HALSE

MADSHALSE@GMAIL.COM

ABSTRACT

This paper investigates an activity designed to teach skills in a way that does not appear with learning in mind. The idea is that the user focuses on an instantly rewarding ”decoy” activity that in reality is designed with skill development, transferable to other contexts in mind. A design experiments is described which suggests that linking body movements to the progression of music can motivate physical training.

INTRODUCTION

Learning new skills or knowledge is something that people might benefit from long term, but may not be motivated to invest the effort to learn. The approach proposed here uses a “decoy” activity that at first seem to be having a different purpose than to stimulate learning. In psychology, unconscious learning is known as “implicit learning” (Berry & Broadbent 1987; Reber 1989), whereas the term “disguised learning” are found in educational context emphasising activities that are also engaging and fun. Moreover, implicit learning (disguised or not) might provide a performance benefit: A study on golf players learning basics golf swings found that performers having larger pools of implicit knowledge were less likely to fail under pressure than performers having larger pools of explicit knowledge (Masters 1992).

DESIGN EXPERIMENT: THE SURFTRAINER

The experiment was inspired by the observation that most beginner surfers stands tall on their surfboard while surfing. A tall standing surfer will likely not be able to react quickly, and may often fall off the board, affecting the surf experience negatively. One way experienced surfers maintain flow, balance and quick reactions is through constantly adapting their centre of gravity by bending and straitening the knees. Sometimes balance is kept by being crouched for shorter periods of time. Thus, the SurfTrainer (ST) experiment was designed with two functional objectives:

1) Motivate beginner surfers to build a habit / train movements that bend and straighten the knees/legs

2) Increase strength and make beginners comfortable in keeping knees bend for shorter periods of time

BUILDING MUSIC

To create a “product” containing a decoy activity that might be experienced as an end in itself, the idea was to link the user’s movements to some other objective to focus upon, making the movements means to an end instead of the end themselves. The choice fell upon linking the users movements to the progression of music played for the user in earplugs as position was changed. Music was chosen because of its properties to facilitate body movements, immersion and joy. The conceptual idea in terms of user/system interaction is similar to figure 1, especially focussing on exploring ways to make a similar circular interaction process (*system feedback → user judgement → user behaviour → system feedback…*) engaging.

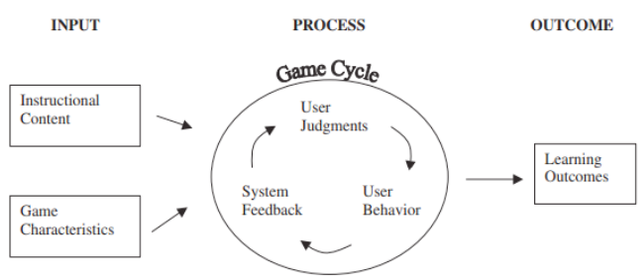

Figure 1: Input-Process-Outcome model (Garris et al. 2002)

A feature – *Build* - was conceptualized to make the activity interesting, and was hypothesized as an obvious way for a user to make sense of the ST. The idea was to let users “build” a section of an already known song, sample by sample, using his/her movements (as described in functional objective 1). Each sample would be the length of a musical measure (approx. two seconds), and these samples would be assigned to a variable (height level in cm) in a program. The ST (attached to the users lower back) would register the height (at the interval as the length of the measures/samples), and would play the assigned sample after each registration. This would make the user capable of building and listening to the song as originally recorded. The song of choice was “While My Guitar Gently Weeps” because it has a chord progression that changes for each measure, hypothesized to make the samples at each height level

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distinguishable from the others (see Figures 3 & 4 and Table 1 for final setup). To re-create the song, the user would have to:

a) Bend the knees in a sequence of downwards movements through four height levels (at the speed of one measure pr. height level)

b) Return to upright position in a motion of upwards movements through the four levels (same speed)

If sequence a) was completed new samples would momentarily replace the samples that was originally assigned to the different height levels. This would allow the music to progress through the next four measures (sequence b) if the user was capable hereof. To do b) the user had to straighten the legs at the pace as they were bent moments earlier, returning to starting position. Here a longer sample would be played to mark the finish, and allow the user to relax without doing any movements[1]. Functional purpose 2) was incorporated to the interaction by assigning the last sample in a) and the first in b) to the same height level (nearest to the floor).

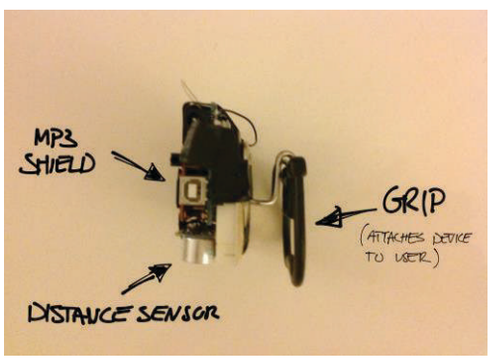

Figure 2: Side view of The SurfTrainer The grip attaches the device to the waistband of the user.

PRETEST AND CONCEPT CALIBRATION

The pretest showed potential in motivating *Build* usage, but it became apparent that a feedback mechanism was needed to guide users into the music zone when the ST was situated above or below the range of the four height-levels, where no samples were assigned. To distinguish the feedback from the existing samples, and as an attempt to incorporate a possible source of amusement for users as well as creating a spectator experience which might be "Suspenseful" (Reeves et al. 2005), samples from two funk artists where chosen to provide the feedback. These samples would sing "*Get down, get down*" (Kool And the Gang) and "*Get up off of that thing*" (James Brown) to users when the device registered heights above or below the four height levels assigned with samples from the song.

TESTING THE SURFTRAINER ON USERS

Three users tested the device as corrected after the pretest. All were familiar with the song. Two surfers (males, aged 29 and 52) and a non-surfer (female, 70) participated. The inclusion of the non-surfing user was motivated by a wish to explore the potential of using the device for training not necessarily related to surfing. Two of the users were recorded on video, which was analyzed after the tests. The third user was observed during test and notes were taken, which was also analyzed. The analysis was centered around identifying users ways of using / learning using the device and emotional reactions connected to usage. No timeframe was set on the tests, which were kept open until the user decided to stop due to tiredness and/or lost interest. This partly to get some understanding of the potential of use in terms of timelength of each "session". The tests lasted between 20 and 30 minutes in total, including usage, instructions and interviewing users during and after interaction with the device. If users got stuck during the interaction, for instance not being able to make sense of how to use the device on their own, hints were revealed related to the *Build* feature. The specific purpose of the test/analysis was to examine if:

i. Users attached any meaning to the system
ii. The *Build* feature was engaging
iii. The funk-samples provoked amusing/visible reactions

i. Did users attach their own meaning to the device?

The device was introduced as "*an idea for surf training*" to the surfers and as "*an idea for a device*" to the non-surfer. Besides that, initial instruction was minimal. The non-surfer did not attach any meaning to the device initially. She had a hard time distinguishing the different samples and how they related to her movements. In the words of Paul Dourish no *coupling* was made (Dourish, 2004), and she required some time to figure out how her movements related to the samples. She initially used the same strategy of moving both before and after being explained the *Build* feature. It was easier for the other users to distinguish the samples, couplings were made between movements and samples, and they where more explorative in their approach.

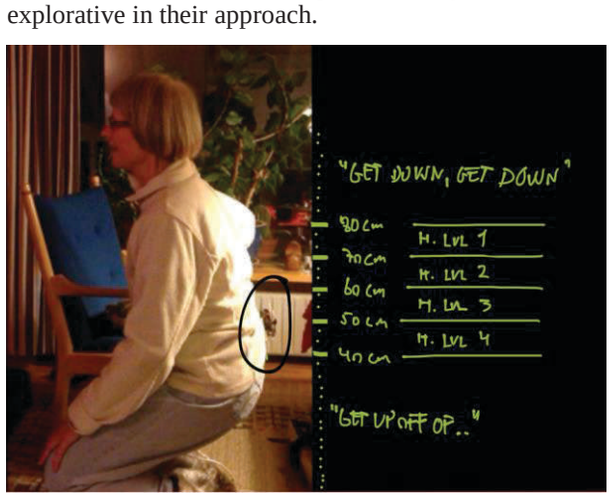

Figure 3: User (non-surfer) testing the SurfTrainer. The black circle marks the SurfTrainer device attached to user, located approx. 50cm above the floor corresponding to a movement from height level 3 to 4.

[1] If the progression of movement was not kept at a one height level pr. sample, the user would have to start over to build the music as recorded. If this happened during b) this meant that the original samples would be reassigned to all height levels.

Figure 4: Users (surfer) testing the SurfTrainer. The green circle marks the device.

Height levels registered by SurfTrainer	***Default samples (a)***	***Temporary samples (b)***	***End sample (played post completion of a and b)***
+90cm	"*Get down, get down*"	*Get down, get down*"	*Get down, get down*"
80-90cm	**Sec. 0-2**	**Sec. 14-16**	**Sec. 16 -**
70-80cm	**Sec. 2-4**	**Sec. 12-14**	Sec. 2-4
60-70cm	**Sec. 4-6**	**Sec. 10-12**	Sec. 4-6
50-60cm	**Sec. 6-8**	**Sec. 8-10**	Sec. 6-8
0 -50cm	"*Get up off of that thing*"	"*Get up off of that thing*"	"*Get up off of that thing*"

Table 1: Shows how the different samples/measures from a song corresponds to the different heights registered by the ST. The red arrow illustrates the downward sequential position of the ST (bending the knees) through the sections while playing seconds 0-8 of the song and unlocking temporary samples. The blue arrow illustrates the sequential upward movement (return to start) through the levels, which unlocks the final sample and marks the end of the exercise.

One user attached his own meaning to the ST, deciding that the goal was to reach the bottom of the movement without triggering the "*Get up off of that thing*" sample. Here coupling was made between movements and samples, not resulting in the desired direction of action.

ii. Was the Build feature engaging for the users?

After the *Build* feature was explained, all users tried to construct the song using their movements, though not without problems. This partly due to inconstancy in the height registrations, resulting in the "*Get down, get down*" sample at random frequency got played at levels with other samples assigned, making users express frustration (through facial expressions, move-ments, sighs and words). The inconsistency made it hard to construct the music, and one user "hit" the air in frustration when it happened while she was on her way to complete sequence b). An interesting observation

Figure 5: A user hitting the air.

was that all users had sudden experiences of "legburns", and that their fatigue was expressed in a surprising voice by all. Two of them immediately took a break after they verbalized their fatigue. One got dizzy, another began using a nearby chair as support when trying to build the music. An interpretation is that their entire focus had been on constructing the music, not being aware they were doing intense physical work, indicating the *Build* feature as an engaging decoy activity. The non-surfer asked if the ST was meant to motivate older people do training. She felt it was "*fun*" and motivating to try to "*catch*" the music. All users succeeded in moving in a way that would play the four first samples in the a) sequence and unlock the next four samples, and all got a boost of motivation as a result. One exclaimed "*I got it*", "*I got it*" in an enthusiastic voice, and re-approached the movements with more focus and determination. Two of the user would not respond to questions in the moments following the completion of a). Their facial expression would change and their glance became firmer. The third user would only answer in quick, short responses of "*yes*", "*no*", "*don't know*", seemingly irritated by the interruption. Successful recreation of the music was described as "*rewarding*", "*fun*", "*nice*", "*satisfying*" and as a "*success*". The *Build* feature was seen as a challenge to overcome, which motivated the users to keep trying to get feelings of reward and satisfaction, and try get more consistent[2]. The sound of the music enhanced these feelings. After completion of b) one user began playing air-guitar. He said he liked the song and was constantly looking forward to hear the music continue as recorded. He also felt that the rhythm /feeling of the music was nice for the exercise. To demonstrate he began humming the song, using his voice and exaggerated movements to show how the chords suited the downward motion. The music changed particularly when a) was completed and the b) samples were unlocked, which intensified the experience for one user, calling the change in the music *"uplifting"* and the feeling "*lovely*".

[2] One described himself as "*a rat in a maze*".

Figure 6: A user humming and gesturing (demonstrating how the music supports the movements) and playing airguitar.

iii. Did the funk-samples provoke reactions?

One user seemed to get a bit annoyed after hearing the samples when positioned high or low, and said things like "*easy, chill, I'm getting down*", and "*shut up, James Brown*" as respond to the samples. Another user was provoked by the "*Get up off of that thing*" sample. She heard it as "*Get up the fuck there*" and felt it was rude, saying things like "*who do you think you are? Be polite!*", as a respond to the ST. Interestingly, she was laughing while describing how the sample made her feel, especially when revealing that she "*would like to punch him*[3]". Seemingly inconsistent with her laughing reaction, she stated that she would rather have some positive feedback, for instance a neutral voice saying "*You can do it, try again*", instead of the "rude" funk-sample. The third user seemed indifferent about these samples. He did experience the guiding function they were thought to have, but they did not provoke any visible emotional reactions.

DISCUSSION

Returning to the purpose – creating a disguised learning activity that could be an end in itself and train specific movements, the experiment indicate that building of music using ones movements can direct users actions towards a desired pattern of movements in an emotionally engaging way. This is not limited to movements related to surfing but might also motivate general workout activities as suggested by the non-surfer. The sudden legburns, dizziness and need for breaks indicated that substantial amounts of energy was used, and that the experience had been engaging to a degree where users were focused on obtaining emotional rewards rather than paying attention to the state of their bodies. Also, all users reported sore legs on the day following the tests.

In additional experiments, a few issues should be considered. First of all, to validate the concept more knowledge about which music is suitable for this kind of activity is needed. The chosen song was a fine choice for starters. All users were eventually able to distinguish the samples from one another making coupling to the movements possible. Just as important, the feel of the music was by one user experienced as "uplifting" at the step in the interaction where the upwards movement was to be initiated. Discussing results with brain researcher Kjeld Fredens during a phone conversation (after the tests), he independently suggested to use music with an uplifting feel at this step to support users perform the upwards movements. Secondly, despite the song qualities, one of the users could not clearly distinguish the samples without aid, indicating more musical choices should be available to cater for different degrees of musicality in the users. Thirdly, the funksamples turned out to provoke annoyance, indifference, and an expressed negative attitude accompanied by laughter. A possible explanation is that this user may not have liked the sample, but liked that it triggered a strong feeling enabling her to feel herself clearly. Nonetheless, it was clear that the sample triggered a strong emotional response, but unclear if the sample helped to create an engaging experience for the user, which could be further explored. Finally, users did not know how to make sense of the ST until the *Build* feature was explained. The user that applied his own meaning was not very enthusiastic about this particular way of using the ST. This limits the use of the ST. In further experiments, it would be interesting to test the potential of designing an experience more suited for exploration, for instance by using clean notes or chords instead of well known songs, as well as making the *Build* easier to use.

ACKNOWLEDGMENTS

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BODY, MIND, PLAY - DESIGNING AN INTERACTIVE PLAYGROUND FOR MENTAL WELLBEING

MOA BERGSMARK
ROYAL INSTITUTE OF TECHNOLOGY, KTH
STOCKHOLM, SWEDEN
MOABE@KTH.SE

ANNA MOVIN
ROYAL INSTITUTE OF TECHNOLOGY, KTH
STOCKHOLM, SWEDEN
MOVIN@KTH.SE

ABSTRACT

The study explored the design space of digital and physical playgrounds, focusing on design for mental wellbeing. A concept of a playground with one expressive and one relaxing area was developed through an iterative design process of ideations, critique sessions and an interview with a child psychologist. The design initiated a discussion about whether or not letting feelings out could help children feeling better. Another outcome of this design is how it challenges the image of children as active and always in the mood for play, since it was designed for acknowledging a wider range of emotions.

INTRODUCTION

The playground is a place reserved for children and play. Exploring the possibilities of digital and physical playgrounds could be interesting from a responsible design perspective. On the playground, children are often expected to be active, social and in the mood for play. We believe that this view of children could be overly simplified and that complex feelings get neglected. In design it is generally common not to consider dark complex emotions (Dunne & Raby 2013).

In this project we wanted to open up the design space of designing for mental wellbeing. Initially the motivation was to design for children that have anxiety and/or feel stressed. Later in the design process we broadened the target group, thinking that everyone can feel bad sometimes. The ambition of the project is not to solve mental health related problems, but to raise the question of mental wellbeing and to create a design with this issue in focus.

In HCI research attention towards slow and sensual interaction with technology has started to appear (Sundström et al. 2014). We wanted to explore different levels of physical activity in the playground. In this study we came up with a concept of a playground, which has two contrasting areas: one calm and relaxing area and one area for physical, expressive play.

BACKGROUND

It is common that children feel stressed or have anxiety. Some of the common reasons for feeling stressed is the separation anxiety that children feel about the attachment to their parents, a difficulty in communicating and expressing yourself, bullying, pressure to perform, under stimulation or illness. (Plummer 2010)

STRESS AND DEVELOPMENT OF THE BRAIN

When people are stressed, physical reactions occur in the body. This is normal and good in many situations. However, if people stress too much, the physical reactions might have a negative impact, for example physical pain, increased levels of anxiety or loss of cognitive abilities. For children this could affect their wellbeing chronically and make it more difficult to manage emotions later in life. (Plummer 2010)

RESILIENCE CHANNELS AND TRAUMAS

Children need to find ways to regulate emotions and to build up resiliency. Berger and Lahad (2009) write about six channels of resilience for coping with traumas: Beliefs, Affect, Social Functioning, Imagination, Cognition and Physiology. The authors argue that the modern world often focuses on the cognition channel and that the other channels are often neglected. Physical and affective expressions could help the healing of traumas. The social channel could help a person to feel less lonely and helpless. The imagination channel can

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be strong as you can imagine alternative realities. Plummer (2010) also stresses the importance of imagination as a tool for creative thinking and healthy self-esteem.

NATURE AND MINDFULNESS

Berger and Lahad (2009) suggest that being in nature can be a way for people to get closer to their inner nature and to become connected to themselves. Plummer (2010) believe that regular relaxation exercises help children to feel better mentally and to relieve physical tension. In addition physical activities, preferably outdoors, are also a good way to relieve stress and increase wellbeing (Plummer 2010).

CULTURAL BOUNDARIES FOR EXPRESSING EMOTIONS

It is important to value children's emotions and let them know that it is ok to feel angry, sad or confused sometimes. Culture and people around affect the way individuals express their feelings (Plummer 2010). Dobson (2005) has touched upon this issue in her design of wearable body organs where she experiments with the boundaries of emotional expressions in public environments and where emotional release traditionally is not socially accepted. In relation to our study, her work is aimed more towards a discussion of body-machine boundaries, rather than to explore how to design for emotions.

AFFECTIVE LOOP

An affective loop means that the user first expresses an emotion and then gets a response. The response will then affect the user, a loop is created and the user gets more involved. Affective loops can be used when designing for emotional experiences in interactive technology. (Höök et al. 2008)

METHOD

In this study we have used a research through design approach with an iterative design process (Zimmerman et al. 2007) . Our methodology included an ideation process, where two different design ideas were sketched out. Each design was discussed during critique sessions where interaction design students and teachers were participating. Based on the discussions, two designs were selected. These were further explored by the construction of two low-fi full size prototypes. Furthermore, one semi-structured interview was conducted with a child psychologist. The child psychologist is newly graduated from university and currently works with children aged six to twelve at a county council psychiatry for children and young adults. The sketches and images of the full size prototypes were used as a medium for discussion. Finally a miniature model was constructed to showcase our design concept.

TWO DESIGN IDEAS

To explore the design space of playgrounds for children with anxiety and stress, we came up with two ideas.

Figure 1: *Listening seashell* sketch and full-size prototype.

LISTENING SEASHELL

One idea was inspired from the popular folk myth that you can hear the ocean when you hold a seashell to the ear. The Listening Seashell (see Figure 1) has the appearance of a big seashell. It contains a hidden speaker and a sound sensor. A child can talk with the seashell and when the child pauses for a moment, the sensor will trigger an ambient blip-blopping sound from the speakers, creating a reply. This design allows the child to use his/her imagination. The seashell is attached with a curly wire to a stone in a secluded part of the playground.

The full-size prototype made of paper and fabric, has small speakers inside it, connected to a media player device. We explored dripping sound samples and believe similar sounds could represent the soothing voice of the seashell.

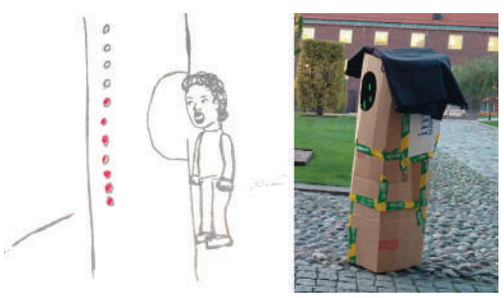

Figure 2. *Scream machine* sketch and full-size prototype

SREAM MACHINE

The scream machine is a standing tube with a hole where the child is meant to stick his/her head inside and scream. The inspiration came from the idea that screaming could be helpful for letting feelings out and from observations of children screaming while playing. The artifact has sound sensors and the child gets visual feedback inside the tube, mapped to the pitch and intensity of the scream. The visual feedback is constructed of abstract branching patterns in different colors.

In the early stage of the idea (see Figure 2) the visualization was limited to a level meter outside of the tube. After discussions around the sketch, a decision was made to put the feedback inside the tube, which enables the child to see the visualization while screaming and gives a more private experience. Another decision was to make the visualization abstract instead of quantitative to support deeper interpretations.

When making the full-size prototype we discussed the height of the scream machine, realizing that a fixed height would not be usable for everyone. Thus, the design should be adjustable for different heights and a small ladder could be added. Other discussions based on the prototype concerned the level of sound isolation and the size of the hole. These two aspects would be interesting to investigate further with target users.

INTERVIEW CHILD PSYCHOLOGIST

In the interview with the child psychologist we started to discuss the Scream Machine. His reaction was that the idea of letting out emotions to feel better is an old notion from Aristotle used by Freud. He explained that this notion has been largely questioned by contemporary psychology research. The critique is based on that by expressing anger, you can become more aggressive and learn that this is the way to handle unwanted situations. However, the psychologist said that there could be a difference between screaming to a person and screaming into an object. Thus, it might not be harmful to use the scream machine. He also mentioned that there is research showing that it is easier to handle and cope with stress if you express your feelings.

The psychologist believed that there is a challenge to create a trusting bond with the listening seashell. It is common that children confide to teddy bears, but they are often given to the children when they are very young and the bond to the teddy bear is special. He thought that the responses of the seashell potentially could help building that kind of bond.

According to the interviewee children in general find interactive objects with feedback fun to use. Feedback can reinforce behaviors and it could be used as a reward. The interview continued with the psychologist coming up with ideas of other concepts with interactive objects in playgrounds, touching upon four new themes:

- Design for collaboration where many children can be included, which could counteract bullying.
- Design for children that have phobias and fears. Feedback rewards could help confronting fears.
- Design for encouraging physical movement, as this can make children feel better and less stressed.
- Design for children that need to practice relaxation. This is good for children who are stressed.

The psychologist thought the designs for children to encourage physical movement and to help children to relax were the most universal, and could also benefit children without specific problems. He suggested that the playground could include different stations, where one could be activating the children and the other one make the children wind down. Something similar to this had been discussed previously in the project. With the interview the station concept was strengthened and we decided to go forward with this.

A PLAYGROUND CONCEPT

The resulting concept is a playground divided in two parts. One part is active and expressive, while the other one is focusing on relaxation and reflection. In our miniature model we included two concretizations for each part (see Figure 3). The concept could easily be expanded to include other ideas and the presented ones could be exchanged.

THE EXPRESSIVE PART

In the expressive part we included the *Scream Machine*, but also added a new idea, the *Lightning Springs*, which consists of three springs that encourage cooperation and physical activity. When a child jumps on a spring a light is triggered underneath the spring. If three children jump synchronized, all lights lit up with extra intensity. This way we use visual feedback to inspire cooperative behavior. For the scream machine we chose to include a wall behind it.

THE REALXING PART

The relaxing part includes the *Listening Seashell*, which did not change for the resulting concept, and a new idea called *Relaxing Net*. The *Relaxing Net* is a net where children can lay down and practice relaxation. The net has sensors that detects if a child is laying still. If the child lies there for a while, speakers hidden in the trees surrounding the net will play whale sounds. If the child keeps staying calm, an ambient light show will come to life and change appearance in a slow paced rhythm. Thus an affective loop is created(Höök et al. 2008).

Both the *Listening Seashell* and the *Relaxing Net* encourage inward looking activities. Therefore we thought the aspects from nature therapy could be useful to include in these designs.

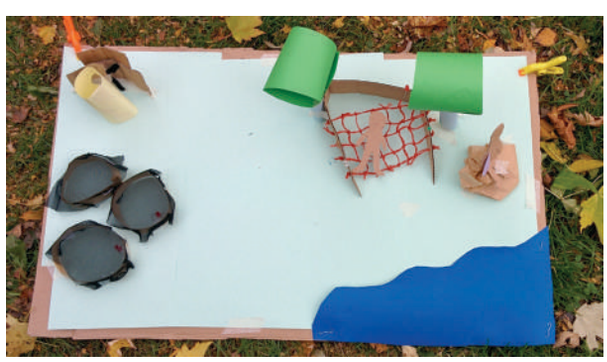

Figure 3. Miniature model of playground concept

THE CHANNELS AND THE CRITIQUE OF LETTING OUT EMOTIONS

We used the channel theory mentioned by Berger and Lahad (2009) for thinking about how the playground could help the children in different ways. We wanted to incorporate different channels in our design by letting the stations complement each other. The Lightning Springs concept is targeted to the physical channel, while the seashell, with its conversational aspects and the need for imagining what the seashell answers back,

could connect to the social channel and the imagination channel. When screaming into the scream machine, both the physical channel and the emotional channel could be used. Thus, we have used several different channels in our design, in an attempt to make children feeling better. However, we don't know how relevant these channels are for children that have not experienced trauma. Neither can we validate if this theory is relevant at all. The critique of the idea of letting out emotions might be contradicting the channel theory, since the channel theory with the affective channel is about expressing emotions.

FUTURE WORK

For further research it would be interesting to test the concepts and see if and how they impact the children's wellbeing. The affective loops (Höök et al. 2008) in the scream machine and in the net could be especially interesting to investigate. Do the children get angrier by screaming and getting the visual feedback in the scream machine and do they become calmer by the sound and visual feedback in the net?

Discursive designs on the topic of mental wellbeing for children could perhaps create a discussion concerning how children and people in general could deal with different emotions and how we can become more mindful.

CONCLUSION

The concept of a playground with one calm part and one active part explores the combination of different resilience channels as well as different ways to cope with stress. The actual benefits of using concepts based on the theory that you can let feelings out and afterwards become more harmonious could be questioned. Thereby it is unclear whether concepts similar to the *Scream Machine* would be effective. The benefits of relaxation and physical activity in general to reduce stress, were on the other hand supported both by the interviewed child psychologist and by the background theories. We hope our design could lead to an increased acceptance for children to show and deal with their emotions.

ACKNOWLEDGMENTS

We thank the ones that have given us feedback during our design process, including both classmates and teachers. We would also like to thank our interviewee.

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LANTIN: A HYBRID PLAYFUL PRODUCT

JAMES NORWOOD, MORTEN DAMGAARD, EAL
JANO@EAL.DK, MDAM@EAL.DK

ABSTRACT

Social play is a key part of a child's development and learning throughout early life. Children indeed work hard at play. However the traditional forms of physical and social play with toys find themselves in competition with the popularity and rich interaction offered by the more isolated experience of tablet based computers, which can be seen as detrimental to the benefits developed through social play. The ability to blend both the richness of interaction offered in the digital space with the tactile and social benefits of the physical space is rapidly emerging as a new genera for toys and gaming. In this paper we discuss the development of the Lantin play platform, a modular play set, which incorporates both, the benefits of physical play with the rich interactivity of digital play.

KEYWORDS

Interactive Audio, Play Environment, Social Play, Context Aware Physical Interfaces, Interactive Toys, Hybrid Playful Products, Tangible Interfaces

INTRODUCTION

Interacting in a physical social shared space of play has been noted as a contributing factor to creating a joyful interactive experience which humans are key to (Magerkurth, Engelke, Memisoglu 2004).

Play and interaction using a computer or tablet is however still perceived as an isolated activity as stated by Zagal, Nussbaum, Rosas in (Magerkurth, Engelke, Memisoglu 2004). Even with the richness and depth of interaction offered in digital games and apps for children, the focus is still on individual play and conventional interaction through touch interfaces, and or keyboards, joypads. Missing is the richness of human-to-human interactions, which evolve during the play process such as mirroring, eye contact, social presence (Fails, Druin, Guha, Chipman, Simms, Churaman 2005). In addition to the benefits of social play the affordance that material play offers to physical, tactile and spatial interaction (Heikki, Kultima, Mäyrä, 2013) is something, which is limited with a purely digital experience. The physicality of play products (such as toys) has an impact on how children can personalise and identify within the play experience (Gulden 2014). Considering the benefits of both physical and digital space in play we have developed Lantin, a Hybrid Playful Product (Heikki, Kultima, Mäyrä, 2013).

Figure 1: Object designs for Lantin. Simple iconic shapes made from solid wood with NFC chips attached to the bottom covered by felt pads. The weight, scale and solidity make for enjoyable tactile interactive experience.

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ABOUT LANTIN

The Lantin system works as modular road tile enabling children to use toy cars and trains to play as they would with a traditional play mat. Supplied with the base unit (tile) are a number of smart building objects such as houses, factories, offices that can be placed on the tile to build up the play environment (Figure 1).

When an object is placed on the Lantin tile, the system comes to life by producing an environment sound relating to the object or object combinations. A short video of system can be viewed at the following link http://bit.ly/lantinplay. Depending on the combinations of objects placed on the tile the soundscape will change contextually, thus allowing children to create their own environment for play. The system allows for this environment to be altered at any point in the play process creating dynamic play sessions. The tile therefor becomes an environment for play and not the sole focus of play (Figure 2). Children are able to bring their imagination into the environment along with interaction from other toys thus enabling a more personalised play experience (Gulden 2014). Audio as a trigger for conveying complex interactivity has also be acknowledged by (Fontijn, Mendels 2005) in their work on StoryFarm.

Unlike other Hybrid Playful Products such as Skylanders, Infinity and Amiibo, Lantin attempts to integrate and weave itself into play and not act as only a trigger or input device to enable play.

Figure 2: Play test between two boys aged 3 and 6 years. Having set up an environment they were happy with, play continued with toy cars on and around the tile.

RELATED WORK

When conducting a review of similar products we can point to the work of Augmented Knights' Castle (AKC), Candyland Adenture Platform (CAP), (Magerkurth, Engelke, Memisoglu, 2004), StoryFarm (SF) (Fontij, Mendels 2005), along with many other commercially available products such as the Activision Skylanders, Disney Infinity, Nintendo Amiibo, Sifteo Cubes (Merrill, Sun, Kalanithi 2012), Ravensburger TipToi and Hasbro Furby Boom (Figure 3). All of these products could be defined as Hybrid Playful Products (Heikki, Kultima, Mäyrä, 2013).

With the commercially available products interaction tends to be limited to either objects being used as control triggers for screen based game play (Skylanders, Infinity, Amiibo, Sifteo) or a singular focused interaction (Furby, TipToi). Lantin shares a similar technological configuration to that of (CAP), (AKC), (SF) an important differentiation through is Lantin's focus on reactive play (Fontij, Mendels 2005). Where (CAP), (AKC) and (SF) focus on telling of stories through the interaction, Lantin's interaction is designed to not directly guide or lead the users but enable them the ability to explore, setup and play scenarios which are able to evolve under the systems own intelligence.

Figure 3: Related Hybrid Playful Products. Top left: Disney Infinity Top Right: Furby Boom. Bottom left: Augmented Knights' Castle. Bottom right: TipToi

INTERACTION WITH LANTIN

There is a moment of magic (Fontijn W, Mendels P 2005) once a child places a smart object on the Lantin tile. It was observed in tests with children between ages 3 to 8 the look of surprise and excitement this initial interaction created. Although it was hard for the children to articulate why they had reacted in this manner we can speculate that the material nature of Lantin lends itself to this response. Indeed as is noted by (Hepworth, 2007) a magical experience can be "questioning the ordinary, surprising experiences". If we consider the unit, on first inspection appears dumb, the base tile and smart objects are simply designed and made from. There are no clues as to any hidden complexity or promise of audio interaction with the system. A benefit to this unexpected and initially unfamiliar reaction/response to the system is regarded by research as a way to help promote engagement and

attention with toys and play products (Hiske, Lampe, Yuill, Price, Langheinrich 2009). The responsiveness of the system was also an important factor in creating a successful interaction and engagement with the users. As has been noted children are more conditioned to expect precise feedback due to their familiarity with technology (Montemayor J, Druin A, Chipman G, Farber A, Guha M 2004). The tactile nature of Lantin interfaces however differs from traditional desktop GUI interfaces not only by allowing for direct manipulation and interaction but also opening up for multiple users. This has an implicit effect on how users are able to abstract, learn and understand the rules of the system (Itoh, Akinobu, Ichida, Watanabe, Kitamura, Kishino 2004).

THE LANTIN INTERFACE

Lantin, at present, is reliant on users placing smart objects at specified points on a smart tile. Once placed the system checks the name of the object against a hardcoded database to determine what sounds to play.

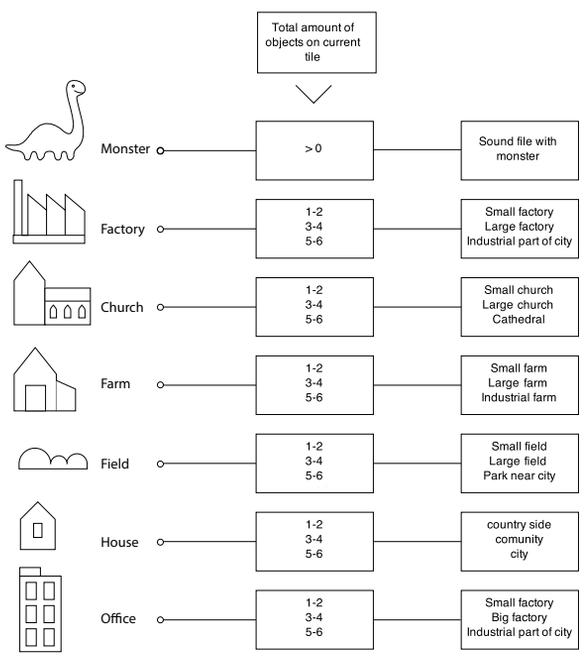

Figure 4: Example of the interaction layer for combining objects onto the Lantin tile. The system uses a hardcoded database to lookup audio files to play depending on combinations of smart objects.

The smart tiles are able to determine items through information that has been encoded onto NFC (Near Field Communication) chips placed on the bottom of each smart object. In the smart object library there currently exist 6 houses, 6 offices, 1 factory, 1 church, 2 fields, 1 clock tower, 1 farm building and 1 monster. At present, based on certain combination, objects such as the church have an overriding effect on other objects placed on the tile. An example might be if a church were placed with no other object, the sounds would resemble that of a village church. By placing a number of houses and offices on a tile the church sound would change to that of a cathedral (Figure 4). The audioscape therefore contextually changes to reflect the state of the environment. It is this contextual association which user begin to discover upon interaction with the system.

TECHNOLOGICAL DESIGN

The Lantin prototype runs off six Arduino Uno microprocessor each connected to an NFC/RFID (Near Field Communication, Radio Frequency Identification) enabled card readers. Five of the Arduino units act as collecting points for data (from their attached card readers) sending this to the sixth controller unit which process the data and assigns audio files to play, depending on the configuration of smart objects places on the tile. The controller microprocessor also features an attached audio shield unit, which is connected to an active speaker. All units are powered by a single battery pack. It should be noted that this setup could also be achieved using a single Arduino unit supporting more inputs for multiple NFC/RFID readers. However we have chosen to test this distributed system to assess the possibilities for future connected tiles.

DESIGN OF LANTIN

Lantin is primarily aimed as a toy for children; therefore the importance for involving them in this phase of the project was paramount. As noted by Druin in (Jensen, Skov 2005) the difference in cognitive and physical capabilities to that of adults can have a marked impact on design. Additional detailing was also added to the final designs, enabling users (primarily children) to identify and therefore associate with the objects in a clearer sense. It has been shown that children are able to identify and imitate through imaginative play based on familiarity and resemblance of an objects physical appearance (Hinske, Langheinrich, Lampe 2008). The material used in the design was an important factor in creating surprise and a sense of juxtaposition with the interaction. By using wood and obscuring all references to the digital context it was hoped we could create a far richer experience for those who use Lantin. There is a simple timeless quality to wooden toys (Lange 2014), which we play upon in our design. The work also took into consideration many of the guidelines for designing Augmented Toy Environments as outlined in (Hinske, Langheinrich, Lampe 2008).

FUTURE DEVELOPMENTS

The current Lantin prototype supports only one active tile, however the planed development of this product will support a network on multiple road tiles and platforms (similar to the way in which Brio train tracks can be connected to create an expansive play environment). With each tile being able to communicate with the adjoining tile the interaction between objects placed can become more engaging and interactive. When you consider the way in which Will Wrights seminal game Sim City was able to model a level of emergence behaviour (Johnson 2001) between city blocks, Lantin programming hopes to achieve the same results. Consider placing multiple factories on one tile and the effect that this may have on a more residential

populated adjoining tile. The soundscape would evolve based on not only the combination of objects placed but also based on their proximity and effect on other tiles. By adding this additional level of richness to the software design it is our hope to create a sustained level of engagement and thus create more magical moments in the play experience.

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THE HI-TECH/LO-TECH PLAYGROUND: MATERIALIZING ENERGY THROUGH PLAY

TOMMY FELDT

MSC STUDENT

MEDIA TECHNOLOGY AND INTERACTION DESIGN, ROYAL INSTITUTE OF TECHNOLOGY

TFELDT@KTH.SE

YELENA KOSELNIK

MSC STUDENT

MEDIA TECHNOLOGY AND INTERACTION DESIGN, ROYAL INSTITUTE OF TECHNOLOGY

KOSELNIK@KTH.SE

ABSTRACT

The hi-tech/lo-tech playground concept is a re-design of a traditional playground that allows children to explore and learn about different energy-related activities such as the collection, keeping, sharing and activation of energy, through physical play and collaboration. Divided into two halves, the playground design contains one area where children generate electricity using their bodies, and one area where they use that electricity to power interactive games. They can however only play as long as they have enough energy – when it runs out, the interactive side goes to *shutdown mode*, indicating to the children with lights and sounds that more energy needs to be collected. We discuss our design choices, the balance between realism and user experience, the possibilities of learning through play and the overall relevance of our design within the broader sustainable interaction design field.

INTRODUCTION

The question of sustainability, i.e. how we can live our lives in a way that does not deplete the resources of the world or threaten the ability of future generations to do the same, is a question of vital importance for the world as a whole (Brundtland 1989). It is also increasingly becoming an area of focus for interaction design researchers and practitioners, as attempts are made to leverage ICT to help solve global problems such as pollution, energy waste or biodegradation. Particular focus has been placed on the issue of energy and electricity use. As pointed out by Pierce and Paulos (2010), energy tends to be invisible to us and therefore taken for granted (at least in the developed world). It is simply there when needed, and only noticed when there is a breakdown or a shortage. Many sustainable interaction design researchers have therefore focused on designing artifacts that make energy consumption more visible to the user. This is so that the user as an individual can become aware of, and correct, wasteful usage patterns that were previously hidden (Pierce and Paulos 2012).

A second and parallel research trend, exemplified by Pierce and Paulos (2010) and Strengers (2014), instead tries to change the way that energy is discussed, by focusing on how it is related to human activity in broader terms. Pierce and Paulos note that humans collect, keep, share and activate energy, and suggest that a key goal of sustainable interaction design should be to make energy more material: we need to stop taking energy for granted and instead engage with it and all its different complexities directly.

Inspired by the second research trend, we have developed an interaction design concept that lets children engage physically with different energy-related activities in a playground setting. The purpose is to explore whether play can be a way to familiarize children with energy concepts at an early age. In this

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paper, we will detail our design and discuss relevant issues when designing for children with regards to energy, such as the balance between realism and user experience and the possibilities of learning through play.

RELATED WORK

A recent review of sustainable interaction design articles revealed that 70 % of recent published articles were aimed towards the design of novel artifacts for energy consumption feedback, or ECF (Pierce and Paulos 2012). This tendency to focus on changing consumption behaviors through increased awareness has been criticized by both Strengers (2014) and Pierce and Paulos (2010) for failing to take into account social aspects such as why we use and see energy the way we do. Pierce and Paulos argue that sustainable interaction design researchers instead need to "drastically rethink" how we relate to and live with energy. They then propose a critical alternative to our present "background relationship" where energy is rarely noticed for its own sake but only for the experiences it facilitates for us. In their alternative view, energy is given materiality and brought to the foreground as something that can be manipulated and engaged with by designers and users. A few of the design possibilities that they discuss include designing for emotional attachment between energy and its user, or making energy more tangible, less omnipresent and less easily accessible (Pierce and Paulos 2010).

One related research project involving children and energy is *EnergyBugs*, a wearable artifact that generates electricity through a child's own kinetic energy, and lets them use the electricity they have generated to power a LED light (Ryokai et al. 2014). One of many interesting findings from the project was that the children felt that their electricity "held a special significance" because they had generated it themselves, and this regardless of the manner of generation. The generation activity also appeared to be socially engaging, with the children comparing their performance with each other. Overall, the results showed that human-powered micro-generation had a positive effect on the children's engagement and curiosity and that the hands-on experience was helpful in making the concept of energy seem less abstract.

PROCESS AND RESULTS

Our project was part of an advanced course in interaction design and spanned over a period of 4 weeks at half-pace. The process began with an ideation session using *parallel design methodology* (Faber and Nielsen 1996) where we tried to come up with and develop at least three ideas each, before discussing them together. The concept was then defined, prototyped and re-evaluated iteratively through weekly critique sessions with teachers and classmates. During these critique sessions, the concept evolved and was gradually fleshed out with more details to describe what happens when the child presses different buttons, when the playground runs out of energy and how the state of the playground should be visualized. The design was also influenced by advice we received during individual feedback sessions with our supervisor, Anders Lundström, a PhD student and expert in energy and interaction design. We also interviewed Hanna Hasselqvist, another PhD student in the same field at the institution, for her input.

When consulting with these two experts, it was pointed out that we would not be able to make the playground fully "energy sustainable" in any case, due to the energy that would already have been invested in its production and development. Also, the low amount of energy collected by the children would severely limit the types of interactions that would be possible to design for. This turned out to be a major change in our design, and will be discussed later in the paper.

At the end of the project, a model of the playground (see figure 1) was shown at a public exhibition at the KTH Library. A majority of the visitors who talked to us at the exhibition were positive to the playground and the idea of using play to familiarize children with energy.

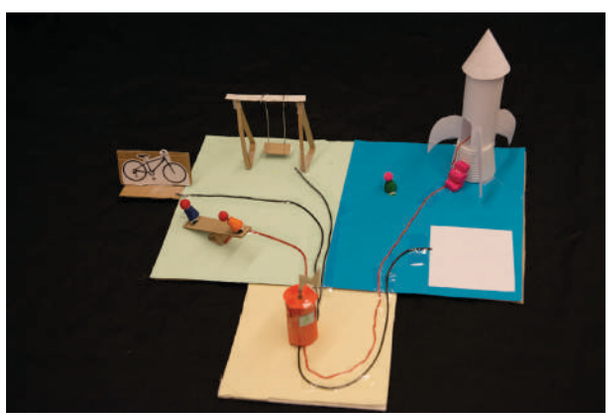

Figure 1: A model showing the lo-tech (left) and hi-tech (right) halves of the playground.

DESIGN

The main goal of the design is to allow children to explore and learn about electricity generation and consumption and its connection to technology through the act of physical play. The concept is a re-design of a traditional playground, divided into two halves: one *lo-tech* and one *hi-tech*. The two halves are connected through power cords running on the ground to a central energy storage unit - the *power pylon*.

THE LOW-TECH HALF

On the lo-tech half of the playground, the children use their own bodies to generate electricity by swinging, pedaling on a stationary bicycle or using a seesaw. All the different electricity-generating actions are designed to be natural and familiar from traditional playgrounds. Some, like the seesaw, require collaboration between multiple participants to do efficiently. The thought was that when having to coordinate their actions with each other, the children might become more involved in the

energy generation process. The swings, the stationary bicycle and the seesaw are connected separately to the power pylon, each with their own visible cord on the ground. The design of this half is purposely low-tech and uses mainly natural materials such as wood, except for the energy harvesting technology.

THE POWER PYLON

The power pylon, placed where it is visible from the entire playground, shows how much energy the children on the lo-tech half have generated, and also stores it. It also displays how long the energy will last at present consumption levels, with a countdown in minutes/seconds. There are big buttons on the power pylon where the children can activate and deactivate the electricity-dependent installations on the hi-tech side. The children thus have to make an active choice to power on and off the playground installations, and they have to do it by hand, in a location that is separate from where the energy will be used. Our hope is that this disconnect will help make the concepts of energy storage and transportation more tangible for the children. Similar to the *Power-Aware Cord* (Gustafsson and Gyllenswärd 2005), the power cords running on the ground light up and give a pulse when active, visualizing the path of the electricity, from where it is generated, via the pylon to where it is presently being used.

THE HIGH-TECH HALF

The other half of the playground is designed in a space-age theme. There are two installations here: a large rocket and a message board. Inside the rocket, there are a number of interactive games for smaller children, with blinking lights, sounds and simple screens. The message board, a concept developed by two classmates earlier during the course, is a big canvas on the ground, where children can draw with their bodies using infrared technology. This area is dependent on energy transported from the lo-tech half; once the energy stored in the pylon runs out, the message board and the interactive installations within the rocket will go to *shut down mode*. The shutdown mode stops play and instead gives auditory and visual feedback showing the children that more energy is necessary for this half to work. For instance, the rocket may play a sound effect indicating "failure to launch" when trying to play with the installation. The power cord will also display a light pulse going to the lo-tech half, to show the children how and where to collect more energy. The shutdown mode is purposely abrupt, as it stops all interactive games immediately when it activates. It forces the children to make a decision whether to collect more energy, or to simply play with something that does not require electricity. We intended this to

DISCUSSION

During the course of the project we found a number of interesting design implications that warrant further discussion. First of all is the question of realism versus user experience. At first, we planned to have the hi-tech half only use the electricity that is generated by the children themselves, as this would be the most "sustainable" option. However, after consulting with the two domain experts, a decision was made to add additional electricity to the playground, hidden from the children. With auxiliary electricity, we can design for a more inviting user experience and also give relevant visual and auditory feedback even after the collected energy has run out, allowing for the shutdown mode. Using only the electricity created by the children would limit the time that they would be able to spend in the hi-tech half, perhaps to such a degree that the playground would lose its appeal, making the design useless and therefore wasteful.

A discussion can be raised here regarding the honesty of this approach since, strictly speaking, the children would not be manipulating their own electricity. In any case, there is definitely room for more research on how to make satisfactory design trade-offs between realism, user experience and learning when designing for children in the energy domain.

The second discussion point is the concept's value as an artifact for teaching. Will children gain a better understanding of energy concepts such as the collection, sharing, keeping and activation of energy, from playing on this playground? Previous work with children and energy, such as Johansson et al. (2011) and Ryokai et al. (2014), has indeed indicated that hands-on experience and micro-generation has a positive impact on engagement and curiosity. When the children had to work for their energy, they cared more about how it is used, and asked more questions. However, without a proper evaluation of a functional prototype, we cannot tell for sure if this finding would carry over to our design as well. It is quite possible that the open-ended nature of playground play would lead to different learning outcomes compared to the classroom-based activities examined in previous research.

The third and perhaps most important question is whether or not this concept would make any difference at all in the bigger picture. We are aware of the enormity of the sustainability problem and that it would be absurd to think it is possible to "solve" the problem through design. However, if we believe Pierce and Paulos (2010) that a culture shift is necessary regarding humans' relationship to energy, there might be a value in itself to have children engage with and familiarize themselves with energy concepts from an early age. By adding to the body of interaction design research that attempts to materialize energy, we hope that this concept has at least made a small contribution to that difficult culture shift.

LIMITATIONS AND FUTURE WORK

The short length of the project (four weeks part-time) did not allow for the creation of working prototypes or any substantial user involvement in the design process.

Therefore, an idea for future work is to build a testable version of the playground and evaluate it with children in a realistic playground setting. Another idea for future work that does not require building a functional prototype is to conduct a more formal expert evaluation together with professionals working with energy, sustainability and children's outdoor play. Through their experience, they would be able to give valuable comments on the validity of the concept.

CONCLUSIONS

In this article, we have outlined a design concept for a playground where children can engage and play with energy-related concepts such as the collection, sharing, keeping and activation of energy. Though not meant to be sustainable on its own, our design is intended to aid energy awareness in children from an early age through the materialization of electricity and energy. We have discussed several different implications of the design, among them the balance between realism and user experience when it comes to energy-related play, and discussed possible future work.

ACKNOWLEDGEMENTS

First of all, we would like to thank our supervisor Anders Lundström for all his invaluable feedback and inspiration. His enthusiasm and support was key to us moving the design forward. We would also like to thank Hanna Hasselqvist and Vincent Lewandowski for their input.

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BUTTER IT! - A COLLOCATED GAME

IDA HÄGGLUND, STEVEN TENG, JAMES WELLENCE

CHALMERS UNIVERSITY OF TECHNOLOGY

IDAHA@STUDENT.CHALMERS.SE, STEVENT@STUDENT.CHALMERS.SE,
WELLENCE@STUDENT.CHALMERS.SE

ABSTRACT

Most apps for mobile devices are designed to be used in isolation. Even apps for communication, like chat or social networks, still isolate users from others who are physically present in the same room. We designed and programmed *Butter It!*, a multiplayer game for iOS that encourages people to interact with collocated individuals via their mobile phones. Players race to butter the most pieces of toast on their phones, while an iPad serves as the virtual stick of butter that players scoop. Players enjoyed the competition and would interact with each other in ways we had not imagined, like physically pushing each other to impede each other's progress, and future versions of this app would further encourage this type of local interaction.

INTRODUCTION

In Lundgren and Torgersson´s paper, Bursting the Mobile Bubble, the authors describe a common situation where multiple people in the same room are socially isolated because everyone's attention is focused on their own mobile phones (2013). They argue for the further development of mobile apps that promote interaction between these collocated individuals. One of the apps they showcase in their paper is a mobile adaptation of the popular board game Settlers of Catan. In this version, players use a combination of a shared tablet and smart phones to respectively display public and private information. This creates an interesting dynamic where most of the game is publicly displayed, but some key components, like players' cards, are hidden from other players.

This is an interesting proposal, to take private devices that normally demand our full attention and turn them into a catalyst for social interaction. With Lundgren and Torgersson's idea in mind, we developed a game titled *Butter It!*, a competitive game for 2-4 players. By using a tablet as a symbolic tub of butter and individual phones as pieces of toast, *Butter It!* creates a collocated experience where players compete to butter the most pieces of toast to be declared the butter champion.

RELATED WORK

Games are an ideal environment to experiment with collocated interactions because they invite people to break social norms while interacting with each other. Many mobile games already exist that force people to interact with each other in the same physical space.

SPACETEAM

Spaceteam is a multiplayer, cooperative game designed for iOS and Android where players guide their spaceship through the hazards of interstellar travel. Each player is given a random array of knobs, buttons, and sliders with instructions of what to do with these controls. The challenge is that the control a player is instructed to change may be on another player's phone, meaning players have to simultaneously tell (or more often, yell) the instructions to each other.

Spaceteam encourages collocated interaction with mobile phones in a nearly ideal way. It makes for an excellent party or pub game and it served as inspiration for us to create another game that could be used in a similar setting.

MARBLE MIXER

Marble Mixer is a digital version of an ordinary marble game. It is a collocated game because up till four players must share one iPad to play. Players shoot marbles from their corner to feed a marble monster in the center, but players may choose to aim at other players in order to block their progress. It served as some inspiration in showcasing how a single device can invite several players to interact with each other.

CONCEPT

Butter It! is a simple multiplayer app that promotes collocated interaction by having players split actions on a shared iPad and their own individual iPhones. Players must physically sit next to each other in order to play the game.

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As the name suggests, the goal of the game is to butter as many pieces of toast within the time limit. Players collect butter by swiping a butter stick on an iPad, then spread this collected butter on a piece of toast located on their own phone. Speed and precision are important; the former due to the time constraints, the latter because the game rewards evenly spreading butter over the entire piece of toast instead of rebuttering the same spot multiple times. To further reinforce the speed and precision pressures, players are penalized a few seconds for trying to submit an incompletely buttered piece of toast for scoring.

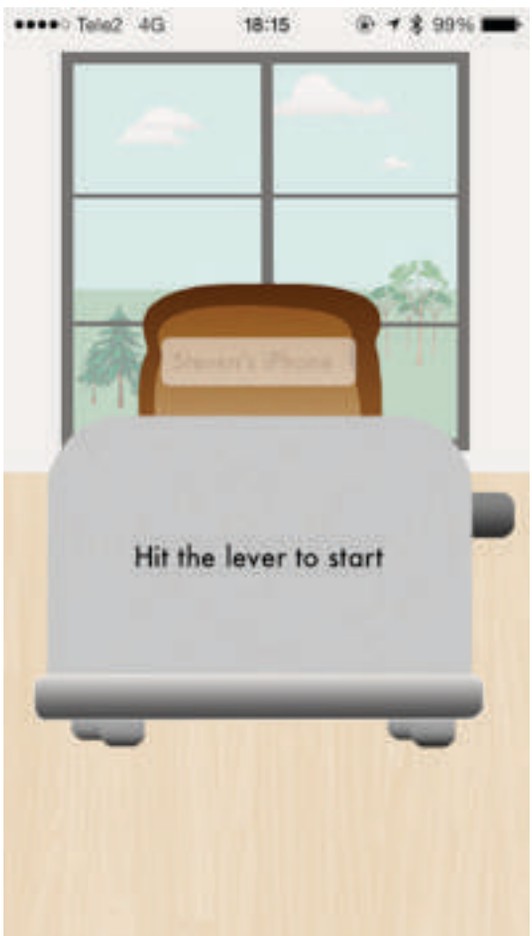

Figure 1: Start screen on an iPhone.

Drawing some inspiration from the iOS guidelines, we created a consistent look for the entire game by adopting a visual metaphor of a 1960's kitchen. The graphics, font, and overall presentation take their design cues from this metaphor. Players start the game on their phones by pressing a lever on an old fashioned toaster; butter is presented as butter on a plate (rather than the more modern tubs of whipped butter or margarine); even the font choice was picked to be representative from this time period. There is only one break in the consistency, which is the player select screen on the iPad, because we borrowed a standard screen from Apple's Multipeer Connectivity framework due to time constraints (iOS Human Interface Guidelines, 2014).

Figure 2: Gameplay screenshot of a player's iPhone.

DESIGN METHOD

IDEA GENERATION

From the start, we wanted to create a simple, yet fun, game. After a slow start brainstorming ideas, inspiration struck while taking a lunch break. One of us was buttering a piece of bread and we thought that this could be the basis of a good game. While buttering bread is a solitary task, breakfast is often a social event because of the shared setting. By forcing people to draw butter from a common pot, we could recreate a social breakfast setting in our game.

PROTOTYPING

We developed the original prototype for the game with just pencil and paper. With these humble beginnings, we were able to plan out the game's graphics, layout, and gameplay that we would eventually implement in the final mobile app. Planning out the visual aesthetic and gameplay before any programming guided us throughout the entire process and made development much easier.

GAMEPLAY DESIGN

Our main goal with this game was to encourage collocated interaction in a fun way. There are three main components in Hunicke's MDA model for analyzing

gameplay, i.e. mechanics, dynamics, and aesthetics (Hunicke et al. 2004). From the start, we knew we wanted an aesthetic of a silly game that would feel natural to play at a party or a bar setting. The dynamics would involve forcing collocated interaction and mimicking the actual process of scooping and spreading butter. Thus, we designed our gameplay mechanics to develop these specific dynamics and aesthetics.

Figure 3: iPad screenshot during the game.

The most important gameplay mechanic for promoting collocated interaction is the iPad serving as a common source of butter of all players. This also led to a dynamic of sabotage, as players monitored each other's progress and tried to impede other players by physically pushing them. In order to mimic the process of scooping and spreading butter, we used simple swipe and touch gestures on the iPad and iPhone. Scooping butter in the game is simply swiping on the butter on the iPad; spreading butter is drawing butter lines on the toast with one's finger. We felt it was essential that players use the same finger for scooping and spreading butter in order to recreate the feeling using a butter knife. If players were to scoop butter with one hand and spread the butter with the other hand, this would break the game metaphor and make the gameplay too easy. To prevent players breaking the game this way, we force players to keep one hand occupied at all times by continuously holding down a button on their iPhone. Letting go of this button before the toast is completely buttered results in a penalty for the player, where they have to wait a few seconds before being allowed to continue.

EVALUATION

The game's mechanics were refined through an iterative design process, so we conducted frequent internal playtests throughout the development of the game. From the lessons learned in these tests, we would conduct scrum rounds to plan out our strategies for the day's design goals. Then we would playtest again to see if our work matched our vision for the goals of the game. During these iterative stages, the internal playtest sessions forced us to rethink and redesign several gameplay mechanics and dynamics. Internal tests were important for balancing some basic game mechanics, such as how much butter would fit on a player's virtual butter knife.

Once the game reached a presentable level of polish, we conducted two rounds of external playtests to gauge the collocated interaction and understanding of our game. Since the game mechanics mirrors real life interactions with bread and butter, we found that people quickly figured out mechanics, though the "hold here" button caused the most problems. Players also often complained about a lack of feedback; they did not always know what was required of them from the game. We resolved some of these issues by increasing font size and adding a few more messages that instruct the player. Playtesters also wanted more interaction between the players, an idea we elaborate on in the discussion sectin. When new players faced experienced players, we found that the more experienced players had an advantage of understanding the mechanics, interface, and the rules of the game, so we later added a brief tutorial image that explains the basics of the game.

DISCUSSION

Designing and implementing a mobile app in 5 weeks was a challenging task, especially since this was our first time developing for iOS. The combined pressure of having a standalone app, working in a tight deadline, and working in a new environment meant we were unable to program some game features. Because of our design goals to get people in the same physical space to interact with each other, we would have liked to added additional gameplay elements that force people to speak with each other, hinder other players' progress, or even encourage them to physically interact (e.g. like when we found players pushing each other in the playtest).

However, we did achieve our core goal of encouraging collocated interaction through game of buttering virtual toast. Future versions of this game would capitalize on this success and add additional game mechanics that increase interactions between players.

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BODILY INTERACTION AS A SHARED APPROACH TO IMMERSION AND CHARACTER IDENTIFICATION IN VIDEO GAMES

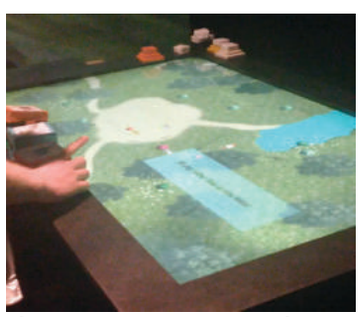
MARIE-LOUISE CHRISTENSEN
AARHUS UNIVERSITY
MALOU86@GMAIL.COM

ABSTRACT

In the pursuit of creating a meaningful play experience, I have explored the concepts of immersion and character identification. The exploration is based on the video game prototype *SpyFly*, which is a multiplayer cooperation game set out on two different and separated platforms: an interactive table and a 3D cinema. The purpose of having two different systems is to substantiate the two, also very different, media character perspectives. The systems are thus designed to fit the individual character perspectives, in the attempt to create an immersive game, in which players can identify with their' characters. Both systems have sought to deepen the relationship between the virtual characters and the players' bodies by moving beyond the traditional setup of a vertical screen, mouse and keyboard. Through my reflection of concept I will argue that an embodiment of technology is an effective approach, as it potentially enables both immersive experiences and character identification.

INTRODUCTION

In the design team, I was a part of, we initially started a material exploration of communicating technologies, which eventually led to an exploration into how communication between technologies can shape social interaction and shared play experiences. This turned into a vision wanting to create a cooperative video game that moved beyond traditional multiplayer games, where players share interfaces of similar physical shape and graphical content. The result, our prototype *SpyFly*, is a game aimed at children. It must be played by a minimum of two players, allocated in two separate locations. The two players represent the little evil genius Hector and his bionic fly. Hector wishes to destroy a birthday party, which he was not invited to and therefore sends his fly to discover the one thing that would destroy the party. The aim of the game is for player A (Hector) to guide player B (Spyfly) through a park to find this birthday-destroying factor (the clues). In location A the player (Hector) interacts through an interactive table using fiducials. At location B the player (SpyFly) interacts with a remote controller facing a 3D cinema. The two systems are linked through a wireless Internet connection and players are installed with a headset that allows them to communicate.



Above: Picture 1: Location A and an example of a fiducial.
Below: Picture 2: Location B (Player B's perspective).

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Player A has a top view of the park (see pic.1) and player B has a first person perspective inside the park (see pic. 2). When Player B discovers a clue and flies into it, the content of the clue pops up at the table. When a number of clues have popped up, Player A has to choose between the different solutions available to the player. When Player A places one of the fiducials, each representing a solution, on the table, the solution appears at Location B for Player B to activate. The two different interaction systems allows for each player to experience the mission from distinct angles, which support the two different types of tasks. The purpose is to give players an embodied experience through diverse interaction architectures, which is intended to deepen the relationship between each player and their character.

THEORY AND METHOD

Our focus has been investigating the ways in which we can strengthen immersion and character identification mechanisms because they are considered to be mechanisms of video game enjoyment (Hefner, Klimmt & Vorderer 2007, Christou 2013). Character identification as a term is self-explanatory and immersion can be described as the psychological experience of being submersed in the game world, whereby the player ignores shortcomings of the media or aspects that indicate the improbability of the virtual world (Christou 2013). When discussing character identification it has been questioned whether video games enable identification or whether players simply develop empathic emotions towards their characters (Hefner, Klimmt & Vorderer 2007). Advocating for identification it is said that it is the mere interactivity of games, which makes the player an integral part of the mediated world thus allowing for real identification to occur (Vorderer 2000). All video games are more or less interactive, however advanced game technology is argued to facilitate more intensive forms of identification by creating a more convincing spatial and social environment, within which the player can perform the actions attached to his/her role (Hefner, Klimmt & Vorderer 2007). Technological features likewise have a huge impact on immersion. Immersion and character identification thus share common influential mechanisms, which is why I explore the possibility of a shared approach. Immersion may however explain something beyond identification because it relates to the entire game world experience and not only the player/character relationship. *Presence* for instance is a variant of the immersion term that is used to explain the physical experience of being in one environment while physically being in another (Witmer & Singer 1998). Immersive qualities and identification are however not intrinsic values of a game (Christou 2013), as the experience depend highly on the player playing. According to Christou (2013) designers can therefore measure the games' appeal instead, in an attempt to create immersive experiences. Appeal can amongst others be measured on attributes like hedonic stimulation and identification. Hedonic stimulation includes attributes of personal development and hedonic identification addresses the expression of the self through objects. The more a game enables hedonic stimulation and identification the more appealing the game is and thus, also more immersive, Christou (2013) argues. Many such attributes are often evaluated in relation to the audiovisual content. But the physical properties of the media can also shape and enable immersive experiences, such as the screen size, which has proven to affect players' ability to be immersed, because it shields their' visual field (Hou et al. 2011). Another physical, influential aspect is the controller. Most video games are operated by standard controllers, which contain one or more buttons and joysticks. However, some controllers are more realistic and more accurately imitate real-world objects, such as driving-wheel controllers, sword-shaped controllers or gun-shaped controllers. A transfer of skills and behaviours learned in a video game onto real world situations can occur if the controller is more realistic (Whitaker & Bushmann 2012). In Whitaker and Bushmanns' study (2012) of gun-shaped controllers they discovered a transfer of skills when operating real weapons. Their study supports physiological attributes of a game, like the input device, can create a link between the real and the virtual. These examples amongst other therefore support the benefits of redesigning or actively using the physical shape of the computer when designing a game.

RELATED WORK

Like our prototype, other concepts that explore a more complex interaction system have been designed e.g. MIND-WARPING (Starner et, al. 2000), TOUCH-SPACE (Cheok et, al. 2002) and TANKWAR (Nilsen & Looser 2005). These games likewise explore combining modality inputs, linking the real and the virtual and the social relationships between players. I have used our contribution, however, as a tool to explore more specifically the relationship between embodiment, immersion and character identification.

METHOD OF EXPLORATION

The prototype is a tool of exploration even though it is a simplified version of how we imagine the actual game. It is therefore only the architecture of the systems and their' connection I have focused on and not audiovisual content in detail. We have yet to obtain empirical data to establish whether or not our prototype actually enable character identification and immersion. In order to make any such conclusion we would need to conduct more thorough user studies, thus this paper only functions as a theoretical discussion.

DESIGN APPROACH

Our prototype has been shaped by our pragmatic aesthetic influences e.g. stating that design should strive to give aesthetic experiences (Petersen, Iversen et. al. 2004). An aesthetic experience is the users' opportunity to experience and learn something new about the world. This coheres to hedonic stimulation, which, as I have mentioned, can be used as an approach towards immersion. One of the key focus points when designing for an

aesthetic experience should be to design for body and mind (Petersen, Iversen et. Al. 2004). On this premise the goal of our concept has been to involve the body on a higher level than a traditional video game setup would. This is hardly a new approach in the games industry though, as we see many such examples e.g. Nintendo Wii and, the before mentioned, real world object-shaped controllers. SpyFly however differs by being a multiplayer game where the interaction systems are fitted to the type of task the character must perform instead of using similar controllers, dual display or multiple screens as in traditional multiplayer games. We have therefore not only used visually different content but entirely different architectures to shape the individual experiences (see fig. 1-3).

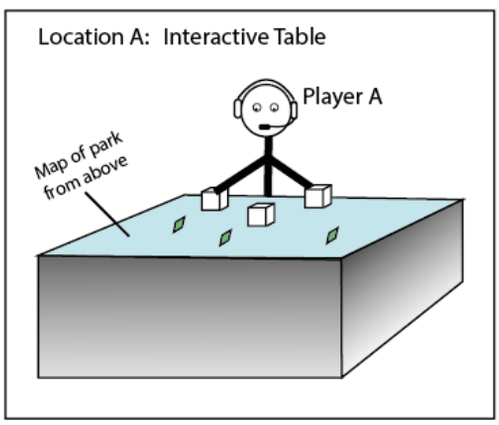

Figure 1: A model of the interaction system at location A

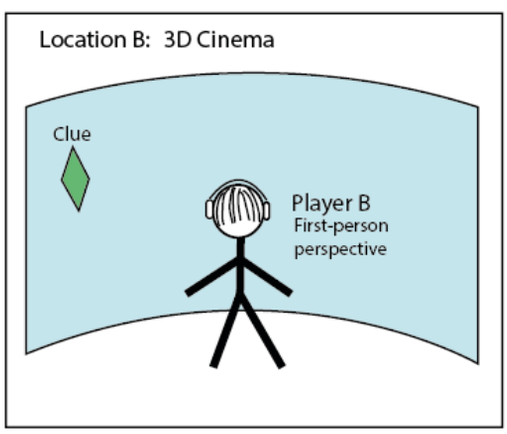

Figure 2: A model of the interaction system at location B

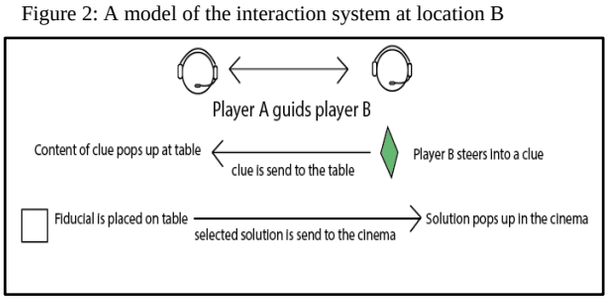

Figure 3: A model of the interaction between systems and players

DISCUSSION

In relation to Player A's experience, we have aimed at enabling a sense of power and control. In the case of Player B we have concentrated on his or her physical sense of being in the game world.
The source of our inspiration has been a blind man's buff, where one has to guide another blindfolded person, which can be of great communicational challenge. By distributing the game mission between the players on differentiating interfaces we have tried to create a similar experience of complexity. Complexity yields the potential to create new meaningful experiences; hence it can be an attribute of an aesthetic experience (Janlert & Stolterman 2010). The purpose of having a complex system is therefore not only to support the individual experiences but also to create complexity in the social relation. The complexity of the systems means that each player has a limited overview and that they cannot rely on shared, mutual information. The complexity is thus likely to challenge how players communicate through the headsets. With this as an integral part of the game the intention is to make players feel they are their characters and that they are putting their own competences at risk. In other words it is intended to facilitate hedonic stimulation. In the following sections I will focus on the individual technological system and individual experiences.

LOCATION A

The study of gun-shaped controllers indicated that skills acquired from games could be transferred to real world tasks. In return, I suggest, that players' experience with real world objects can be transferred into the game experience. By projecting the game world onto the interactive table, from a top view perspective, we wish to create a connotation to a traditional landscape map. We also wish to involve the physical space of the players' environment by using this table. In a future development the table, it is imagined looking as something that would fit into a control room or a laboratory. By using the entire table, as an integral part of the game, it is our intention that the player steps into the game world, in another manner than if he or she puts on virtual reality goggles – or rather it is just the opposite, it is the game world objects that materializes into the real world.
Seeing the world from above on a horizontal plane is also intended to give the player a sense of control and connotes known (movie) scenarios where people is gathered around a table, planning a mission e.g. by the help of blueprints, maps or little figurines. Using fiducials to interfere in the game world also adds a link between the real and the virtual, because they can reconstruct the players' understanding of his or her intervention in the virtual world (Nielsen et. Al 2009). Placing a haptic interface on the table, then to have it pop up in location B, is consequently intended to add another layer to the sense of control – like being a puppeteer or almost godlike. In the narrative the evil genius has invented the bionic fly and is thus supposed to feel powerful. Presented with the physical aids, we hope to create a

higher level of immersion and character identification than the traditional interaction set-up. We believe the potential is there because the body of the player is in what appears to be a more 1:1 relationship with the game objects or put differently, the game features is objectified through real life objects.

LOCATION B

The apparent immersive potential of the interaction system in location B is in the 3D cinema screen. I have already established that the physical size of a screen has proven to be immersive, because it encloses the view field of the player. The complete darkness of the room further contributes to the ignorance of the real world. Besides the physical shape, the content of the game in this system possibly also plays an important role. The visuals are created to fit the perspective of a fly. Arguing that a person can identify with a fly might be futile, the aim is therefore more accurately to make the player feel like he or she shares some of the same abilities, such as flying or feeling small in the environment.
In our prototype, player B had to steer with a controller, but in a more advanced system we would suggest that the player could move completely free of controller devices and instead be tracked with camera tracking technology. This would most likely allow for an even greater bodily experience and possibly make the player feeling more like he or she is actually flying.

CONCLUSION

SpyFly has explored how the concepts of immersion and character identification possibly are interconnected. Both experiences share some of the same attributes, for instance can both arguably be influenced by the physical properties of the media. Instead of approaching each concept separately in the design process, we have therefore focused on the physical aspects of the interaction systems. More specifically we have focussed on designing for bodily interaction by taking the multiplayer game onto more untraditional player interaction platforms. To sum up we have tried to design for two different bodily experiences that correspond to the narrative roles of the players. Reflecting on our prototype and the design perspectives influencing us, has led me to argue that a bodily interaction approach accommodates both immersion and character identification. Bringing the body into play might therefore be a shared design approach towards creating the potential for these two experiences.

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SIDER '15

THE SOCIAL BODY

HOW CAN DESIGNED RESONANCE IN INTERACTION INFLUENCE THE SOCIALITY BETWEEN TWO STRANGERS?

TOM VAN 'T WESTEINDE
DEPARTMENT OF INDUSTRIAL DESIGN,
UNIVERSITY OF TECHNOLOGY, EINDHOVEN
T.V.T.WESTEINDE@STUDENT.TUE.NL

ABSTRACT

During this study it was explored how resonance in interaction could have an influence on the sociality between two people who do not know each other. This is then related to the effect of bringing different backgrounds together in a socio-cultural environment where means for advanced sociality are necessary. A physical prototype designed as an engagement catalyser has been used to accelerate the process of becoming engaged with somebody. The prototype has been enriched by adding different digital feedback variables. In an experiment consisting out of ten sessions with duo's it is researched what the influence could be on the relationship between to strangers after they have interacted with this the different modalities of the prototype. Finally the implications for designing with engagement catalysers and the steering of social intelligence are discussed.

INTRODUCTION

ESSENTIAL DETAILS

The basis of this research finds its origin in the research on perceptive qualities in interaction as described by Stienstra, Alonso, Wensveen and Kuenen (2012). It elaborates on the (es)sence project by Pierre Lévy et all [2] which questions the value of designing for details in irresistible interactions. However, the majority of previous projects like Kinetic Folds [3] and Kik [4] were

focussing on the interaction between a single user and an artefact. This research has a strong focus on how designed details could have an influence on two people and the perception of one another when they have a simultaneous interaction with the same artefact.

TRANSFORMATION SOCIETY

Nowadays we have to cope with numerous societal challenges such as pollution, safety and health issues. These problems are becoming more and more transparent because of the possibilities of on-line debating [5]. The collective thinking that is being facilitated because of this transparency results in the growing realisation that we cannot continue living the way we have been living [6]. In order to facilitate this Sanders and Stappers (2012) suggest to support conviviality and find a balance between consumptive activities and the ability to participate in creative activities. Indications of change can be found in the recent interest and enthusiasm for design thinking [7]. These changes have implications for the disciplines of design and design research resulting in emerging fields like design for innovation and design for transformation [6]. In order to design for this the collaboration of many different backgrounds is necessary since the challenges are often too complex for any single stakeholder to resolve [5].

ENGAGEMENT CATALYSERS

To get towards these new ways of working together it is necessary that new methods, processes, techniques and tools are developed in order to build a constructive dialogue [8]. For this research it was chosen to work with an engagement catalyser as one of these new techniques. The origin of this tool can be found in the design framework called Designing in Skills (Dis) [9].

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During the process described in this paper the technique of creating the tool is not used as research material. The designed tool is used as a mean to connect people and enhance engagement, empathy and respect through collaboration [8].

RESONANCE IN INTERACTION

Based on the elements of the (es)sence project the research that is done contains three elements that are taken into account during the study. These three elements together form the basis for the notion of resonance in interaction; the perfect interplay between a product and a person which evokes strong positive emotion [10]. For this research it is chosen to focus on three elements that are believed to be part of this resonance [2]. With these items it is then investigated how this could have effect on sociality when these elements are implemented in a prototype.

DETAILS

In general details are spoken of as individual facts or items (Oxford Dictionary) and therefore often part of a bigger whole. A detail on its own is not always perceivable. However, the importance of the data that is contained inside the detail only becomes visible when it is missing and therefore influencing, in the case of design, for example the usability or functionality. This means that no matter how well the main features are designed, if a sequence of interactions has poor details it results in a more negative experience [11]. It is therefore chosen to work with designed details in order to see if a desired output can be influenced.

FEEDBACK

In this study the details that are designed are part of the person-product interaction that focuses on action-reaction coupling through feedback. Feedback as a design principle refers to the return of information about the result of a process or activity. When referring to interaction design this information can be any type of data [12]. Here feedback is divided into a functional, augmented and inherent element. For this research there is a strong focus on the inherent and augmented feedback. The physical part of the interaction contains information that is provided as a natural consequence of an action; feedback arising from the movement itself (inherent feedback). The other feedback that is given comes from an additional source and focuses on the cognitive skills of each individual (augmented feedback) [12]. The research element can be found in that interplay between the physical and digital action-reaction with the users. It is then researched, when using a variability for the augmented feedback, if this has an effect on the sociality between two strangers. The feedback has to stimulate the reinforcement of behaviour. The goal is to strengthen the behaviour and increase the likelihood that it will occur again in the future [13]. An engaging experience can make the feedback the character and personality of the interaction [11].

IRRESISTABILITY IN INTERACTION

When the cognitive system cannot directly understand what happens this if often because we try to fit something in a schema; a cognitive framework or concept that helps organize and interpret information [14]. This is also what happens when you perceive an optical illusion. When you see an illusion your brain is trying to match sensory input patterns (bottom up) to perceptual templates (top down). If the template matches

this is translated to your conceptual knowledge and the illusion can no longer be unseen [15]. Unconsciously your brain does this the whole day. It is when we are surprised and we are in need of a deeper understanding that we notice this.

EXPERIMENT

PROTOTYPE

In order to investigate the influence the designed resonance on sociality the prototype should have physical features that can influence the direction and intensity in which sociality unfolds during interaction. The characteristics that are supporting social functionality are called social affordances; features that allow for communication, cooperation and sharing [16]. With the focus on a simultaneous collaboration these features are used to influence the social behaviour of the participants. Their actions and behaviour correspond with their intentions and personalities and are unconsciously compared to the other person in order to evaluate one’s own actions during collaboration [17]. This is the response that is measured after each session. The prototype that is designed is based on the principle of kinetic origami and uses this to create a surprise effect and need for understanding [18]. The artefact had a multifaceted dynamic that only can be explored through physical interaction. Each of the sixteen triangular shapes had an opaque surface that could be set to an individual colour. The speed, sequence and intensity of how these surfaces changed colour could be controlled through programming. These items were used as the presumed effect during the research and is manipulated. There were two different modes developed in which the change between different colour settings and the reward for every task were different (mode1 and mode2). One mode had the designed details of hierarchical timing [19] and used this principle of motion to convey which parts of the object were most important by creating a path for the eye to follow. The reward in this mode is based on the feedback of the slots and has a higher vividness; a richness hat is increased by a medium through (multi)sensory stimulation [16]. This is done by a continuous and dynamic change in the colour, speed and brightness of each triangular surface, creating a ‘disco’ effect. The other mode lacks both these lacks both these implementations.

PARTICIPANTS

The context for the experiments is defined as a collaborative environment within the educational model of Industrial Design at the Eindhoven University of Technology, Eindhoven, The Netherlands. All students and staff are part of the same educational model. However, they all have a different background, expertise and development. Every participant was a student who is part of this educational model with an age between 18 and 28 years old. The students were chosen based on the condition that they did not know the other participant on a personal level and that they were not in a collaboration at the moment or had not been in the past. A total of 10 duo's participated in the study; 5 duo's were asked to perform a set of task with the artefact containing mode1,the other five performed the task with the same artefact containing mode2.

PROCEDURE AND MEASURES

The duos were invited into a room containing two chairs that were faced towards each other. As a warm up exercise they were given two minutes to find the name of a game with the letters on the vertical surfaces by manipulating the tool, keeping their hands on the same parts. In this way they could explore how the tool reacted to their input, and more importantly, how they were influenced by the input of the other participant. They were told not to force their actions and 'listen' to the intentions of the other participant that were communicated through the tool. This warm up exercise was proceeded by a set of 6 puzzles; a graphic representation of what the participants had to recreate. They were instructed to minimize verbal communication during the tasks. Before the puzzle was presented to the duo they were asked to pay attention to the colour setting that was loaded for every puzzle. After they completed a puzzle they were rewarded according to the different modes. At the end of each sessions both participants filled in the same questionnaire separately from each other in order to assess their collaboration and their attitude towards the other person. The items to assess the collaboration were related to group affiliation, social action and social roles as mentioned by Marco Roozendaal (2009). The items to assess the attitude were based on personality assessment criteria [20]. Furthermore minor qualitative notes were taken during the session. For each session the time it took to execute the 6 puzzles was recorded. After each session people were free to make notes and give comments about what they had experienced. This data is taken into account in the discussion.

ANALYSIS

METHOD

The data was analysed using two different methods. The Wilcoxon signed Rank Test is a non-parametric statistical hypothesis test and was used to see if there was a significant difference ($p \leq 0.05$) between the different modes in general. Following up the program GenStat was used to interpret all individual data and make a comparison between all the individual items corresponding to the two different modes. For each item it was calculated if there was a significant difference ($p \leq 0.05$) between the two modes.

HYPOTHESIS

The experiment was set up to see if the difference in designed details of the two different modes would have an influence on the experience of the participants. There are two hypotheses since it was tested if the prototype had a significant effect regarding the items as a whole between the two groups and between the items as individuals.

Hypothesis 1

H0: There is no significant effect ($p > 0.05$) between the two groups regarding the items of the assessment on their experience.

H1: There is a significant effect ($p \leq 0.05$) between the two groups regarding the items of the assessment on their experience.

Hypothesis 2

H0: There was no significant effect ($p > 0.05$) for all participants regarding the individual items of the assessment on their experience.

H1: There was a significant effect ($p \leq 0.05$) for all participants regarding the individual items of the assessment on their experience.

RESULTS

The results of the Wilcoxon Signed Rank Test. The calculations resulted in a test statistic of 27. With a critical value of 25 for a two tailed test ($\alpha = 0{,}05$) this means that the H0 of hypothesis 1 cannot be rejected. The GenStat results showed the calculation for each different item. H0 of the second hypothesis, can only be rejected for the third item; group effectiveness.

DISCUSSION

Most of the items did not show a significant difference in the comparison for ($p \leq 0.05$). The items we feeling and shyness however, come very close to this probability ($p = 0.164$ and $p = 0.07$). This could be due to the amount of participants. In an ideal situation it would be better to have at least 30 participants per group to create a realistic view. It seems that there is no direct relation between the time aspect and the assessment on the experience. The group from mode1 conducted the tests in an average time of 5:41 minutes, just a little longer than the group from mode2 with an average time of 5:11 minutes. What however would be interesting to see how this time aspect is related to ability (internal) and effort (external) and the assessment of the experiences. From a psychological point of view the increase in effort to overcome a challenge by mastering the task can satisfy the individual [21]. This could suggest that the people who had to put more time and effort into performing the task could rate their experience higher. A sign for this is one

participant who was colour blind and had to be instructed by the other participant about the colour differences. The time they took was foremost the longest (8:28 minutes) but their rating on the item proud of the group action was much higher than the average (a score of 8,5 against a 7,2 average in their group). Another sign related to this is the ability of the participants when performing the task. It is stated that an individual who is less able to perform a certain task will feel more successful as long as they can satisfy an effort to learn and improve. This means that the differences in ability can limit the effectiveness of effort when the individual achieves with a low failure rate [21]. This can be seen in the duo that conducted the task in a relative short period of time (3:58 minutes). With the warm-up exercise one of the participants of the duo guessed the word within a time of 15 seconds meaning that that person was very able to solve the puzzle. From the same duo the other person indicated to have seen a similar structure as the prototype before he participated in the experiment. He therefore stated that he knew how the tool worked and did not need much ability to perform the tasks. This can be seen in, again, the rate of the item proud of the group action; a score of 6,5 against a 7,5 average in their group. It would be interested to conduct the research again but with more focus on the aspects of time, effort and ability in order to see how this would influence the assessment of collaboration and attitude. It could be said that these items have more influence on how people perceive each other than the designed details used in this research.

CONCLUSION

The designed details in this engagement catalyser specifically do not have a significant effect on how people assess their experience. It can however be concluded that there a more influential items in the research that could have an effect on this. As mentioned in the discussion this could be researched in a different study with more focus on the items of time, effort and ability. Following up it would be interested to see how the effect of an engagement catalyser can be steered into a certain desired direction. It could be discussed how the use of these tools can be (mis-)used in our current society and how influential the role of design has become in bringing different backgrounds together.

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THE MOOGS: TANGIBLE TOOLS TO FACILITATE CONVERSATION AMONG PATIENTS IN SUPPORT GROUPS

CYNTHIA BRAVO
UNIVERSITY OF SOUTHERN DENMARK
CYBRA14@STUDENT.SDU.DK

ENRIQUE ENCINAS
UNIVERSITY OF SOUTHERN DENMARK
ENENC12@STUDENT.SDU.DK

MARIA KARIDA
UNIVERSITY OF SOUTHERN DENMARK
MARKA14@STUDENT.SDU.DK

ABSTRACT

This paper presents an exploration on how material objects might aid bipolar disorder patients in overcoming communicative hurdles imposed by depression (fear, hopelessness, indecision, confusion, etc.) by facilitating conversation and hence favoring the therapeutic outcome of support group sessions. The methods and techniques were drawn from the Scandinavian tradition of participatory design. Through an exploratory workshop we studied the role of tangible materials in communication processes among the group, and from a series of cultural probes we gathered qualitative information about the patients' condition. As a result, a set of coffee cups, the Moogs, was developed as tools to inspire story and conversations to support groups for bipolar disorder patients. By doing so, we expect in support patients in expressing themselves to the outside world.

INTRODUCTION

Vast criticism (Breggin, 1991; Moncrief, Hopker & Thomas, 2005; Moncrief, 2006, 2007) confronts the well established neuro reductionist approach: the assumption that mental diseases are the consequence of solely neurobiological processes (i.e. chemical imbalances in the brain) (Noë & Thompson, 2004), therefore strongly undermining the importance of subjective meaning and experience and ignoring the amalgamate of social and cultural factors present in psychopathology (Radley, 1994).

Therefore it was previously decided that we would approach the topic through a phenomenological lenses inspired by Critical Neuroscience (Choudhury & Slaby, 2012b), considering perception and cognition as a holistic phenomena that includes experience and subjectivity rather than assuming a clear separation between object and subject (Natanson, 1973).

This paper describes the design process and outcome resulting from the ideation, design and construction of a set of tools (the mood jugs or Moogs) to be used by mental health patients as an aid for verbally expressing their mood state. Firstly, this paper reflects on qualitative data about the illness and explorations on tangibility and materiality as support to verbally convey fruitful insights. Secondly, derived from those reflections, it presents the conclusions and parameters to design the Moogs. Finally, it describes the first prototype of this tool and how it should be used.

RESEARCH APPROACH

The first step of the process was to understand the patient's experience of sharing stories about their condition. Since a phenomenological approach blurs the mind and body distinction, the research methods and techniques used in this project had to focus on the individual as a whole. Thus, it needed to be as flexible and comprehensive as possible in the attempt of capturing the patients' perspective.

The participatory design approach (Spinuzzy, 2005) considers that much knowledge is tacit, holistic rather than clear and systematized, it is what people know without being able to articulate. Spinuzzy (2005) mention in his article "The methodology of Participatory Design": "As Ehn argues, participatory design takes a Heideggerian approach to knowledge in which "the fundamental difference between involved,

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practical understanding and detached theoretical reflection is stressed" (1989, p. 28). This pragmatic approach involves alternating between the two by discovering tacit knowledge, then critically reflecting on it." In order to capture that knowledge, participatory tools rely on participatory action research (Ehn, 1991): practical interventionistic investigations. Thus, since the aim of this research was to understand the patients' conditions and thoughts holistically, the participatory design approach seemed to be the most suitable one.

In order to collect tacit knowledge and critically reflect on it to create the foundation of our design, we draw information from literature and documentaries, reviewed the results of previous exploration workshop with tangible tools and analyzed the data collected from cultural probes sent to patients.

FIRST EXPLORATIONS

In order to start making sense of the disorder, we studied literature about critical neuroscience (Choudhury & Slaby 2012b), phenomenology (Being in the world 2010), Participatory Design (Spinuzzi 2005) and the illness itself (Stephen Fry: Secret lives of the manic depressive 2006).

The information gathered was analyzed in affinity diagrams to find patterns. In the first moment big themes emerged such as: "social": the role and influence of the social setting in the bipolar disorder, "symptoms": how are they seen by the different people involved, "treatment": how is it and how is it approached, "sense making": how the different people involved understand the disorder, "skills": what kind of tools and techniques patients develop to deal with their illness, "coping": how do the people involved in the illness context cope with it. As subtopics "Mood" and "Cure" were also points that emerged within the main topics.

However, in the attempt to structure these themes some questions were raised:

- Are the skills a way to cope or to make sense?
- Is it possible to make sense without coping?
- Are the symptoms somehow defined by what is social accepted?
- Can the treatment be the development of a skill?

Thus we realized that those topics overlap in many levels and can be considered interdependent.

PARTICIPATORY DESIGN METHODS

Following the participatory design approach, a workshop was held with bipolar disorder patients from a support group. Using existing tangible tools sets, the first step in investigating the use of tangible materials as a tool to ease the act of talking was taken.

Eight patients, in pairs, were invited to use tangible materials to provide support for the explanation of themes they previously chose to discuss. Four toolkits were used by the patients in order unfold their imagination. All of them are depicted in Figure 1: the Silver set – a set of different ready-made objects made from steel-like materials –, the abstract acrylics pieces set, the train set and a combination of wood blocks and clay.

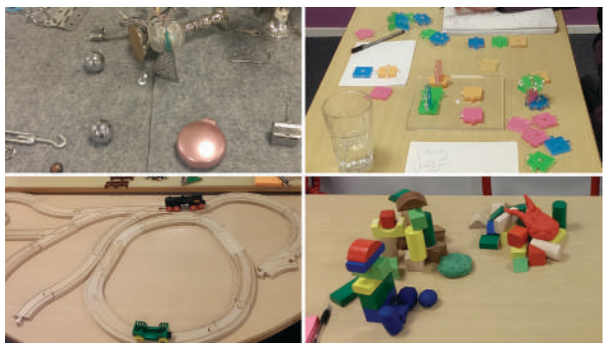

Figure 1: "Silver set", abstract acrylic pieces set, train set, and wood blocks and clay.

According to the participants' comments the experience was positive and rewarding. By analysing the video of this session, it was possible to draw rich insights to inform the designing process of the tangible tool.

CULTURAL PROBES

Cultural probes (Gaver et al., 1999) are collections of evocative tasks meant to elicit inspirational responses from people – not so much comprehensive information about them, but fragmentary clues about their lives and thoughts. Those were delivered to a group of four patients in order to mine qualitative information about themes and forms of expressing their feelings and thoughts on their illness.

For ten days, the patients had to try to depict how they felt with the materials given to them with no other limitations. In the set of materials there was: different natures of clays, paper, pen, photo camera, fabrics, a diary. The group also had the freedom to complete the task only if they felt like it. Not accomplishing them was also a fine result for the research.

After receiving the cultural probes back, all the materials produced were thoroughly unpacked and provided new insights that inspired the next steps in the design process.

Figure 2: Cultural probes unpacked.

RESULTS

In order to extract design guidelines for the tools that would be developed, the information was analyzed using affinity diagrams. From that emerged reoccurring themes, requirements for the tools regarding its form, functions, forms of use and the constraints imposed by the context they would be placed in.

On the first exploration it became clear that “mood” was a reoccurring topic in all the themes extracted from the references in phenomenology and bipolar disorder (The secret lives of the maniac depressive 2006; Being in the world 2010). According to Hubert Dreyfus (“Being in the world” 2010), it is one of the lenses that bring new meanings to the world.

Through the exploration workshop we were able to gather findings about particularities of each tool and stories they inspired. The main highlights were:

- Materials like clay apparently don’t trigger stories by its own, it is shaped and altered according to a previously thought topic.
- Non-representational (abstract, non-figurative) and homogeneous tools, like the acrylic pieces, helped more to discuss the matter within the group than to represent it to others.
- There was some negotiation of which materials to use depending on the issue to model, in particular.
- Participants decided on a different issue than the initially chosen when facing the materials they had to work with.
- The tools at hand might elicit different topics according to their nature.
- Ready-made objects, such as the ones in the Silver Set, might influence too much the story that is going to be told. Instead of helping to talk, it might shape the whole conversation.

Finally, from the cultural probes, it was drawn what feelings – words extracted from the patients’ speech itself – should the tool to be designed afford to depict. It was also identified that “mood” was a frequent topic in all the patients’ material.

After making sense of all those inputs, it was identified that the same tool/object needed to stimulate different meanings according to the mood of the patient. Also that it should have an abstract form, so the patients had enough space to make their own interpretations.

In addition to meeting that requirements the tool developed should also fit the context it was going to be used: the support groups. Normally, support groups’ sessions have a very structured agenda. This is required so each patient has space to express himself and feel supported to share sensible matters. Otherwise it could impact the therapeutic goal of the meeting by scaring the patient in some way. Because of that, the tool should not consume time from this valuable moment nor disturb its strict dynamic. Therefore, the tool should not require preparation time and should have a familiar presence, yet not too engaging that disturbed the strict dynamic of the group.

At the beginning of our ideation, we tried to empathize with these patients by driving our imagination into the therapy session room. First we imagined positioning our tangible tool in the center of the table the patients gathered around. However, in this scenario, most designed artifacts would gain a chancel meaning detached from the patients. In the next step, our focus shifted to the artifacts used as part of the patients’ therapy session routine. After exploring various possibilities, the coffee jugs were the most suitable objects. They were part of every session, easy to approach and use, detached from the austerity of the theme, playful and foremost easy to be modified and shaped with simple materials.

THE MOOGS

After our exploration, the Moogs (or Mood Jugs) started to be shaped. Undoubtedly, the cultural probes were the main source of inspiration in order to start ideating about how could coffee jugs be transformed into a conversation support tool and be used during the group therapy sessions. In light of the requirements needed to be met: to have the possibility of inspiring multiple meanings, to be abstract and a tool that evoked stories from patients, the design process started.

A set of ten different cups was developed as a first prototype inspired by patient’s words extracted from the cultural probes. “Complicated”, “balance”, “flow”, “change”, “organized”, “sad”, “connection” and “clear” were some of those words. They followed the idea of the troupe l’oeil (Pipes, 2008), the usage of unlikely materials to simulate multiple forms on this familiar object, the jug. The combination of naturalistic forms and strong, heavy shapes were meant to depict multiformity on the objects. That was done to leave space for the patients to associate their mood with them by evoking the patients' kinesthetic vision (Pipes, 2008), in which the eye darts around looking at forms, trying to match them to any memories of similar objects. For example words like “change” and “organized” led us to create objective shapes that could be related to the trees and the natural tension of them to grow higher and be spread at the top. Words like “psychotic” and “irritation” was depicted with elusive forms that tend to remind us of surrealistic sculptures.

The Moogs should be used in support groups in a way that doesn’t disturb their activities. Drinking coffee, thus choosing a cup, is already a habit that follows the beginning of every session. It was thought, then, that an easy and quick question/task would replace that activity. Instead of choosing an insignificant cup, the patient would be asked to choose the cup that better depicted how he felt that day. Later, during the discussion, the reasons of choosing that cup or what stories they evoked

and why could bring interesting insights to the conversation.

Figure 3: The Moogs.

CONCLUSION

Through the phenomenological approach any experience is not considered meaningful if object and subject are dissociated. This project aimed to develop a set of tools that, through the patient's interaction, could evoke stories and give more meaning to conversations in support groups. The Moogs are the result of this project. This paper aimed to show the design process of it: methods and techniques, analysis and design requirements it had to follow.

The Moogs (or Mood Jugs) are a set of jugs inspired by the patients own words depicted in abstract forms guided by arts and design principles with the right balance between being a familiar objects to the patients and yet inspirational enough to stimulate their own reflections about their stories and moods. They are an attempt to aid the discussion about the emotional state of bipolar disorder patients during support group sessions.

Testing the cups in real context is still something to be done. However, though it might sound audacious that a cup of coffee could actually be used as a tool in a therapeutic session, only by asking the patients to chose a meaningful cup might aid them to start their own reflection on their emotional state and give him a support to put their emotions on. In our perspective, any aid in giving meaningful ways of expression to those patients is already a great development to those support groups practices.

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BILBORD: A FAMILY-FOCUSED INTERACTIVE SYSTEM FOR DRIVERLESS CARS

ADAM DUNFORD
CHALMERS UNIVERSITY OF TECHNOLOGY
DUNFORD@STUDENT.CHALMERS.SE

ALMA CASTILLO ANTOLIN
CHALMERS UNIVERSITY OF TECHNOLOGY
ANTOLIN@STUDENT.CHALMERS.SE

ABSTRACT

This paper describes an interactive solution for family entertainment in a driverless car involving personal entertainment devices that can be digitally and physically connected. We describe the design methods and process that led to it, the evaluation made by different users, and final result.

INTRODUCTION

With a driverless vehicle, a family can fully focus on each other while traveling. Yet personal electronic devices may prevent this interaction. This paper describes a research-based design process to create a possible solution to this problem, accounting for both the unique qualities of driverless cars and the realities of family interactions. We then evaluate the high-fidelity prototype developed from this design process.

LITERATURE AND THEORY

While the concept of autonomous vehicles has existed for more than 50 years (The Victoria Advocate, 1957), ongoing advancements have made self-driving cars a near reality (Wuensche, Luettel 2012). Projects like Google's "Self-Driving Car" are already on the road, testing how an automated car could work in real life (Guizzo). Even though the method for transporting ourselves on roads may evolve, research remains to be conducted on how the existing desires of drivers may change when there is no one behind the wheel (Gkouskos et al., 2014). What new opportunities for intercommunication could a driverless car present to families when a parent no longer has to focus on the road?

Entertainment is a clear area of interest for many families, yet existing car entertainment systems, such as carputers, focus on self-entertainment and passive consumption. Amusement is highly individualistic, and varying ages, genders, and personalities within a family make it even more difficult to find shared activities. The confined space of a vehicle and the variable time trips take can create additional obstacles for enjoyable in-car entertainment experiences (Alt et al., 2010).

DATA AND METHODS

To explore possible solutions to the problem of family interaction in an autonomous vehicle, we followed a Divergence, Transformation, and Convergence design process that would permit the broadest possible set of solutions within the given constraints.

DIVERGENCE

To better understand the interactive possibilities an autonomous car could offer, we researched literature related to automated cars. From there, we used the KJ method to individually brainstorm and silently group ideas in order to explore both family-specific and car-related issues and design areas that could be addressed in a new technology. KJ is an ideal beginning method because it allowed us to explore the most important aspects of traveling by car without focusing on problems or solutions yet. KJ's silent method allowed everyone to express opinions unhindered, which coalesced around three main topics: Children, Activities and Feelings.

To better understand family needs, we created a number of character profiles for different family compositions, including extreme cases such as a group of children without adult supervision. From these various passenger scenarios, we can summarize a car journey as:

- sitting stationary
- in a closed space
- for a defined amount of time

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These elements are no different whether a driver is present or not. Yet with the possibility of a driverless vehicle, a parent can pay attention to children rather than the road. To best explore how this attention could be directed using a technology solution, we focused specifically on families with young children, both because young children expect more attention from parents and are less capable of using current technology devices unattended. To further develop our perspective, we shadowed families with children to see how they behave inside cars. This method allowed us to examine the user group before framing the problem we were designing for. This helped us investigate possible concepts and get started on the transformation.

TRANSFORMATION

During the Divergence effort, we concluded that car travel is not much different than sitting a waiting room or around a dinner table, yet most activities performed in a car are anti-social. Thus for the Transformation effort, we decided our solution should help families to come together and interact with each other during a trip, not only for entertainment, but also to give input on where to go, where to eat, etc.

Using mind maps, we created different scenarios representing different trip types, creating a context for testing design ideas and verify their viability. One concept we chose to pursue further was incorporating one or more screens in our solution. We discussed using opaque screens as windows in the car, locating screens on the inside roof or on the back of the chairs and to let each user have a tablet that is connected to each other.

CONVERGENCE

From the Transformation, we began addressing feasibility. We felt that using windows as screens would work against having families interact together by directing users to face away from each other when using them. Instead, tablets would allow for the most diverse forms of interaction. Additionally, we conceived an ability to combine tablets into one shared surface, which would force all users to focus their attention at the same activity. We then started our convergence by taking the idea and making it a prototype.

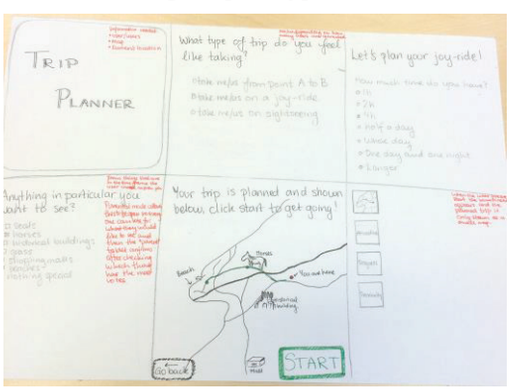

Fig. 1. A paper prototype and overview of the trip planner.

We began by making paper prototypes because it is simpler to edit and rethink minor parts of the idea (see Fig. 1). The choice of methods was pretty natural for us. By first getting all of the brainstorming down on sketches, it makes it easier to refine ones idea before completing it. Making sketches before making the paper prototypes of higher fidelity (see Fig. 2) made it easier to divide our idea and system into different sections.

A collaborative design workshop with users unfamiliar with the solution further developed our idea. While we explained the broad layout of the hardware system, we intentionally kept the description brief, instead preparing different age characters for role-playing using the DSD cards (Antle). This made the participants act out age-related behaviours and explore how the specific features would work better for them. We discover that some features were not suitable for users that did not wish to be involved at all, such as teenagers. The participants came up with new ideas. The different activities available on the tablets were presented to the participants for them to criticize them. The big surface created by connecting several tablets in different angles was also presented in order to evaluate it and explore the possibilities it led to. This was shown to provide a bigger engagement between family members in a similar activity and enhance physical communication complemented by the electronic one.

EVALUATION OF DATA

For evaluation, we created an interactive prototype based on the designs made in the convergence phase. This prototype allows users to walk through the different features of our system by clicking different parts of the screen and seeing resulting interactions

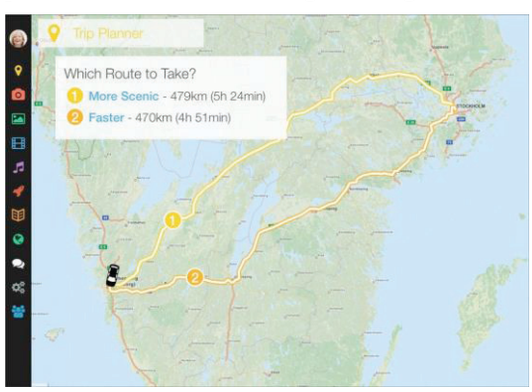

Fig. 2. A high fidelity prototype of BilBord, including functionality for choosing between a faster or more scenic route.

We then sent the prototype to families in different countries along with an online survey for feedback. Twenty-one parents responded, providing information about their own families' behaviours in cars, as well as their reactions to the interactive prototype.

Overall, the users liked the BilBord system. Users were particularly pleased with the ability to plan a trip route together, including selecting restaurants and creating a shared music playlist. The option to have shared games

and group prompts further enhanced the experience. They also considered the "parent mode" very valuable, with its granular access controls and ability to remotely control a child's screen so that parents can monitor and limit device use, while permitting autonomy for the children as well.

Most of the complaints were about the prototype itself and some interaction issues it had. Some people also felt this kind of system prevented traditional interaction and reinforced individual entertainment, even if the activity taking place is collective.

While the survey's open-ended questions allowed us to gather peoples' opinions rapidly from a variety of different cultures and backgrounds, the self-directed nature of the remote prototype evaluation suffered somewhat due to lack of user orientation. If we could have been present, perhaps subjects' confusion about the system could have been resolved more easily.

In the future, testing more polished digital prototypes in a more controlled environment might offer better feedback on the strengths and weaknesses of the system.

RESULTS

The proposed BilBord system consists of a set of tablet devices for each passenger. Using facial or voice recognition with its front-facing camera and microphone, each touch-enabled tablet recognizes the current user and personalizes the interface with age-appropriate games and applications, connected to a shared network to allow collaborative play and parental controls.

Potential functionality for the proposed tablet includes:

TRIP PLANNING

The map software allows the family to plan trips together. They can choose between different itineraries given the length or related experience (i.e. sightseeing). This allows them to plan what they want to see and enjoy the ride itself. Different information about the itinerary will automatically prompt when needed, such as the need to refill the gas or an interesting attraction nearby. This allows the family to enjoy their interaction while being in the car, not worrying about logistics.

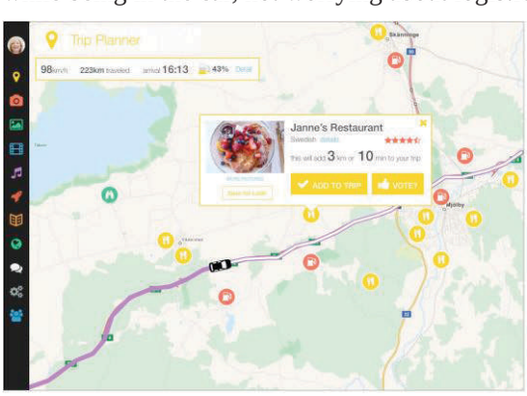

Fig. 3. The trip planner allows for collaboration along the way.

MUSIC SHARING

The music software consists of a shared playlist where all family members can suggest different songs. Each family member can either up or down-vote songs on the list, so that they disappear if they have a sufficient amount of negative votes (Fig. 4). This makes it possible to create a list that is appealing to the whole family. The system will balance the songs so that a significant amount of songs from each person gets played, and everyone feels represented.

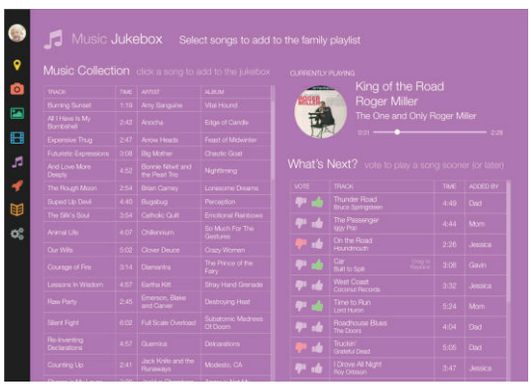

Fig. 4. Shared music playlists let everyone have a say

PARENT MODE

The parent mode is a feature that lets parents suggest or force the family to partake in an activity, such as choosing a restaurant, ordering lunch, adding music to the shared playlist or playing a game (Fig. 5). This system is focused on giving some power to the parents to regain their children's attention inside the car. This will allow the family to stay connected during the trip.

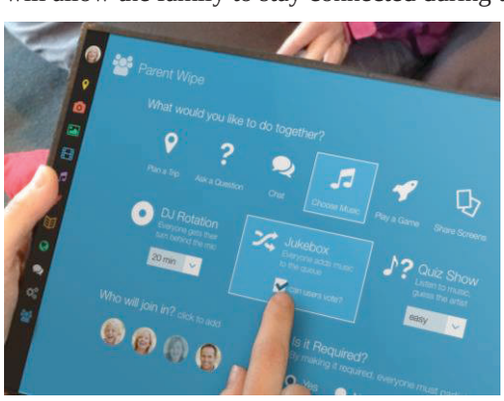

Fig. 5. Parent mode allows shared interaction across devices

GAMES

While the number of existing network games would provide a likely base for, we also conceived of three games specifically designed for this system:

"Draw Together" allows the family to sketch on the same virtual canvas either using their individual tablets connected over the network or by putting several devices together and creating a larger canvas.

"Who Said This" is a trivia game to see how well family members know each other. Each person writes facts

about themselves and the rest have to guess who said what on their devices. This game is especially useful for parents getting to know their children some more and engages the whole family.

”Photo Finder” challenges family members to take a picture of something specific they will see through the car window. The one that takes a picture of that item first will be the winner. This game engages the whole family in a competitive activity that also allows them to explore the environment around them while traveling.

BILBORD TABLE

Additionally, the devices can be physically attached to one another, creating a larger screen that can let the whole family interact together face to face. Trip planning, music selection, and especially games would be enhanced as interaction with one another is placed in physical proximity with one another.

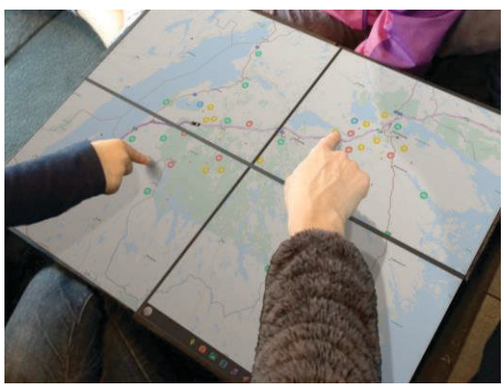

Fig. 6. Multiple BilBord tablets connect to share a surface

DISCUSSION

POSSIBLE IMPROVEMENTS

Looking back at our process we realise disabled users could be taken into account. This could be done by building holders for the tablet into the car seats or having the tablet fold out as a tray.

The system could also be adapted for families with teenagers, who might not find our system that helpful for interaction. Teenagers may feel that it is more fun to connect to social media, which makes this system more suitable for families with younger children. However, this system doesn’t generally substitute physical interaction. It complements it by allowing the family to interact together with elements related to the car trip such as tourist and route information and playing music. The fact that tablets can be connected makes the game interaction resemble that of a board game but being enriched by technology.

CONCLUSION

This system was designed to entertain the family in a driverless car. We focused on the different problems and needs a family could have in a car, and we decided to focus on entertainment and social collaborative activities. The system was prototyped in various ways and presented to users for evaluation.

The user evaluation showed that BilBord was generally appreciated. Users enjoyed the democracy for choosing different activities, but surprisingly also appreciated the parent mode for imposing a decision or activity. This shows how parents want to interact with their without losing control. It also shows they want to be heard if there is something important to communicate.

This system provides a new dimension to traditional car entertainment systems as it enhances interaction and communication between family members. Unlike other pieces of technology, it can be used both separately and together in one or several common activities. The chosen themes adapt to the car environment as they control the trip, the car inner environment and the family entertainment. This system differs from traditional tablets with the remote parental control, the integration with the car to track the journey, and how it encourages common activities both in the custom group applications and physically placing several devices together.

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PHYSICAL COLLABORATIVE PLAY IN PUBLIC SPACES

SARA SAID MOSLEH
UNIVERSITY OF SOUTHERN DENMARK
SMOSL13@STUDENT.SDU.DK

NELE SCHMIDT
UNIVERSITY OF SOUTHERN DENMARK
NESCH13@STUDENT.SDU.DK

TUDOR TEISANU
UNIVERSITY OF SOUTHERN DENMARK
TUTEI13@STUDENT.SDU.DK

ABSTRACT

As technology is developing rather quickly and taking up permanent roles in the everyday lives of people, it has led to a decreased social interaction between people, away from the physical worlds. Through ethnographical and design anthropological approaches, this paper seeks to present how people can be motivated to socially interact in environments that otherwise are antisocial.

The main findings in this research show how people need a very clear reason for interaction and hold back despite the wish to interact due to unwritten cultural constraints. The outcome of the research is though limited to Danish socio-cultural environments and has potential to support similar studies in further western societies. When designing for the public it is crucial to consider the existing behaviour in the specific context in order to design means that do not vary too significantly from what is socially acceptable in the environment.

AUTHOR KEYWORDS

Game design, body, interaction, User-Centred Design, public space, physical play, persuasion technology

INTRODUCTION

As social human beings, we are continuously participating in different social environments within different contexts and by undertaking various roles. This involvement creates, without question, a social interaction, which is slowly but steadily shifting towards a more private space either at home or within a larger shared environment. Due to the available present technology, this social interaction lost its physicality, as everything can be done in front of a screen, only involving our psychic abilities. The task ahead was designing a concept that involves people physically, and triggers them to collaborate while playing in different forms, within a public space.

Collaboration plays a key role, as while trying to achieve a common goal, task or reward, social bonds are created between people.

This paper focuses on the public space of train stations and investigates how people behave both socially and antisocially, why people behave like they do in such a context and how the team can design an artifact, which can motivate people to socially interact at a space that otherwise seems to allow little social interaction.

RELATED LITERATURE AND THEORIES

Social interaction at public spaces and game design are fields that have come together on many occasions, leading to very interesting research.

Relevant research has been conducted by Adam Kendon (2009), who discusses the notion of formation and shared transactional spaces. He states that people at public spaces will keep adjusting their positions as newcomers add to the crowd of people. He explains

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how this is a behaviour that is very common, as people tend to adjust themselves to create a consistent pattern and distance between each other. Furthermore he discusses the notion of shared transactional spaces meaning the space, which is shared between people for the same main overall activity. He states how people will adjust themselves to the main overall activity that is shared in the context. This is relevant for our own research as Kendon investigates people's behaviour at public spaces, and leads us to consider and be cautious about how we approach the setting, in reference to the norm that exists. Furthermore it leads us to reflect upon how those patterns can be influenced through design and methods that aim to reveal and affect the behaviour of people in such settings. Mark Nelson (2014) who works with game design, states that when designing for people it is crucial to understand that a designer should not try to change the user's behaviour and habits, but rather understand their existing behaviour in order to design products and means that fit according to the users existing habits. That is a very interesting statement as humans are social beings that tend to stay in flocks, which means that it can become very difficult to implement a design in the environment of train stations that make them deviate from the rest. Therefore it leads us to believe that it is crucial in the process of designing games for the public, to investigate how people behave in that context and develop a game design that requires interaction, which fit their existing habits.

Bekker et al. 2009 discuss easy stepping in and stepping out solutions. They indicate the importance of designing games for the public, which are easy to instantly understand and step into and at the same time easy to step out of when the user no longer wishes to participate. We see this as a rather interesting point as we believe that this can lead to a design of a game that has no beginning or end that makes people wait for too long or trapped in the game. We believe that it requires a design that offers immediate understanding and offers a novel mapping between actions and results (Norman, 1988), which makes it less intimidating, while giving the users the opportunity to step out whenever they desire. Bekker et al. 2009 further state that games at public spaces need to be "…easy to learn, but hard to master" as it should be rather easy to include the users in the game, but still offer some challenges that keeps the users interested and offer them some specific and clear goals that need to be reached. They further state that when designing games for public spaces it is rather important that the design is integrated in the environment and context, in a way that it does not differ too significantly from the existing space, in order for it to be motivating. This is very relevant, as there needs to be a natural transition in the environment when the user interacts with the game. As earlier stated we believe that as people are very social beings, we do not wish to be exposed and stand out from the crowd, meaning that when implementing a new design at a space it should appear natural. This leads us to point at the paper written by Alexander et al. (2012), who discuss the idea of foot interaction at public spaces instead of hand interaction, as it offers rather different interactions but more importantly approaches the issue of hygiene, and how people tend to avoid interacting with things at public spaces, due to reasons related to sanitation. They further discuss how it can be a solution when the upper body is occupied. Relating this statement to the findings of Nelson (2014) we come to see the potential in foot interaction as it can be a more discrete form of interaction that does not force people to expose themselves too significantly by interacting with the game in a way that force them to stand out of the crowd. Bekker et al. (2009) also states that when designing games it is important to give the user control over speed, direction and sensation, which is defined as playful persuasion. This we can directly related to the research done by Wensvween et al. (2004), as they discuss the different kinds of feedback that give a natural coupling between actions and results, which includes different aspects related to dynamics, time and direction.

A last important consideration is what principal game design at public spaces is based on. Bekker et al. 2009 discuss how physical play can be a motivator for social interaction and how oppositely social interaction can be a motivator for physical play. In our case, where social interaction is the main issue, we wish to motivate people to socially interact through physical play.

APPROACH AND METHODS

To specify the environment that we wanted to investigate, a brainstorming session of different public locations was conducted. The outcome of this session was evaluated based on a framework consisting of three aspects; **aim** *(what do we want to change?*), **method** *(how could we make a change?),* **users** *(who are the possible target groups?)*. Through this, we narrowed the ideas to two possible locations; public hospitals and train stations. These were investigated further in the field through observations to get an understanding of the potential of the design space. Based on how well we could answer our three initial questions, the choice fell upon the location of train stations.

In order to get an understanding of our users and the issue at hand, various methods were used as an approach to gather data of both qualitative and quantitative form. As an initial research, we did participant observations to first get an idea about the environment and the people in it, by including ourselves actively in the environment and not solely passive (Ross, 2009). We did this by appearing as travellers and made sure to blend in with the crowd in order to not interrupt their natural behaviour and be able to feel the experience ourselves. Doing this also meant that we were not able to take notes in the field, as we wanted to appear like travellers, but rather used the outcome through experiences and narratives that followed after the study.

Another important and traditional method was interviewing. We deliberately did this after doing observations, as we believe that it is easy to become influenced by what people say. These interviews were conducted based on semi-structured interviews that suggested both qualitative and quantitative questions that led to fixed data regarding age, gender, travelling, etc. and more qualitative questions that led to experiences that we could later discuss and reflect upon.

After conducting these initial research methods, in order to get a basic understanding of the field we were getting involved in, we continued to more elaborate methods to challenge our own perceptions and our users'. The methods were based on following questions:

"How do people react to coincidental verbal contact?"
"How do people react to physical contact?"
"How do people help each other in different situations?"
"Do people gather? How?"
"Is there a pattern in how people place themselves? How can that be influenced?"

To get answers to these questions, we used different methods. These were applied both at Sønderborg train station and Kolding train station. The very first approach required that we included ourselves in the environment as travellers. We started by approaching random people and started small conversations with them, in order to see how they react to verbal and/or physical contact. What we did here was starting the conversations on a very light and superficial level and then slowly became more personal in order to see how far people will go when interacting with strangers. This gave us an understanding of how willing people are to interact with each other.

Next, we developed the method "Encouraged Interaction" where we had boxes placed on the platform that each encouraged people to interact with another in a certain way. This gradually became more and more daring as the first request was to smile at a stranger and the last was to pick up a small ball that was placed and for playing with it with a stranger. This method aimed to see how elements of play influenced people's behaviour and whether they would be reluctant to interact with each other when given such a reason to. These mentioned approaches were all conducted in the field, which gave some valuable data that was captured in portraits, mind maps, pictures, videos and notes.

The next step was taking our users out of their environment and creating a collaborative space, which would address the issue at hand more directly. It was important to know whether being in the environment while talking to our users could affect their answers and perceptions. For this purpose we arranged a workshop where 16 people from different age groups and gender were invited. These were selected with the intent of having a diverse group of people with different backgrounds and lifestyles. Some were students who commuted by train often; others were from a younger generation contacted through youth-clubs, while some were middle-aged adults with families and stable jobs.

The workshop was based on the design anthropological approach of the past, present and future, where we created a tool that intended to make people reflect upon how they saw the past trains stations, how they currently see them and use those statements about the past and the present, to propose their perceptions and visions for the future train stations (see fig. 1). Following the workshop we had tangible data that was rather convenient to analyse as everything the users had been discussing was reflected in the tool. Furthermore, video, notes and pictures supported the data from the tool.

Figure 1: *Workshop "Train track tool" presenting the past, present and future perceptions of the train station.*

CREDIBILITY THROUGH EVALUATION OF DATA

Following the studies, we were left with a lot of data that had to support our design decision in the process of designing the game. Implementing qualitative as well as quantitative data in the design, led us to make use of different analysis approaches for each of the methods used. For the interviews, it was rather simple since some of it was quantitative while the workshop and "encouraged interaction", small taking and observations were rather qualitative and needed a much more cautious approach in order to obtain creditability. For the workshop we had our data in our tool, which made it fairly easy to extract, as the observations required a longer process of comparisons of experiences and notes.

To obtain more credible foundations for our design decisions, we turned to a more engineering approach as we used our findings to create a morphology table, meaning that we listed our findings and held each of our ideas and designs up against those criteria in order to analyse them and solve the issue at hand with reference to our findings through our research. This was though still critical as it is very difficult to access our ideas and designs through a point and weight system, since the assessment can become very subjective. When using ethnographic and design anthropological approaches for product design, some data can get lost in the process of trying to quantify qualitative data, to satisfy the engineering aspect of product design. Therefore we used the engineering method of morphology in a more qualitative matter, since we did not wish to reformulate our findings in a way that our data got lost, but rather

maintain the value that anecdotes, observations and discussions can contribute with to inspire new ideas and designs that cannot always be found through quantification of data.

TRAINIT- DESGINING FOR COLLABORATION

Based on our research we ended designing a game that consists of a game board integrated in the platform, and four balance boards used as controllers for the game. The game board has four spheres, which can be controlled by the balance boards and has different spots on the board as goals. The idea is that when a user steps on a balance board, they will be able to select their travelling destination. As a destination is selected, a sphere on the game board will light up in a certain colour, where the purpose for the user is to control the sphere to the spot that lights up in the same color as the sphere. As a spot is reached, another lights up and the game speeds up. The purpose appears when another person steps up on another board and chooses their destination. If the destination is the same as the first user's, they will have a common goal and the game can turn into a competition or teamwork (see fig. 2).

Figure 2: *The prototype of TrainIT being tested in the intended environment of the train station.*

Bekker et al. (2009) states a game can either be based on teamwork or competition. We chose to give either option as we learned that it was important that the users have a certain freedom of interaction. This is based on our findings through the workshop as the users expressed how they are too constrained in the modern society by too many rules, and how the past was characterised as a more free, simple and unconstrained time.

The shape of the game was inspired by Kendon's (2009) research concerning people's behaviour in public and our own observations of the patterns they created when waiting at the station. It was experienced how they never directly faced each other if talking and always kept themselves at a certain distance. This was supported by Kendon's (2009) theory as he proposes the L-shape pattern that is created when a group of people who are not too familiar with each other interact. As seen on figure 2 the balance boards are arranged in a L-shape that makes people avoid direct eye contact to motivate them to participate in the game. It furthermore proved to be a rather good idea to base the design on foot interaction as we, through observations, noticed how people waiting at the train stations had the tendency of using their feet to create patterns and pace back and forth rather impatiently. Based on Nelson's (2014) statement we implemented this design alternative in order to create a familiar experience for the users in the environment.

A very important aspect is the fact that it was observed how the users need a very clear reason to interact with each other. When approaching people at the train station we noticed how willing they were to interact when someone gave them a reason to and initiated the action. As we did the "encouraged interaction" we noticed how they were not too willing to participate, as the reason was not good enough. Using their destinations as a fundament for the game creates a very natural and clear reason for interaction as it fits in the context. This is also based on the very nostalgic discussion that appeared during the workshop among the users. We tried to recreate their idea of travelling in groups in their childhoods, by giving them a specific reason and common interest for them to base their interaction on.

The idea with the game is to instigate a subtle, social interaction that should proceed when travellers board their trains.

DISCUSSION

Through a longer process of research we come to realize that no public space resembles another concerning people's behaviour. Each environment has its own norms and unwritten rules that people follow without question. When doing ethnographical and design anthropological research, we realize how selective we need to be depending on the environment and context. As we experienced in the method "encouraged interaction", it is important to implement methods that fit into the context, though it can lead to some very surprising and useful findings, as we found how people respond to things that seem odd or out of place in their environment. This emphasized the importance of designing the games in public in a way that it becomes a part of the context in aesthetics, interaction and function. Furthermore, it is crucial that the purpose of the game is meaningful in reference to the shared transactional space in order to be motivating and provide a clear reason for interaction. We come to learn how the statement of using physical play as a motivator for social interaction is rather difficult in public and should not be underestimated as it exposes people in a vulnerable way. Furthermore, we have come to realize that in order to design games for public spaces, one needs to consider a very subtle form of technology that is adapted to the environment and the unwritten norms and rules regarding the social behaviour. This leads us to discuss the benefit of persuasive technology as the design and interaction format should be persuasive through careful considerations of the aesthetics that gives a certain feedforward and the functionality, which should indicate a clear goal for the user before even

stepping into the game. A last point which was observed and seemed to surprise the team, was how when the prototype of the game was tested in the environment it seemed to not only appeal to the actual participants, but created a space that included spectators. This indicated how public game design does not only have to include the actual participants but rather create a shared transactional space in the whole environment.

The reason why train stations specifically are interesting in connection with the theme of the research is that the environment includes people with very diverse age groups, social and cultural backgrounds, as well as lifestyles and interests. However these people, unlike other public spaces as malls, parks etc. (where people have more individual goals), have a specific and common goal, which is travelling and reaching a destination. Besides travelling, these people are not aware of any possible shared interests as the train station does not facilitate any means to make people socially interact by any matter, which additionally is not helped by the norms of the culture. This makes most people seek other forms of interaction, which brings them to the use of personal technological devices, thus creating their own microenvironments. This decreases the possibilities of physical social interaction. For this reason, the technological development has become a strong competitor against physical social interaction in this context. For others, the space turns into a waiting platform that instigates a restless and bored behaviour. This creates a challenging design opportunity where the balance lies in facilitating a physical social platform based on one single shared interest that captivates people in a common space and activity in spite of their diversity. However, the designers still need to respect the values and norms of the social setting and the people engaged in those. The research contributes to the field by exploring a design process that aspires to combine and enhance the methodologies used within the field of design anthropology and ethnography as well as design and engineering. The paper further seeks to support studies concerning designing for social public spaces as we learned how this field is rather complex, since it highly depends on multiple factors concerning people, space, context, activity and culture.

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DOING THE DODO — A COLLOCATED APP FOR HOUSEHOLD CHORES

JOHANNA GLEMBO
CHALMERS UNIVERSITY OF TECHNOLOGY
GLEMBO@STUDENT.CHALMERS.SE

NANNA NAUMAN
CHALMERS UNIVERSITY OF TECHNOLOGY
NAUMANN@STUDENT.CHALMERS.SE

ABSTRACT

Doing chores can be a source for stress and arguments in households. The felt responsibility for such chores can have negative effects on our health. The idea of collocational technology can be used to provide for a basis of shared responsibility for the execution of chores, as it can help communication and the feeling of togetherness. This paper describes the work of a project that sets out to create a mobile app to support households in joint ownership and responsibility of chores, as well as equal distribution and commitment. The paper describes the route taken and design choices made in order to create this app. The result was a mobile app for use during household meetings that randomly distributes chores among household members and allows them to exchange these chores with each other via the use of an in-app resource.

INTRODUCTION

There are numerous productivity apps for mobiles today. It seems clear that being productive is something many people care about, and find can be improved via the use of technology. A lot of these productivity apps are todo-lists, where the user can add chores that has to be done, and then check them off. In a household, there are often many people sharing chores. This can be a source for arguments and anger, itself leading to stress and in the long run health issues.

This paper is the result of a project where we were to design a mobile app for collocational use. Our experience told us that household chores would be an area in need of new thinking and collocational support. We started out with the belief that there is a value in sharing responsibility in a household, both in that responsibility is not always an easy load, but also that it can lead to empowerment for all parties. We wanted to create an app that encourages households to sit and plan the chores together, but also in a way that would be more intriguing than ordinary household meetings.

LITERATURE AND THEORY

HOUSEHOLD CHORES

People today feel more stressed and short on time than ever before (Robinson & Godbey 2005). These may all be reasons why books such as Getting Things Done (Allan 2002) is selling millions of copies. People are looking for ways and strategies to help them to handle their busy lives. The amount of work to be done in a home alone can be overwhelming. In a study, Cakmak & Takayama (2013) found 884 separate tasks associated to cleaning and household chores. The more people living in a household, the more chores to be done, and the more time and effort it will take to divide the chores among them.

Thurston et al. (2011) found that the felt responsibility for household chores was associated with increased blood pressure. This means that it is not only the division of house labour that matters, but also the responsibility of getting it done. Sharing this responsibility among household members would perhaps lead to better health. However, taking part in household chores is difficult for many children especially when the expectations are not clear (Klein et al. 2009). Communicating what is expected is of importance if we want children to be able to finish chores. Involving the children is not only of instrumental value; many children take pride in having and completing chores in the house (Berridge & Romich 2011). It can be a way of preparing the children for life,

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and also teaching them how to become responsible adults. Thus, involving everyone in the household in not just doing chores, but taking responsibility for them, is important in many ways.

Although the results may not be generalizable, Yuill et al. (2013) showed that mobile technology can help support cooperation in families. In their research, an app was built to enable families to work together on a drawing, taking turns and merging everyone's personal contributions. The result was that the families experienced a shared ownership of the creation. Yuill et al. discuss the feeling of private ownership that comes with a mobile, and the opportunity to share ownership that comes with a tablet. Dividing household chores would come at the intersection of these experiences: it is a shared ownership of the household, but perhaps a (at least temporary) private ownership of chores.

COLLOCATION

We all probably have the experience of not noticing the world around us when interacting with a mobile phone. Lundgren et al. (2015) call this the mobile bubble, where people tend to disappear into their own worlds when using a mobile phone. Contrary to this experience, there is a possibility for mobile phones to be used as a means to support collocational interaction between people, as is shown by the work of Lundgren et al. (2015) as well as by Lundgren & Torgersson (2013). An app is defined as collocational if it supports face-to-face situations, so that it can be used by several people sharing the same space at the same time. Many designs fitting this description fall into the games category, but others are more oriented towards productivity and other areas. Lundgren et al (2015) set up a framework which can be used to analyze collocational apps, discussing collocation from four perspectives. The social perspective is concerned with how the relationship between actors is constructed. The technological perspective discusses how the concept is designed and the utilization of hardware. As for the spacial perspective, it helps describes locations and environments. Finally, the temporal perspective explains how the concept is experienced by the users temporally, including pacing and engagement.

METHODS

FOLDING IT OUT

Dividing chores in a household is not always an easy task. Our first step was to perform interviews to get a clearer picture of the problem. We made sure to find people who shared a household with one or several others. Our main objective was to further pinpoint what actually counts as a household chore, how people divide the chores among themselves and why it is divided the way it is, as well as to see if there are problems caused by chores such as quarrels or stress. In short, we wanted to see what chores are present in a relationship, and the implications of this. The interviews were semistructured, which means that they followed a preset path but allowed for digressions. They were conducted in quiet contexts, and took about 20 minutes each. The results were compared and common elements were noted.

From this we went to looking at similar work. The closest theme we found was apps with "to-do-lists" and other productivity apps, such as 'Business Task' and 'Routinely'. Some were specified towards families, such as 'Reward My Chore' and 'Cozi Family Calendar and Lists'. Some focus on managing tasks, whereas others support more aspects of life such as booking appointments and managing schedules. We analyzed these apps in order to find common aspects as well as unique perspectives.

NARROWING IT DOWN

Sketching and paper prototyping as well as mockups were used in order to explore the ideas we had at this point. Several iterations and variants were produced, but in the end we decided to boil them all down to one clear central concept: how to make families share the responsibility of household chores.

When our concept and idea were formed, we made a quick paper prototype to use in a user study. Two groups of people got to test the idea by playing a game. First, the context was set. The participants were instructed that they were to behave as if they were all living together, and that 12 chores had to be done during the week. They were each dealt 3-4 chores, depending on how large the group was. For each chore, they were also dealt one resource, in this case tiny plastic paprikas. The rules were that a player can either accept a chore, or pass it on to the next player by adding a paprika to it. The one who accepts a chore gets all the paprikas that have been added to it. Paprikas carry through to next round. Each game took a few minutes, and at least two rounds were played every time.

Figure 1: Testing a paper version of the game

The next step was to realise our product. We used the resources of android guidelines to make sure the app would be integrated with the android experience. We also took heed to publications about patterns in the subject, so as to make sure to avoid known pitfalls. After doing several sketches and mockups, we continued to produce a running app. For the scope of the project, this had to include delimitations to what was actually the core of our product: the division of chores.

RESULTS

FINDING THE PROBLEM

From the interviews we learned that not everyone shared the same idea of what a chore was. There was a basic core on which everyone agreed, revolving around dishes and cleaning. Then came others that were more ambiguous. For some, cooking was a hobby and therefor not a chore. For others, fixing the car would not be called a chore since it takes place outside of the home, although it could be used as leverage when discussing chores. Household economy as well as gardening was also noted as dividing edges, where some felt they were chores, and others not. It was noted that most interviewees only discussed chores when irritated or in argument: “När nån är sur” (=”When someone’s grumpy”) was the common answer.

The division of the chores were in most cases clear: often the people living together had different preferences which made the division easy. Equality was also a prominent ideal found in our interviews. Other factors were time and convenience. All respondents reported to experience some stress connected to household chores, in concurrence with Thurston et al. (2011).

From our studies of earlier work and existing apps, we found that none (to our knowledge) has focused on the problem with a joint ownership perspective. The apps we studied (Agile Tasks; Business Tasks; CareZone; Cozi Family Organizer; GTasks; Producteev by Jive; Todoist) all involved todo-lists and the possibility of adding another person to a task. But the ownership, as seen in the app, was always to one person alone: the one who created the task. This could mean that some responsibility would always be experienced by this person and thereby, stress. Some of the apps had also gamified the experience so that rewards were obtained as tasks were completed. But we found none that tried to gamify the division of chores itself. The more family-oriented apps were, from our perspective, rather unimaginative: they all consisted of parents being able to give children chores. Empowering the children by giving them opportunity to take equal responsibility for the division itself was lacking.

FINDING THE SOLUTION

In our first user test, our concept proved interesting for all participants. As one expressed it: “It might still not be fun to do the chores, but this makes it a little less boring.” Some interesting dynamics arouse when playing, such as being able to do lots of chores one week and get lots of resources, so that the next week could be easier as all chores could be passed on. It also became apparent that the chores that no one wanted to do quickly gathered lots of resources, making them more valuable. A participant could then choose to do this chore instead of, say, three others, which seemed to be done in all groups. All in all, the concept was well received.

Mockups for our app were created using the guidelines from Android (2015). They were done in iterations where we first focused on internal navigation and form, and later aesthetic impression and emotional perspectives.

Our app, called *Dodo*, focuses on the shared responsibility of all users. Users join a household which shares the chores added to it. Each week, family members hold a meeting, every family member using the Dodo app from their own smart phone. At this meeting, the chores for the coming week will be randomly and numerically equally distributed among the participatory family members. Each chore will come with an in-game resource - a paprika - attached. If the member who got the chore doesn’t want it, he or she can send it to another member of the household, simply by clicking on an arrow. This will subtract a paprika from the user and adding it to the task, thus making the chore more appealing for others. The other option the user has is to accept the task at once and keep the paprikas for more boring tasks or more pressing times.

Figure 2: Mockup of the app

As a household member completes chores, the paprikas are added to that member’s stock to be used in coming weeks’ meetings. However, if the user has spent all paprikas, he or she will inevitably get the remainder of the chores in his/her list that week, as well as all the chores passed on by the neighbour user.

After the meeting, each member has a todo-list. In future versions, when a chore is completed it gets sent to another household member for checking. When checked, the resource is granted. If the chore is found to have been incomplete, it will go back to the owner to do again. This design choice was made to ensure that the household members will share a common view on what the chores amount to, in concurrence with the results found by Klein et al. (2009) that children find it difficult to do chores when they don't know what is expected of them. It will also heighten the collocational aspect of the app, as more communication in the real world would be a probable result. These hypotheses would have to be tested. In this initial version the owner of the task checks it when it is done, which transfers it from the todo-list to the done-list further down on the same page. This way the user will easily see what still needs to be done, but also all the things he or she already accomplished.

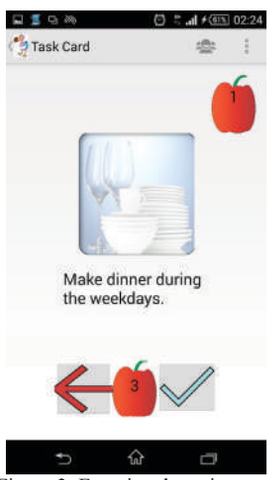

Figure 3: Functional version

DISCUSSION

During the work of this project we have found an interesting concept that we would like to develop further. As of now, the Dodo is a working prototype consisting of the core of our concept. It needs to be evaluated and tested, as well as enclosed in a productive package in order to make it a product anyone could use. We do believe that it addresses several important issues that have as yet been neglected by productivity apps: equality and shared responsibility in households. This has the possibility to lessen the load of those who today take the biggest part of the responsibility for the home and household, and perhaps ease the stress of everyday life. It might also involve children at a higher degree, as it might empower them to take this responsibility themselves, thereby preparing them for their adult lives.

Further, we would like to take use of the framework proposed by Lundgren et al. (2015). As of know, we have foremost used it as an evaluation tool. We have concluded that from the social perspective, the Dodo works with collaborational focus, although there is an ingredient of competition as well. Technologically, it takes use of symmetrical and free information distribution. As for the spatial and temporal perspectives, they both depend on which phase of the app is being used. During the family meeting, spatially and temporally the users will be bound by restrictions of the app. In between meetings, where the chores are being done, the limitations are much less pronounced. We believe this framework could be used not only as an evaluation tool, but that it could also bring interesting consequences if used as a design tool Given a longer time frame, we would have liked to use it to tweak our design, to see if some perspective-change could create exiting effects.

During the project, our division of labour has been rather strict, due to time restraints and interest. Although it did make our work more liable for delays, we found the work easier to do when we had fun doing it. This is a fact that we have pondered, and taken together with the answers in our interviews, it might be of importance for our app. We would like to develop the app to accommodate for preferences and aptitudes in a household. It would also be important to take in consideration the total amount of spare time each member of the household has, as this could be a factor in a division of chores. There are many strains to follow in productivity, and finding a good algorithm for division would be an interesting field to explore.

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APPLYING TANGIBLE OBJECTS TO APPROACH STAKEHOLDERS

YE SHEN
UNIVERSITY OF SOUTHERN DENMARK
YECHE13@STUDENT.SDU.DK

ABSTRACT

This paper sets out to present the iteration and transformation of user research methods, which were applied to approach different stakeholders in a participatory innovation project. The project was aiming to seek design solutions for reducing the falling rate in the hospital. How tangible objects were adopted to approach different stakeholders and inspire reflection and co-ideation will be addressed. By reflecting on the significant transformation of user research methods and the corresponding highly different results, this paper discusses the effects of using tangible objects in engaging stakeholders in thinking and reflecting, and how it matters that who and what materials were involved in the design process.

KEYWORDS

Participatory innovation, Co-ideation, Tangible objects, Methods

INTRODUCTION

The evolution from ‘design for users’ to ‘design with users’ brings a new world for designers, researchers and users to work with. People have been given more room in the early design phases to play their roles in providing expertise and participating in the informing, ideating, and conceptualizing activities since the 1970s. (Sanders & Stappers, 2008) Through engaging users in the design process, on the one hand, designers and researchers can gain a better understanding and more insights about their design target groups. On the other hand, as argued by Buur and Larsen in 2010, it’s crucial for the meeting of different stakeholders because crossing intentions can create new insight and movement of thought and action. (Buur & Larsen, 2010). In a word, designers are getting closer to the future users of what they design by using different participatory design (PD) methods such as user observation, co-design sessions and so on.

In the practice of PD methods, how tangible objects connect different stakeholders and designers drew my attention. People with different backgrounds and disciplines always have different ways of thinking and practices, even speaking different languages. (Heinemann, Boess, Landgrebe, Mitchell & Nevile, 2011) Moreover, our design practice indicated the positive effects of tangible objects in mediating the communication and collaboration between different professionals. The tangible objects play a crucial role in shortening the distance between different stakeholders; therefore maximize the inputs of their abilities, skills and expertise in the early stages of design process. But the burning question is what kind of materials and who should be involved in the iteration of the design process?

RELATED WORK

Participatory innovation (Buur and Matthews 2008) is an approach, exploring the combination of participatory design and design anthropology towards a business orientation. (Buur & Larsen, 2010) The theme of the participatory innovation project that we worked on was fall. As we know that many elderly (+65) injured or even died every year as a result of falls. The goal of the project was to better understand why the elderly falling, and then search for a product or service development. Our team was mainly focusing on coming up with design solutions in reducing the rate of falling when the elderly are hospitalized; in other words, was to prevent patients falling in the hospital.

The design team was made up of three IT-product design students from the University of Southern Denmark. The organization we collaborated with was an orthopaedic surgery ward in Kolding Hospital, Denmark. Besides, researchers and nurse within the field from Brighton University Hospital shared knowledge with us through Skype meetings as well. In

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the early beginning, most of the user studies about the elderly and falls were conducted in Physiotherapist Center Vejle, Denmark.

THE ITERATION OF USER RESEARCH METHODS

In the practice of PD methods, the research methods we established to do are: *normal interviews, group interview with tangible objects*, and *scenario interviews with four scenario pictures* (Figure1).

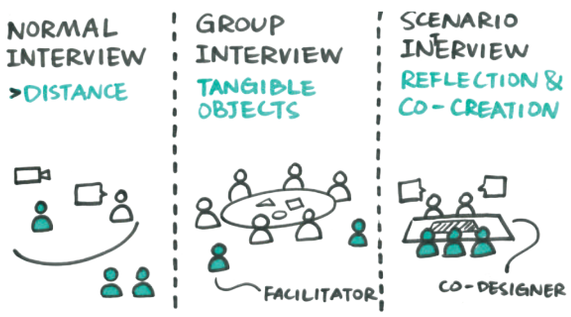

Figure 1 The iteration of user research methods

In the early stage, interview with elderly whose age is above 65 helped us gain an overview of their life and details of their falling experience. However, due to that the elderly were asked the questions frequently about their life dilemma and falling experience, some of them felt very sad to answer and talk to the designer about their bad memories and life experience. What's more, because the elderly can only speak Danish, and in our group only one member is Danish. It's turned out to be an awkward situation for another two, who can only stand behind the camera and contribute nothing. Then it resulted that the Danish team member had a huge workload of translating all the interviews into English.

In order to dig into deeper and understand the elderly's helper network and daily dilemma, a group interview was conducted in Vejle as well. Regarding to the uncomfortable interview experience we brought to the elderly and few analysis results we got in the early interviews, we started to change the way to collaborate with them. This was inspired by a research article that propose to use "things to think with" for user research. (Heinemann, Boess, Landgrebe, Mitchell & Nevile, 2011) In Physiotherapist Center Vejle, six elderly were invited to participate in a group interview (Figure2). They were given the tasks to choose one daily object and several personas, to map out their helper network and tell a story about their daily dilemma. In the group interview, they were encouraged to discuss with each other and support each other if they had similar experiences.

Figure 2 The group interview

The group interview went quite well, especially, when the elderly had something in their hands, they naturally started to play with them and even made jokes with each other. The objects created a fun and pleasing atmosphere, so the elderly told a lot about their life experience and their individual important roles in daily life. During the whole interview, a lot of interesting conversations were generated, thus providing designers a rich data to analyze.

THE EMERGING OF SCENARIO INTERVIEW AND ITS SIGNIFICANT MEANING

The emerging of scenario interview was mainly based on the situations that we experienced while following the nurses. By getting closer to the real lives and experiences of potential future users, designers increase the likelihood that the product or service designed meets the user's needs. (Kouprie & Visser 2009) When moving on to the orthopaedic surgery ward of Kolding Hospital, we had the opportunities to be in the situation and experience the real life and environment of patients be in hospitalized.

From the designers' perspective and observation, those dangerous or emergency situations were tagged by possibilities of causing elder falling in hospital. For example, one dangerous situation we saw in the ward was an old woman who just got surgery few days ago, was left alone in the corner by her physiotherapist after training. The physiotherapist told her the nurse would come to pick her up soon, so she was sitting on the chair and the trolley was in the opposite direction. However, the nurse came back after a long time. Apparently, it was because of that there was a lack of communication between nurses and physiotherapist or some other reasons, which lead to the bad situation.

Meanwhile, inspired by the experience with group interview in Vejle, which using tangible objects to meditate the discussion and communication, we highly believe that the tangible objects would help to talk with patients and nurses, thus let them reflect on those situations. Besides, as Schön argued that the designer is not clear how to solve the problem beforehand and ensure what information is needed. (Schön, 1983) So it's necessary for designers to engage users in a reflective conversation with the problem. (Brandt, E. 2007) According to the observation and interview results, four scenario pictures (Figure 3) based on four

situations were made and brought back to hospital for nurses and patients to reflect on and discuss with.

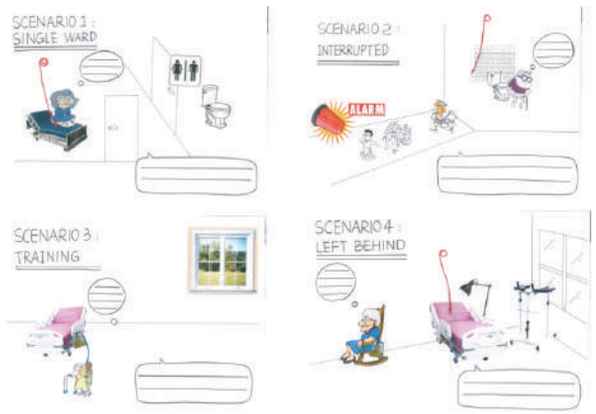

Figure 3 Four scenario pictures

In the scenario interview, the nurses were highly engaged in the discussion as we have been expected. The head nurse was very busy on that day, so she asked her colleague to do the interview with us at the beginning. Moreover, when we started to talk about the scenario pictures, the head nurse was attracted by the picture and turned around to us naturally (Figure 4), and then joined the interview. They were engaged in discussing why it happened and what can be done to avoid the danger, some of the nurses even reflected on their previous experience. Surprisingly, in the end they even started to come up with ideas on interior design that can happen in the future.

Figure 2 The head nurse Heidi joined the scenario interview

DISCUSSION

THE EFFECTS OF TANGIBLE OBJECTS IN THE DESIGN PROCESS

Tools for supporting expression

In the user studies, the tangible objects showed their potential to be served as tools for supporting describing, which is also fitted to the views in “making sense of things”. (Heinemann, Boess, Landgrebe, Mitchell & Nevile, 2011) For instance the daily objects and personas were used to support the elderly to tell their stories and discuss with others. The effects of tangible objects in supporting words and expression were broadly apparent; even offset the language issues to some extent.

Tools for reflection on reality

In addition, the tangible objects were also used as tools for reflecting on the current situations. The scenario pictures which come from the reality stimulated their interests and reminded of nurses’ memories, let them think about what they do every day and reflect on similar situations that they encounter, which then provided a lot of useful feedback for designers to analyze and gain insights.

Tools for provoking thinking

In a way, the tangible objects acted as boundary objects, which spanned the gap between the different competencies and interests of participants in the design. (Brant, 2007) So the tangible objects were unconsciously served as tools to provoke professionals thinking about possible solutions and the design development. Combining the experience and professional knowledge that they brought, the nurses gave us the most reliable feedback on the scenario pictures.

HOW AND WHY THE TANGIBLE OBJECTS INFLUENCE PATIENTS AND PROFESSIONALS’ THINKING?

Based on the reality is crucial for provoking and inspiring them. The tangible material either come from their daily life or is based on the reality; the objects and the situations were familiar to them. As argued by Rosenqvist and Heimdal *“reality is an integrated and important part of participatory encounters where hypothetical spaces are created.”* (Rosenqvist and Heimdal, 2011:50) Besides, compare to boring verbal or text description, the tangible objects were more attractive for them to reflect on and discuss with.

WHETHER THE STAKEHOLDERS ARE APPROPRIATE TO BE INVOLVED IN THE CO-IDEATION PROCESS?

In the scenario interview session, only patients and nurses participated. It’s worthy to tell that engage professionals, for example nurses are quite helpful for gaining valuable results. Moreover, there is a very important role missing, the physiotherapist, especially the one we observed while following the nurses. Regarding to the dangerous situation that mentioned before, the physiotherapist should be a very important group need to be involved in the discussion and gave feedback from our observation.

IS THE TANGIBLE OBJECTS OPEN ENOUGH FOR USERS’ IMAGINATION? HOW TO IMPROVE?

First of all, the scenario pictures were two-dimensional, according to the feedback from researchers and nurse of the Brighton University Hospital, if the scenario picture

could be designed in three dimensions, then users can play the objects and map out the situation by their own, it might be better. Furthermore, engaging users in creating the objects for instance the small figures or hospital facilities during the co-ideation session, and then let them establish the situation; it can be more challenge for them to think about and reflect on.

CONCLUSION

The tangible objects support stakeholders to describe and discuss with others, and attract them to reflect on the past and provoke them to think of the future. Thereby the author proposes that the use of tangible objects is a good way to approach different stakeholders in participatory design practice. Especially, for people carrying out interviews with relatively little experience of interviewing, the use of tangible objects can bring a relatively more data.

However, it is worthwhile to note that, being careful in choosing the materials and being prepared before the co-ideation session is quite necessary. Based on the reality or lean close to users' life that they are familiar with is a crucial point for the success of the tangible objects. In addition, engaging professionals, especially those who are most related to the project could bring more valuable results for design inputs.

ACKNOWLEDGMENTS

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LANTERN IN THE DARK – EXPLORING COLLOCATED INTERACTIONS

CHRISTIAN CARLSSON
CHALMERS UNIVERSITY OF TECHNOLOGY
CHRCAR@STUDENT.CHALMERS.SE

MYLÈNE MENGUAL
CHALMERS UNIVERSITY OF TECHNOLOGY,
MENGUAL@STUDENT.CHALMERS.SE

AXEL PELLING
CHALMERS UNIVERSITY OF TECHNOLOGY
PELLING@STUDENT.CHALMERS.SE

ABSTRACT

Touch devices started to play a prominent role in in 2007 with the release of the first iPhone. The activities involving a smart device include long distance communications, individual work or game and collaborations on a single display. However, the area of collocated interactions between devices has been left almost unexplored. A board game, Lantern in the Dark, was created using mobile phones as physical building blocks in a collocated environment in order to explore a virtual area. The results show that people quickly overcame the difficulty of the new interaction and even built strategies around it.

INTRODUCTION

Mobile phones today are our go-to device when checking news, social-networks, taking photos and more (Lundgren et al. 2015). Collocated interaction, known as face-to-face interaction, is a rare feature in applications and the phones today have limited technologies that support it. Sharing a photo for example in a collocated environment usually ends with a user sending around the phone itself rather than sharing it to the group's phones.

This paper will discuss the concept of using mobile phones as physical building blocks in a collocated environment. The results will therefore not only utilize touch screens and sensors for the interactions. It can be seen as using the phones as pieces in a board game. To showcase the concept we developed a basic game, called Lantern in the Dark. The game features a lumberjack called Sven, who is trying to find his way home in the dark winter night. For each move, a phone is placed where the players want the lumberjack to move next. The whole process, from the theory through the implementation to the evaluation, is presented here.

THEORETICAL BACKGROUND

During this project we used a framework that specializes in collocated interactions provided in the paper "Designing Mobile Experiences for Collocated Interaction" by Lundgren et al. (2015). The framework focuses on four different design perspectives that help designers to systematically create a concept.

The *social perspective* helps with social aspects of how users interact with each other and what social actions have to be made. The *technological perspective* concerns the user's devices and about the limitations with each of them. The *spatial perspective* involves the location of the users and what the distance between the users is. The *temporal perspective* encompasses the order of actions and how the intensity of the actions are, relative to time.

Each of the perspective then has several properties that go more in depth about the perspectives. The framework can be used for ideation to get initial ideas for the concept. It is advised to choose 4-6 properties and then go from there.

Lucero et al. (2011) proposed a set of principles they call the principles of Social and Spatial Interaction. These are: *Social*: Sharing devices to reach a common goal; *Spatial*: Using the phones relative position to each other for interaction, *Tangible*: Using phones as a tangible user interface to manipulate data and *Multimodal*: Giving the user multiple interaction and feedback possibilities. The premise of the principles is to extend the individual use of mobile phones to support shared collocated interaction.

CONCEPT CREATION

The framework by Lundgren et al. (2015) and the SSI principles by Lucero et al. (2011) helped us discover the area of using the phones as tangible pieces. The *Spatial*

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and *Tangible* principles especially influenced us when working with our concept.

The first iteration of the concept was originally inspired by the "hacking" mini-game in the first person shooter BioShock (Bioshock Wiki, 2014). In order to hack safes, turrets etc. the player has to connect flowing water from one location to another in a grid system using pipes. These kinds of games date back to 1980s. Our first idea was to use phones as the pipe pieces in the grid, using the phones' sensors to detect their rotation and movement and use that to rotate and move the pipes. The problem is that to have a big enough grid system, we would require a lot of phones, a 5x5 grid would require 25 phones. However, we liked the basic concept of using phones as building blocks, and tried to further develop the idea.

Instead of using many phones as the whole game board, we use the phones to build the game board. Sort of like how the snake moves in the classic Snake game. One of the phones is randomly selected as the starting point. That phone is placed in the playing area (usually a table with players sitting around it), then the players have to decide which direction they want to go, in this first instance they can go forwards, backwards, left and right. They then place a phone in the direction they want to move. For example, if they want to go left, they place the second phone to the left of the starting phone. They can't move where a phone is already placed. The goal is to help the character (the lumberjack, Sven), find his way home. Placing phones makes Sven move from the previous phone to the newly placed one. This creates a snake-like structure made up of phones. To help the players, we thought of having Sven get warmer or colder depending on if he gets closer or further away from his home each time a phone is placed. To show this warm/cold relation, we would have a slider shown on the all of the phones. When a move was made, the slider would change, to let the players know whether they are moving in the right direction.

EVALUATION OF CONCEPT

The idea behind our concept is to allow a group of collocated people to explore an area in order to reach a goal by placing phones on a table. What we needed to do was to find out which interaction would be best for the concept, i.e. how to move from one phone to another and how to get proper feedback about the position. We realized a pre-study divided into two parts in order to find out what would be the most intuitive solution without making the game too easy.

The first part focused on the navigation by using paper prototypes to realize a user test. Looking at the technology smartphones have today, there is not really one that can make the concept fully realized. We thought about using accelerometers, or some other sensor to detect the movement and position of the phones, but for the purposes of this study and exploring the concept, we wanted a simpler solution to determine movement and position.

The solution we came up with was to use navigational arrows on the screen to fake the phone placing interaction. The phones themselves don't sense each other but they share their own theoretical position data with the others. It is therefore crucial that the users place their phones in a correct order. In order to find the most intuitive interaction of how the navigational arrows would be placed and how they would work we conducted a user test. The user test consisted of three paper prototypes that had different layout for the arrows. To make the participants sure of how the different prototypes works, we gave an explanation for all three of them.

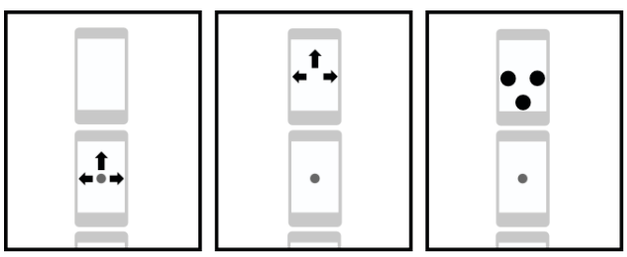

Figure 1: (a), (b), (c) Paper prototypes used during the evaluation of the concept

The first prototype (figure 1.a) had arrows pointing in all possible directions on the first phone, so if the user would press on an arrow, let's say the forwards arrow, the character would move forwards and enter the second phone from the bottom of its screen. The second prototype (figure 1.b) had arrows on the second phone, which meant that the phone was basically a remote control for the character on the first phone. Users would press the forwards arrow on the second phone which made the character go forwards and enter from the bottom on the second phone. The final prototype (figure 1.c) was similar to the second one but instead of using the phone as a remote, the second screen would have "come here" bubbles, which means that the phone would be placed at the desired placed and then a bubble would be selected to say "come here" to the character.

The study involved three participants, who took part in the same session since collaboration is key here. The result of the user test was that the first prototype felt the most natural. Having the navigational arrows on the first phone meant that the users didn't have to consider using both phones when doing one action. Having the second phone as a controller also resulted in that it was more important to put the phone on the right place before pressing an arrow.

The second part focused on the feedback that the users can get from the system. A discussion about that subject was conducted with the same participants. The idea of the warmer/colder slider was presented to them and they were asked to give their opinion on it. The general comments about this were that a slider would make the game too trivial as you could probably find the right

direction in just a couple of moves. One of the participants said that less precise feedback could help promote the discussion on where to go next and therefore the collaboration. While the game was never meant to be too complex since it was made to test the concept of using phones as building blocks, we could see their point. Instead of having the slider, they suggested we use sounds that could be played when Sven went further away and closer to home respectively. Moreover, based on the *Multimodal* SSI principle Lucero et al. (2011), multiple types of feedback are always better.

IMPLEMENTATION

Based on the previous study, a prototype was implemented. The system and the interactions with players rely on different levels of interpretations.

As mentioned before, the purpose of the game is to move from a starting point to the exit, both assigned by the system and unknown to the players. The order of the phones is randomized at the beginning but remains the same in the later steps. In the following section, "phone" and "device" will designate the physical object while "screen" and "interface" will designate what is displayed.

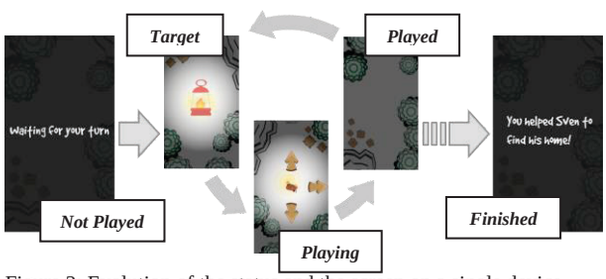

Figure 2: Evolution of the status and the screen on a single device

Each turn, a phone is assigned with a status and its corresponding screen (figure 2): *Not Played*, *Target*, *Playing* and *Played*. *Target* displays a lantern to draw the attention of players on the imminent move of the corresponding device. *Playing* shows Sven (viewed from above) and arrows to make a decision about the direction to take. Finally, a grey layout when it comes to already explored areas is displayed for the *Played* status. All three of them have a forest background, in contrast to the *Not Played* status, which simply shows a dark screen with the words "Waiting for your turn", making obvious that the phone has for now no impact on the game.

It starts when one phone is displaying the *Playing* interface. As shown in figure 3.a, all the other phones are not in play, with either the status *Target* or *Not Played*. All along the game, *Playing* is the screen where Sven currently is and where a decision about the next move will be made. Players provide their instructions to the system by pressing one of the displayed arrows, which disappears once this has been done. Sven then walks to the next phone in line, which is currently *Target* and will be placed on the board at the required position (figure 3.a). The turn is now over. In the next one, as explained in figure 3, the device displaying *Target* becomes *Playing*, which in turns becomes *Played*. One of the *Not Played* phones turns into the next *Target*. This scenario is repeated until there are no more phones. Then already *Played* phones (which are placed in the queue figure 3.b) can be reused, following the same order. From the second turn on, another interaction is added. Sven appears from the side where the previous phone is located. A popup message "you feel colder" or "warmer" is displayed depending on if the lumberjack is further away or closer to the exit, while a sound evoking a howling wind or a fire in a chimney is played, in order to give feedback about the current position. The only arrows that are displayed are the ones pointing to playable directions. The non-allowed positions are defined by the sides of the grid (players can't get out of it) and the places already occupied by *Played* phones. The loop *Target-Playing-Played* (figure 2) ends by winning the game.

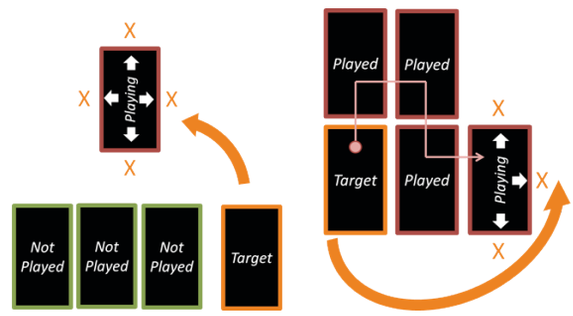

Figure 3: (a) first round, (b) later steps in the game. The green cards are not played yet, the orange one is about to be played (again in figure b) and the red ones have been already played. The playable positions are shown with the orange X. On figure b, the path followed is highlighted.

EVALUATION OF THE PROTOTYPE

In order to evaluate the interaction and concept of the finished prototype, a second user test was conducted. There were two different steps in the study: observation with as little intervention from the moderator as possible and discussion.

Firstly, the four participants of our study were handed a phone and then told to connect. Since the goal was to test the experience of someone playing the game for the first time, no explanation was provided about how to play. The participants got to play through a round of the game from start to finish while we observed. We paid extra attention to the following factors: if the game was easy to understand and if the participants collaborated and discussed decision-making. Afterwards a couple of questions were asked to get their feelings towards the game and concept.

Overall, the participants enjoyed playing the game and thought the concept was promising. The only significant problem encountered by the participants was at the very first turn. As they didn't know that the game is played with phones on the table, the first player clicked an arrow with the phone still in their hand. We intervened

at this point, telling the participants to put their phones on the table. Other than that, the game played out smoothly, with everyone discussing about where to go. The interactions - giving instructions and getting feedback - were easily understood and well used, which made the players quickly focus on the game itself. Since the game is not very complex, it did not take long for users to adopt the proper strategy and to win. This could be considered a downside due to the lack of challenge. The discussion provided some more in-depth perspectives and explanations. The comments were mostly about the issue encountered at the start of the game and how the gameplay could be improved. To make the game easier for the first time players, the participants recommended us to have a short tutorial in the start of the game. The queuing phones were also considered annoying if they have no other purpose in the game than preventing Sven from going back to that position. A gameplay mechanic should be invented to motivate this as well as to increase the difficulty. One idea to solve this issue was raised: something could chase the character and be seen on the previous phones. This would also introduce a time condition and make people take fast decisions.

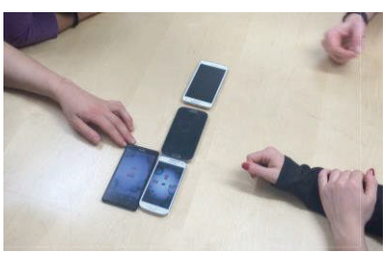

Figure 4: Participants playing during the evaluation of the prototype

DISCUSSION

The results we have from the user tests and the general thoughts from people who were playing the game suggest that the concept is interesting and unexplored. The different points to discuss for further steps are the following ones: the use of sensors and output as well as a way to create a better coherency between the gameplay mechanics and the algorithm developed for the game.

We explained earlier the reasons why we chose not to use any kind of sensor. However, it would be good to compare our results with other kinds of navigation, like using the accelerometer in a clever way. It should also be taken into account that removing arrows also means removing feedback about the playable directions to take. On a more general scale, all feedback could be improved, for example, by using vibrations. It could either break the experience or enhance it, but in order to fully give an opinion about it, it has to be tested. It could make it easier for the users to know which phone that had to be placed next, but the sound could be irritating after a while, we all know how it sounds when a phone is vibrating on a hard surface.

Even more important is to work on the gameplay. As a basis, the prototype was interesting and participants liked using the physical aspect of the phone as well as the interactions with the system and among the devices. Everything was quite intuitive, even though some information at the beginning should be provided. However, as already mentioned, some more thoughts have to be done on the motivation for not allowing players to move to a position already occupied by a *Played* phone. Something chasing Sven, following the same path and displayed on those phones is a quite interesting idea. On the other hand, a solution could be to allow only one step backwards, but in this case, it would probably be better to re-use the previous phone and not have the players stack a second phone on top of the other. Also, the grid system has the downside of having a limit, preventing players from going out of it when they are at the edge. This means there is a pattern of moves that could lock the players in with nowhere to go. Ideally, it should be possible to explore the area without any constraint of this type, since it would fit better the forest environment used in the game.

Other focuses could also be taken into account, like the battery life. For now having the screens always on is not a big issue since a game only lasts a couple of minutes, but adding complexity to the gameplay would automatically increase the time spent to play. Also, the different screen sizes between the devices are a potential issue in later steps, even though we didn't encounter any difficulty in our study. A good balance between the game and technology requirements would have to be defined.

CONCLUSION

This paper has investigated the concept of using mobile phones as building blocks for a game, Lantern in the Dark. The game lets players use their phones to guide a lumberjack through the dark winter night, to find his way home. Through the development and evaluation of this game, we have found that the concept was easily understood and it has potential but requires more exploration to fully utilize collocated interaction possibilities between mobile phones.

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VALUE CREATION IN PARTICIPATORY DESIGN – DESIGN THINKING IN AN EXPERIENCE ECONOMY PERSPECTIVE

LASSE WAGNER
MA EXPERIENCE ECONOMY
AARHUS UNIVERSITY
LASSE.WAGNER@GMAIL.COM

KRISTOFFER MØLSTRØM
MA EXPERIENCE ECONOMY
AARHUS UNIVERSITY
KRISTOFFERMOLSTROM@GMAIL.COM

JULIE ØSTERGAARD JENSEN
MA EXPERIENCE ECONOMY
AARHUS UNIVERSITY
JULIEOSTERGAARDJENSEN@GMAIL.COM

ABSTRACT

This paper explores the coupling of the participatory design's concept of value creation and experience economy and aims to illustrate how design thinking in an experience economy perspective can be unfold. Our main purpose is to investigate the different meanings of value creation in participatory design and experience economy respectively. These two perspectives, on how to create value, can be seen – and should be seen – as two mutually beneficial approaches to create value in both the design process and end-design. Drawing from the concept of emergent boundary objects the paper presents a model to illustrate how one can embed value creation when designing the design process to root value creation in both process and end-design. And hereby design a more complex multi faceted experience for the end-user of the design.

AUTHOR KEYWORDS
Value creation, participatory design, experience economy, boundary objects, design thinking, wicked problems, design situation.

INTRODUCTION

The concept of value creation has long been investigated and problematised; still, the definition and connotations of value creation vary in the many academic traditions. In both Participatory Design (PD) and experience economy value creation is a central concept. Yet their understandings of value differ from one another. As students in both design and experience economy, we understand our framing and dialogical conversation with the situation a deciding factor in the final result and end-design: We are schooled to consider the value that our design aims to conceive, and how the intentional designing of the process can affect this. This paper continues the line of thought on how central concepts in design thinking resonates with the pragmatist philosophy of John Dewey. The argument put forward here is that not only is there a large degree of convergence between the pragmatist perspective and design thinking, but the combination of this line of thinking with that of emergent boundary objects can be used as a prescriptive conceptual scaffold for design thinking and the design of the design process. Thus, the design situation is not to be understood in the singular or as an essence, but is rather realised as a social process. In this way, a pragmatist approach combined with boundary object theory can act as a conceptual foundation to both develop and explain design as a discourse, but also as a prescriptive vehicle to assist design in practice (Dalsgaard 2014).

The aim of this paper is to combine the understanding of value creation in the field of experience economy with the concept of value creation in the study of PD.

METHODS

We have worked with the philosophical position of pragmatism as a conceptual scaffold for design thinking to examine working practically with value creation in relation to PD. Through the experience economic terminology and conceptual understanding we investigate and work with PD, and thus combine the

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understanding of value creation in the field of experience economy and PD respectively, in order to root value throughout the entire process and end-design. On this basis we have developed a model (figure 1, 2 & 3), which has been applied to evaluate, and problematise different design decisions in the design process of a specific interaction design. During the production of the design, the current state of the model evolved to illustrate how one can work with value creation in designs and design processes.

PARTICIPATORY DESIGN IN EXPERIENCE ECONOMY

Amongst others, Boswijk (2007) argues that the understanding and connotation of value in the field of experience economy mainly focuses on how to make experiences that create value and meaningfulness for the user who engage with the experience design. Value in the tradition of experience economy is understood as something beyond that of economic worth and refers to what a person or group consider important and meaningful in their lives (Boswijk 2007).

Furthermore, the experience economy takes its departure in how immaterial values can be a requisite to create valuable and meaningful experiences for people. With a special reference to immaterial values such as cultural, symbolic, social or emotional values (Arvidsson & Peitersen 2013). The primary purpose and relevance for experience economy in the field of design is to develop experience designs based on the knowledge of the immaterial values the user finds important and valuable. When you have this knowledge you can develop a materialised design that represents an immaterial value and then the user can engage in a meaningful and valuable experience (Knudsen et al. 2015: 1f).

The field of PD has evolved since its beginning four decades ago. The general understanding of PD's approach is to create participation in the design process and on that basis entail stakeholders to feel joined and involved in the process. Iversen et al. (2010) however emphasise that having stakeholders participate during the design process does not necessarily qualify as PD and furthermore, PD is not only the use of participatory methods. They point out the notion that PD is about negotiating values – a "moral proposition" that is realised through participation between stakeholders (Iversen et al. 2010: 90f). Furthermore, from Iversen's perspective value in the design process is seen as an ethos that respect people's democratic rights: Those individuals who are going to be affected by the design outcome ought to have a substantive say in what that outcome is (Iversen et al. 2010: 91). In this perspective it is important that designers and stakeholders can bring value to the fore by having a dialogue with the different design interests and the expected outcome of the design. The approach of PD in the light of value creation is thus a participatory dialogue between stakeholders about developing and grounding value in the design process so the design outcome illustrates a common understanding of value between designers and stakeholders. The creation of value happens through interaction, engagement and collaboration between designer and stakeholders.

Through a specific design project we have gained the knowledge that it is important in the design process to actively involve stakeholders and end-users with the purpose of creating a common understanding of the design's embedded immaterial value. Therefore, with our background in the experience economy we use the academic field of PD as a realm of understanding and a tool to develop designs, which create experiences and value for end-users.

DESIGNING THE DESIGN PROCESS FOR VALUE CREATION: BOUNDARY ZONES AND EMERGENT BOUNDARY OBJECTS

We will argue that combining the fields of PD and experience economy can be used as a reference point in the creation of value throughout the whole design process. In other words, by combining these two approaches the boundary objects in the design process will be linked to the understanding of value creation.

Originally coined by Star & Griesemer (1989) the term boundary object is understood as "an object that lives in multiple social worlds and which has different identities in each". In direct continuation of this, Dalsgaard et. al (2014) investigate how such objects have different meanings in the world of design, "but at the same time entail common structures that can facilitate and maintain coherence across intersecting social worlds" (Dalsgaard et. al 2014: 745). Thus they show how the concepts of boundary zones and emergent boundary objects can support the articulation and analysis of the way design concepts emerge and are shaped through ongoing negotiations and reifications. The boundary zone within the design situation is "a conceptual space, rather than a physical space, in which interests of different stakeholders in a design project – be they individuals or groups – overlap, and shared agendas can be negotiated and acted upon" (Dalsgaard et. al 2014: 745).

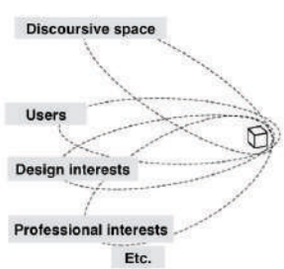

Figure 1: Example diagram of boundary zone and emergent boundary objects. The boundary zones are represented by overlaps between different social worlds. An emergent boundary object is illustrated in the boundary zone between these social spheres.

The design situation as such, is thus not to be understood structurally but must be informed in a dialogical social process. The design solution to a given situation consequently reflects this socialised practice that the effort in working with the design problem has been. These design situations can be characterised by Schön's (1983) concept of "underdetermined problems" or "messy situations" or by Rittel's (1974) term "wicked problem". In research the concept is often encountered under the term "Research Through Design", which emphasises that research is done to develop the field of design without having any fixed methods to utilise (Dalsgaard 2014).

To design can simply be reduced to creating something that changes people's lives and practices (Löwgren & Stolterman 2008). Thus, as designers we do not solve problems with a corresponding solution that furthermore can be designated as either right or wrong (Buchanan 1992). According to Schön (1983: 8) design bears the mark of "uncertainty, uniqueness and conflict", while Buchanan (1992) and Löwgren and Stolterman (2004) articulate design as an ultimate particular: Our design process and situation is unique and is informed and shaped by us as designers, while no panacea exists to follow and guide us. At the same time, our intervention and dialogical conversation with the situation is changing the design context – creating new and unforeseen consequences that possibly will foster new wicked problems (Buchanan 1992: 16). As designers we are thus tied hand and foot to our idiosyncratic history and selves and hence also a part of the design situation – due to the dialectic between the design situation as both the cause and area for the design process. Our actions count: They shape and transform the situation and ultimately the value contained in the end-design (Gedenryd 1998; Hallnäs & Redström 2006).

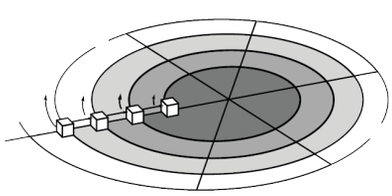

Figure 2: Design is iterative, situated and systemic and described by Hallnäs & Redström (2006) as overcoming a "*hermeneutical gap*" between the existing situation and the product of the design process and between designers' current understandings and the crystallisation of ideas and concepts embodied by the product itself (Dalsgaard 2014: 145).

To be faced with these wicked problems entails an extensive amount of complexity and a vast number of possibilities to intervene in addition to a host of constant shifting contextual factors and opportunities (Stolterman 2008: 57). But, as the aforementioned states we have to frame and focus our studies of the situation to centre on the dimensions to have a leading role in the creation of the design (Löwgren & Stolterman 2004: 31). As inexperienced designers it may seem staggering to face this number of infinite possibilities, and a prevalent strategy when facing complexity is naturally to attempt to reduce it. However, one simultaneously obtains a lack of richness and diversity when reducing the complexity with an arbitrary focus in the desire of a more controllable setting (Buchanan 1992; Thackara 2005; Rogers 2004). As designers and experience economists it is our framing and dialogical conversation with the situation that is a deciding factor in the end-design.

With inspiration from Basballe (2012) and Dalsgaard (2014) the model below sums up the aforementioned perspectives to illustrate how the constant development of the design and design process is regulated by the reciprocal proportions of a vast number of factors: stakeholders, materials, group dynamics, discourses etc. In this perspective, the design is to be understood as an emergent boundary object – constantly evolving and emerging through an on-going negotiation and reification. All design activities can thus meta theoretically be framed and explained through shifting considerations and changeable zones. This is illustrated by the "biased domains" based on deliberate reflections on the design process, which facilities and informs the decision on which design artefacts to utilise.

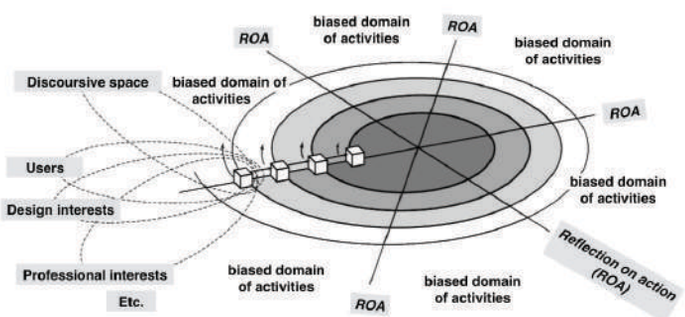

Figure 3: Illustration on how one can work with value creation in designs and design processes. The design is understood as an emergent boundary object that emerges and is shaped through ongoing negotiations and reifications in a boundary zone. Reflections throughout the design process (cf. Schöns (1983) concept of "reflection on action") help focus the design process.

To create value in design one must not choose an arbitrary focus or technology to apply to the design situation. One should focus the activities to inform and strengthen the value creation process and not be tempted to shift the focus to current trends and exciting new technologies. Furthermore, in an experience economy perspective it is not the users' interactions with the design itself, but the long-term value it creates and how this resonates to create lasting symbolic, emotional and economic value. In this perspective, an affective impact by the design itself is of no interest. The affect and interaction must be rooted in a higher-ranking purpose of creating lasting value.

CONCLUSION

This paper illustrates how value creation can be used as a framework throughout the design process by combining the approach of PD and the field of experience economy. This approach does not primarily focus on technology or the users' interaction with the design but instead on the long-term immaterial value the interaction induces.

The combination of different comprehensions of value creation from PD and experience economy enable designers to make use of co-creation and user involvement both in the process and the end-design. And then strengthening the collaboration between designers and users throughout the design process. The designer's continuous dialogical approach to the design situation allows the process and end-design to affect and be affected respectively by each other in an on-going development.

Design thinking in an experience economy perspective can unfold how the interaction with a design must be rooted in a higher-ranking purpose of creating lasting immaterial value, such as social, cultural or emotional values. By focusing on a two-sided co-creation it is possible for the users to cooperate and be a part of the decision making about the longer lasting value creation the design should represent.

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#BADUX: TWEETING ABOUT BAD USER EXPERIENCES

AIDA FREIXANET VIEJO
STUDENT AT HUMAN CENTRED INFORMATICS MASTER. AALBORG UNIVERSITY
AIDAFREIXANET@GMAIL.COM

ABSTRACT

Increasingly, people turn to social media, such as Twitter and Facebook, to share their positive and negative experiences on a variety of topics. One such topic is the actual user experience of the products and services they interact with. In this pilot study, we analyze the instances of bad user experience (UX) that people share on Twitter, which could provide valuable insights for UX research. Our results show that UX is affected by broad range of different issues, with interaction being the most important one. These issues are found mainly in Web and mobile environments, although people also report bad UX using physical products and on real-world locations. Furthermore, many of these issues could be detected and solved if companies performed regular testing and quality assurance checks.

INTRODUCTION

People increasingly turn to social media to share their own experiences, thoughts, and other types of content. A popular example is the micro-blogging service Twitter, which allows its users to post so-called *tweets*: messages limited to 140 characters, which can include images and links as well. Research has shown that common intentions behind a user's tweets include chatter about daily routines or current activities, conversations with other Twitter users, sharing information, and reporting the latest news or current events (Java et al., 2007). Twitter's growing popularity has also resulted in an increasing number of users expressing and sharing their positive and negative experiences with the products, websites, and services they daily interact with. For example, a large volume of user experience (UX) complaints are commonly signaled on Twitter using the term 'badux' and the corresponding hashtag '#badux'. A better understanding of these UX-related issues could translate in a greater understanding of which UX issues are most common and which are most important to users.

In this paper, we describe a data-driven pilot study with the objective of analyzing which types of experience people on Twitter most commonly identify as "bad user experience". More specifically, we aim to answer the following two research questions:

1. Which aspects do Twitter users complain about?
2. Which products and services are these complaints centered around?

Together, the answers to our research questions can be seen as a checklist of UX issues that companies should check before releasing new products or services. In addition, our work provides a better understanding of what people consider to be bad user experience and which aspects are most pertinent.

LITERATURE AND THEORY

There is no previous work related to the analysis of bad users experiences reported on Twitter, but there exists a lot of related work on analyzing and classifying tweets. Java et al. (2007) proposed a framework of user intentions for use of Twitter based on an analysis of over 1.3 million tweets. They found that "people use micro-blogging to talk about their daily activities and to seek or share information" (Java et al., 2007, p. ?), which supports the use of Twitter as a resource for studying which types of bad user experience people are having. Preliminary research and previous work has shown how users share their personal opinions and express their frustrations and emotions on Twitter. In

In Lucero, A., Castañeda, M., Bang A.L. and Buur, J. (2015). Embodied Interactions, Proceedings of Sider 15, March 27-28, Kolding, Denmark

this paper, we are interested in user frustrations with regard to a product or a service.

Kouloumpis, Wilson, & Moore (2011) present an approach on sentiment analysis—detecting the sentiment expressed in a text—tailored specifically to Twitter. They argue that existing lexical resources for sentiment analysis may not be useful in the microblogging domain, and stress the importance of the hashtags and emoticons. Agarwal et al. (2011) propose also a Twitter-specific approach to sentiment analysis.

Another relevant sudy analyises the amount of UX information present in online reviews in Amazon and epinions.com related to sofware and video games. The study focus on how different dimensions of UX are shown and which kind of vocabulary is used.

DATA AND METHODS

DATA COLLECTION

The goal of our pilot study was to examine how people report bad user experiences on Twitter and which products and services these apply to. Preliminary investigation showed that a large number of bad user experiences as signalled on Twitter using the term "badux", which is short for bad UX (or bad user experience). We focused our study on tweets that contain this term.

To collect tweets about bad UX, we used the tool called Docteur Tweety[1] and collect all tweets containing "badux" from November 7th, 2014 to November 15th, 2014. For each tweet, we collected the following information: date, twitter account, name, language, location, followers, friends, creation, description, link (to original), tweet, number of retweets and number of favorites. For this particular study, only the user name, the link to the original tweet and the tweet text itself was used.

PRE-PROCESSING & FILTERING

After collecting our raw set of 103 tweets, we performed the following filtering three pre-processing and filtering steps.

First, we only retained all tweets that contained the hashtag '#badux' For the study the word "badux" which means "bad UX" (bad user experience) was considered as the keyword to identify information relevant to the study. It could have been other words like "fail" (Kouloumpis, Wilson, & Moore, 2011) but we considered that they were too broad and required a much deeper analysis and filtering. In the preliminary analysis we realized that not all the tweets containing the word "badux" referred to bad UX experiences from users, in some cases it was part of the author name and in others it was part of a url, for that reason we focus only on tweets with the hashtags #badux. 20 tweets were eliminated in this first step.

Second, we excluded all tweets that were not in English, French or Spanish—the languages spoken by the annotator, which removed four tweets from consideration. Finally, we manually identified and removed nine duplicate tweets, resulting in 70 tweets to be analysed.

EVALUATION OF DATA

The analysis method chosen for content analysis was to develop a coding scheme through emergent coding (Urquhart, 2012).

The option of using a selection of prestablished dimensions of UX (extracted from heuristics) was considered, but in this project the goal was to see what information emerged from the data itself.

In this case, because the amount of data was small, the initial qualitative analysis to come up with the set of categories and themes was done in the full set of data.

The first thing was to read through all the tweets and open all the original tweets that had an image (they had an url starting with http://t.co/ in the tweet) and write down which kind of UX aspects each tweet was referring to. In this process the images were very important to understand the context and the issue that the user was reporting. The result was a list of 44 different aspects that could be grouped in two main categories: what are the stated problems and where are they happening. Second step was to review the 44 aspects and reduce the list to be able to create a code scheme for further analysis. The final result a code scheme based on the type of issue (see **Figure 1**) and based to where it refers to (see **Figure 2**).

Code and samples of type of UX tweets
Link: "@Architizer How the hell do I open multiple articles in new tabs on your website? Fix the damn Ctrl/Cmd + Click or add proper links. #badux"
Non intuitive: "If someone has to be on hand to teach customers how to operate the lift, I think it's #BadUX"
Navigation / menu: "I spent 5 minutes trying to figure out where the drafts go on latest @twitter build, still haven't found them #badUX"
Missing or wrong information: "TIL that instead of telling you that there's an update, Skype OSX refuses to accept your credentials instead #badUX #UXFail #getittogetherMS"
Error message: "#BadUX of the day - Form field format discrepancy: The form is written one way, validation is another / vs. - http://t.co/U7PaE4laJ7"
Scroll/Pagination: "RT @martincenturion: Mi nuevo hobby es intentar cliquear los links del pie de un sitio antes de que el scroll infinito cargue más contenido #ux #badUX"
Login: "When registering and your long time username is invalid and you swear to hunt down the impostor. But then you had a trailing space #badux"
Icons: "@twitter whos idea was it to put the reply icon right next to the native back icon? The icons are identical! #BadUX http://t.co/m8kyzfrQUr"
Browser: "The #1 thing I don't like about OSX Yosemite: Safari

[1] Available at http://www.docteur-tweety.com.

hides web page addresses. What possible use could this have for anyone? #osx #badux #ux”
Missing options: “@LinkedIn why cant I filter connections by Alphabet and Contact type. While applying one filter the other resets to default. #bug ? #badUX ?”
Statement / quote: “I feel I need a PhD just to figure out all the certificates and provisioning profiles needed to distribute an iOS app. #BadUX”
Bad design: “[BadUX] RT @Spacekatgal: For UI in touch interface, LCARS gets an F-. Bad readabilty, poor font, nonintuitive. http://t.co/y4jfPexyHo”
Interaction: “@facebook needs to stop shutting off my music app for autopay vids I'm never going to click on. #annoying #badux”
Ads (non desired commercial info): “We will never spam you”, unless while you are on our site, trying to read #badUX http://t.co/5wzhET3gd0”
Multichannel UX: “RT @charleskriel: Unboxing a @Sony SmartBand. Sends me to a convoluted support site for instructions. Worst user experience ever. #BadUX #s…”

Figure 1: Final code scheme for the type of UX tweet.

Code and samples of where the UX tweets refers to
In a web (no device identified): “[logout] "Are you sure" [OK][Cancel] [OK] "Do you want to save user name" [OK][Cancel] [OK] "Error: You must be logged in to ..." □ #badux”
In a web in mobile: “Check it out...How do I see info re an Academic program on the Tommie mobile site? #BadUX (My search=faculty roster.) http://t.co/8oXM6OGRCV”
In a web in desktop: “Hey @sfgate, you should really ask for a refund on your site redesign! The awful photos don't help either. #BadUX http://t.co/AFFCqYAEeB”
In a mobile app: “#badux @flipboard what a pity so beautiful app can go infernal circle. Impossible move if tap is center : tap corner http://t.co/3DT08F2AOp”
In a place: “It's too hot in Richards. Always need to take off all but my t-shirt to feel comfortable #badUX”
Physical product: “RT @jkeussen: I bought a scissor but I can't use it because I don't have scissor to cut the packaging with. #BadUX #facepalm http://t.co/w7…”
No Identified (n/i): “Whoever is in charge of the #Eclipse Dark theme really needs to pull their finger out and make it usable. #badux #badhci”

Figure 2: Final code scheme that refers to where the issue happens

The category “Type of issue” allowed for multiple selections while the category “Where” was mutually exclusive.

We then went through all tweets again and applied the codes that applied to them. In order to validate the stability of the coding scheme, we calculated the intracoder agreement by re-coding 20 same tweets in two different days with three days between each coding exercise. The intra-coder agreement was of 0.75. In an ideal situation the reliability and consistency of the coding would be evaluated by an inter-coding agreement with two more researchers but due to the time constraints this was not possible.

RESULTS

After doing the analysis relevant results regarding the type of bad user experience that are reported in Twitter emerged. Two main categories were used to answer the research questions: which are the aspects that users complaint in their tweets? and What kind of products / services are the focus of the complaints?.

Interaction is the main problem reported in 20 out of the 70 tweets, followed by *bad design* with 13 tweets, *missing or wrong info* with 12 tweets and *links* with 11. The less relevant issues reported refer to *scroll/pagination*, *icons*, and *browser* with three tweets each (see Figure 3).

In 31% of the tweets was not possible to identify the type of service or product being the cause of the bad experience because it wasn’t identified in the tweet and there was no image to see the interface, but the type of problems reported points out that most of the nonidentified issues were related to apps or webs. On the other hand 16% of the problems where in webs but could not identify in which device (tablet, computer or mobile). Doing a sum of all the issues reported on web (web-desktop, web – unknown and web-mobile) shows that 42% of the tweets (29 out of 70) refer to issues with using webs. Issues in mobile (app-mobile and webmobile) sum 19% and issues in web 20% (see Figure 2).

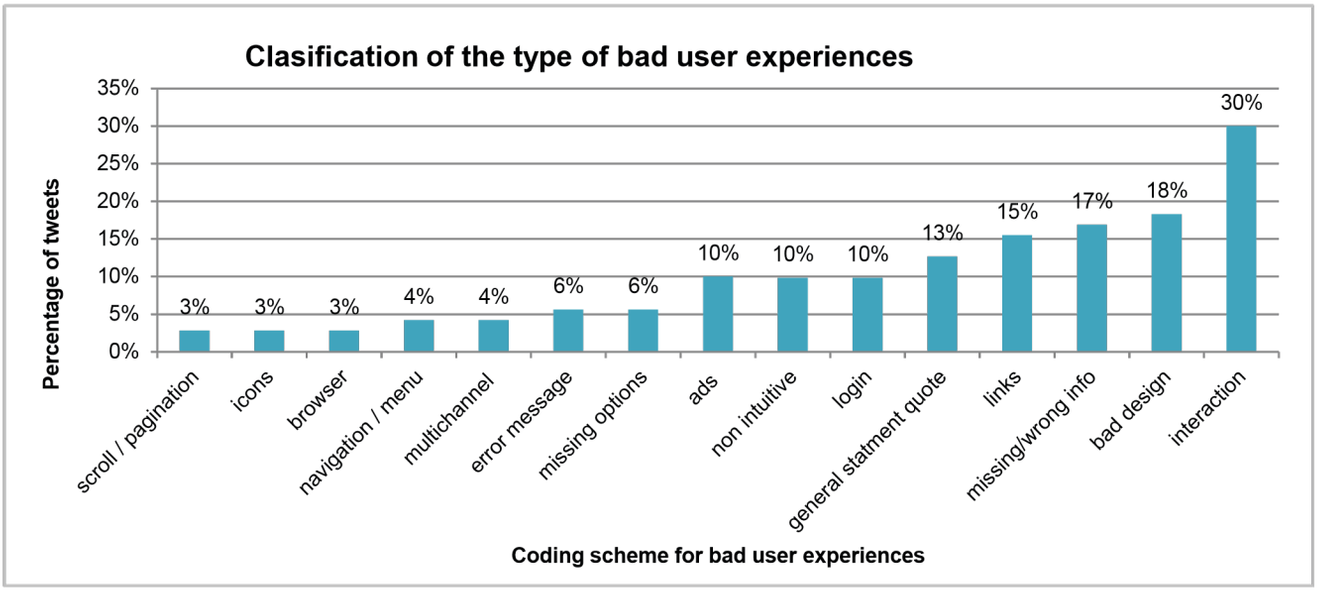
DISCUSSION

Interaction is the main problem that users have, as it shows in 31% of the tweets, this is a broad category, but it refers to the problems that happen when a user tries to interact with a system and it doesn’t reply or perform as expected by the user. *Bad design* is showing in 18% of the tweets, however this is more a subjective aspect, where the user likes or not a particular design like “*RT @SherpaProject: @rachelhaot @freddygusto amazing!!! Please give the same treatment to http://tax.ny.gov pulled hair out this am over its #badUX*”.

17% of the issues were related to *wrong or missing information*, 15 % to problems with *links* and 10% to *login issues*. Those three types of issues usually can be identified using user testing, automated QA and link checkers, so they should be easy to identify by companies. This can be interpreted as companies not being diligent on doing continued quality assurance on their systems.

Ads are still a problem in 10% of the tweets where they complaint about undesired promotions or ads showing while the user is interacting. Those types of issues create a big frustration on the users who use words like “*Stop this. Just stop it” or “Now we have to watch out for banner ads on our TVs? GRRRRRR*”

From the analysis related to the service of product causing the bad experience is clear that web and mobile experience are on top with total of 38 out of the 70 tweets analysed (54%). Between them there is a small difference being mobile 19% and desktop 20% however this information is not conclusive as there are a large percentage of non-identified products or services 30%



that could have an impact on the percentage of each device.

Figure 3: Distribution of the types of bad user experiences (*N* = 70).

From a broad point of view, 9% of the bad experiences where related to places like restaurants or airports (*"Whose bright idea was it to put coat hooks OUTSIDE the bathroom at the STL airport? #badUX http://t.co/eQa7hMfXzB"*), 6% to physical products (*"1st words in 'destination' field of customs form: "US street address/destination"—no wonder non-USdestined ppl confused &write N/A. #badUX"*), and

4% where cross channel issues, which implies users having contact with more than one interaction channel, like web and physical product, (*"Surrounded by #badUX today... Scan "For next bus information" = blank page @clearchanneluk @TfLOfficial http://t.co/zHDaRqykAT"*). This data shows that the user experience is a boarder discipline that goes beyond web and mobile, users expect to have good experiences in interactions with places, objects, etc.

Only web crawling was used as a research method as was considered that it provided enough information to analyse in order to answer the research questions. The ideal scenario, in a larger timeframe, would have been to gather some subjective data through a qualitative method, for example doing a small interview or survey to the authors of the tweets analysed to get a better understanding of the nature and context of the bad experience that they report in their tweet.

The results are limited to the users who actively label a complaint as "badux" therefore there are bad users experiences that even if would be relevant for the research could not be identified. The word "badux" implies a minimum knowledge about the UX field, and this is not the case for all the users. For future research would be relevant do a preliminary study of how users report bad experiences to come up with a better way of identifying this type of tweets. Could be interesting to follow the tweets and observe what happens later on with those tweets, do they get an answer from the company or anyone? Could be interesting to further analyses the data from the tweets to find which companies are having more complaints or which type of words are used to define their frustration, more in a semantic and rhetorical level.

It's clear that people use Twitter to explain their bad experiences using products or services. In a search on 7 consecutive days 103 results containing the key word "badux" where found, which shows that people is actively complaining about issues and problems they have and some even identify them as "badux".

The results show that companies need to actively test their products or services to avoid most part of user experience problems that users report in Twitter. The exposure of a brand when someone is reporting a bad experience in twitter is now much higher than when social media was not so powerful, therefore companies need to make an extra effort to keep those complaints at the minimum level or find a strategy to manage this critical situations.

User experience needs to be considered outside of mobile and computers, as it goes beyond. The significant information is that users do also perceive experiences on other fields (away from their devices) as "badux".

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SIDER '15

ANY-BODY HOME?

CUBER – CONTROLLING AMBIANCE IN SHARED APARTMENTS TO ENHANCE ACTIVITIES

CHRISTIAN CARLSSON
CHALMERS UNIVERSITY OF TECHNOLOGY
CHRCAR@STUDENT.CHALMERS.SE

HANNA FRANK
CHALMERS UNIVERSITY OF TECHNOLOGY
FRHANNA@STUDENT.CHALMERS.SE

ANDREAS KARLSSON
CHALMERS UNIVERSITY OF TECHNOLOGY
ANDKARM@STUDENT.CHALMERS.SE

MYLÈNE MENGUAL
CHALMERS UNIVERSITY OF TECHNOLOGY
MENGUAL@STUDENT.CHALMERS.SE

ABSTRACT

As the prices for housing increase, the question arises whether there is a way to build smaller apartments, yet keeping all the conveniences of a bigger apartment and making it possible to be shared by several people. The concept of Cuber seeks to provide a solution for the problem of having limited space in a shared apartment by enhancing the different activities of the people living in it. Furthermore, it should enable each resident to create their personal space where these activities can be performed. In this paper, a concept is described which makes residents feel in control of their apartment and provides a way to fully adapt the environment to their needs. As a result, a prototype of a tangible cube shaped remote control was implemented that could control lights and sound in a room-like setting and was presented in an exhibition.

INTRODUCTION

The housing situation in Sweden today is facing the problem of increased square meter prices. According to a 2013 report for Finanspolitska rådet (Sørensen 2013) in Sweden the prices have more than doubled since 1990 and are now higher than ever before. Features and technologies are currently being investigated that could make those small apartments more attractive for customers. This includes smart solutions for storage and space saving furniture, like the OMA's De Rotterdam project (Quintal 2014). Furthermore, plenty of advice on how to make an apartment appear bigger can be found online, e.g. Bourne (2014). Tips range from adding mirrors, using light colors for the walls to having small distributed light sources. Those interior design focused ideas inspire to think about how ambiance, represented mainly by lights and colors, can influence people's perception of space, their feelings and behaviors. Areas in psychology deal with this effect of color on the mood and common sense often implies, for instance, blue as a productive color or green for tranquillity. On the other hand, the topic of smart homes (a home that adapts to the user's needs) is part of several researches. For instance, Ross and Keyson (2007), investigated controlling ambient systems and a way to make the interactions with these more tangible and integrative in the everyday context.

The project being described in this paper was realized in collaboration with the construction company PEAB. The constraints given by this client were to focus on an apartment with the size of 54 square meters and the fact that it should be shared by three to four people. This means several people living together in an area that is usually used by one or two people. The target group was defined to be families of four. Thus, problems like combining different incompatible needs and interests,

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like playing loudly or relaxing, had to be considered thoroughly.

CONCEPT AND DESIGN

The Cuber concept deals with the above mentioned constraints of limited space in a shared apartment. It supports the inhabitants with performing their various activities, such as relaxing, working, playing and provides them with the possibility to create personal spaces by adapting the environment. The concept is divided into two parts, both based on the simple idea of a cube. Firstly, the layout of the apartment is flexible to be arranged for the different needs. Secondly, a way to control and adapt the environment including certain parameters such as light and sound is provided. The two components and the design decisions that were made will be discussed further in the following paragraphs.

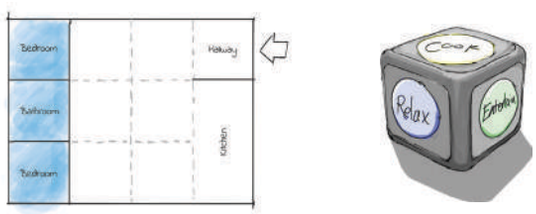

Figure 1: Cuber concept: (a) layout of the apartment, (b) the cube as a remote control

THE APARTMENT

First of all, the focus was set on the apartment and on rearranging it by defining specific areas, but without going into architectural detail.

As it is visualized in figure 1.a, the layout is divided into squares of 2.1 x 2.1 meters which makes it convenient to combine them to different sized rooms. Additionally, twelve of these cubes would add up to approximately 54 square meters which fulfils one of the constraints. They are clustered in two main categories: private and public spaces. The first zone comprehends the rooms where people need real privacy, such as in the bedroom or bathroom. The second one has a fixed part, which contains the hallway and the kitchen along with dining room, and a large open area that is not dedicated to any activity in particular. Instead, it serves for all different activities that people wish to perform in their apartment. With the focus on the latter, the following parameters were defined, based on literature as well as common sense, to be adaptable to the inhabitants needs:

Light: The illuminance level of the ceilings lights can be changed, since it is indeed unlikely that the same brightness will be used for a relaxing environment as for working. Furthermore, when watching TV, lower light will make it easier for the viewer to focus on what's shown on the TV, as well as it decreases the chance of reflections.

Ambient color: Different colors of lights stimulate different moods and feelings and therefore are useful to enhance activities. As investigated by Vandewalle et al. (2010), the color of ambient light influences emotion processing in the brain. For example, blue color increases stimuli in the voice area and the area that is important for memory processing.

Ambient sound: Sounds and music are often used to create a relaxed feeling, as motivation for working or for entertainment.

Devices: TVs and computers could be automatically turned on and off.

Curtains: If the ambiance doesn't create enough separation from the other spaces, curtains can be used to support this. Curtains, rather than solid walls made out of glass or wood, were chosen since they are flexible even if furniture is in the way. They also lower the light "nuisances" as well as sound to some extent. Our idea incorporates that curtains will be fixed along a grid shown as dashed lines in figure 1.a but can be moved slightly to make space for furniture. It should also be possible to add and remove the curtains if wanted.

THE CUBE

Cuber can be seen as a universal remote control and a tangible user interface for controlling elements in the home that were described in the previous section. Instead of controlling each element separately, Cuber does it all in one motion. Just as the apartment layout, this remote control is based on the basic shape of a cube.

As shown in figure 1.b, each side of the cube represents an activity and by placing the cube on a surface, the activity facing upwards will be activated. The parameters mentioned above will then adapt automatically according to the settings for that activity. It is important to note that the users themselves decide what settings should be included for each activity.

The cube also includes location tracking which makes it possible to only change the elements directly around you, no matter if it's at the kitchen table or on the couch. For instance, a working activity could be set on the couch, a relaxing activity could take place at the kitchen table or vice versa. These personal spaces can be created wherever the cube is.

In addition to selecting the activity, the user can control elements by interacting directly with the cube. The user starts by pressing the button on the active activity side and can then make modifications. If the user wants to save the modifications, he presses the button again and the settings will be saved. There are four basic interactions that were defined in the concept. Changing the volume of the background music is done by moving the cube vertically; up for increasing the volume and down for lowering like using a slider. This interaction is similar to the volume changing on computers. In order to skip a song in the current play list, the cube is tilted slightly to the left (previous song) or right (next song). Changing the entire play list is then done by moving the cube to the left or right. In both cases the directions

commonly represent back or forth in audio or video interfaces and are therefore appropriate to use. As for changing the color of the ambient light, the cube is turned some degrees to the left or right. The colors are virtually arranged like on a color wheel and will change directly as the cube is turned. All interactions were chosen to be intuitive and easy to learn, providing the user with direct feedback of what is being changed.

The first motivation to introduce the cube was the simplicity implied by a tangible approach. It seems convenient to have a tangible object because the already existing switches and buttons for controlling the elements in apartments are tangible. On the other hand, digital controls like apps on smartphones can be complex for certain target groups like children and elderly people who might not be used to this kind of technology. The absence of screens in the Cuber concept makes the object even less complex and at the same time more durable.

The cube shape itself brings along several advantages. Having six equal sides makes it easy to see which side is active, namely the one facing upwards. Furthermore, the cube is a basic and universal shape that is known across many cultures, so “the affordance of the device is known to every potential user” Terrenghi et al. (2006). Even more, Block et al. (2004) who investigated different shapes for remote controls, claim that the cube shape makes it is easy to handle, provides intuitive interactions and is convenient to be placed on tables and other horizontal surfaces. The number of sides was also appropriate when defining the activities as it covered the most important ones. Besides, the cube can be seen as a playful shape and could, for instance, be used like a dice making it fun and easy to pick an activity randomly by simply rolling it.

METHODS AND PROCESS

The project process that resulted in the above explained concept featured several important phases.

In the first phase, a brainstorming session about what makes a home smart set our aim on making it more comfortable for every person to live in a limited space. Further discussions and background studies in literature helped to refine the focus on the inhabitants and their needs. The possibility to accomplish different activities and at the same time a feeling of comfort were defined as essential aspects to consider and with this the surrounding atmosphere that has great influence on this.

Secondly, based on the mentioned considerations, the basic concept was defined. A list of activities performed at home was determined and divided into private and public ones, focusing on the latter. Sketching the various possible layouts of the apartment with regard to the given constraints changed our view on the apartment itself. It opened up the common perception of a fixed room dedicated to a specific activity towards a more public space that can host any activity. Another part of the concept definition was the parameters that would be appropriate to adapt in the environment.

This led to the question of how to control all parameters of the environment and made us realize its complexity. It made obvious that the need to create a simple remote control that would link the adaptable parameter with the activities and the apartment. Further, the cube shape was decided on quickly, also because of its references in literature, but defining the most suitable size required some tests within the group. For this purpose different sized foam prototypes were created. Afterwards, bodystorming with these low-fidelity prototypes was used in order to find out what would be the most intuitive interactions with the cube. Finally, prototypes were realised that could be presented as part of an exhibition. The users there would evaluate them and give valuable feedback for further work on this project.

RESULTS

PROTOTYPES

The final prototype consists of several different parts that visualize the concept. Firstly, a full scale model of a corner of an apartment containing a simplified prototype of the cube. As support for explaining the concept a miniature model shows the layout of the whole apartment including the curtains which help to divide the open space. Lastly, a conceptual video shown on a screen next to the prototypes gives details about the interactions with the cube. The prototypes were presented in an open exhibition visited by students, architects and people from the industry.

Figure 2: Prototypes: (a) full-scale model, (b) cube

The corner of the apartment focuses on the aspect of controlling the ambience. It visualizes how the different environments could be created with the help of lights, music and curtains (see figure 2.a). The ambient light is achieved with the help of LED strips, in which each LED is addressable and whose color can be controlled individually. Two dimmable halogen lamps are mounted on the ceiling to demonstrate the different levels of brightness. Finally, speakers were installed to add various kinds of ambient music. The prototype of the cube, as shown in figure 2.b, consists of a 3D printed shell which contains all necessary electronic parts. A light-dependent resistor (LDR) on each side of the cube detects the level of light it is exposed to. If there is no light, it means the respective side is facing the table and the side opposite to it is facing upwards, which activates this. Additionally, a white LED on every side gives the user visual feedback of which side is active. All

parameters are connected to an Arduino microcontroller, which then detects what activity is on and activates the according settings for the lights. Furthermore a program running on a laptop plays related music from different play lists which are dedicated to the six activities. This prototype only shows the interactions of activating an activity; the manual control of the different elements was not implemented.

FEEDBACK FROM THE EXHIBITION

During the exhibition people were able to test the prototype and get an idea of the concept. In general, the reactions were positive, many were enthusiastic and confirmed that they would use a remote control like this at home regardless of the size of their apartment. Most people focused on the simplicity of the controlling rather than the manipulations in the apartment itself. Visitors had different opinions about the size chosen for the prototype, possibly also depending on the size of their hands. Some would rather use it stationary and therefore prefer a bigger size, others would like to carry around and play with it, which would make a smaller cube more convenient. Finally, the visitors' feedback included suggestions of applying the concept to other living space such as bigger apartments, offices, but also public areas like airports and train stations and even vehicles.

DISCUSSION AND FUTURE WORK

Despite the positive feedback, there are indeed some critical aspects that have to be considered for further work. As an example, using curtains to divide space is not ideal. The solution for now is easy to adapt and flexible, yet, it is not soundproof enough. Therefore, other material might have to be investigated in order to allow noisy and silence activities to be performed in parallel.

Cuber is aimed to be personal. This can create some other conflict cases, for instance, when two people try to activate their settings at the same place simultaneously. For now, one solution has been discussed but not developed any further. The idea is to prioritize the first cube activated in the concerned area. Then, if people agree on combining their preferences, it should be possible to let the system know by making the cube touch each other. Communication between the inhabitants would still be the key to solve conflicts.

Regarding the shape and size of the remote control some further user study would have to be conducted. One option could be adapting the size to each individual's need making it even more personal. Although the cube seemed to be an appropriate shape for its purpose, rounded edges to make it more ergonomic or even a different shape could be considered.

Besides, since the cube lacks affordances possible interactions might not be obvious which makes it less intuitive for first-time users. Providing the user with more feedback, for instance, when changing the elements with the cube, could be one focus for improving this. This could include haptic feedback in form of slight vibration of the cube itself. In that way, the user would not even have to look at the cube when controlling. Looking closer at the controlling part could also imply introducing more elements to be controlled by the cube such as radiators, ventilation and more electronic devices. Lastly the concept is adapted to a small apartment but could be applied to other kinds environments, as also mentioned in the user feedback.

CONCLUSION

Although our physical prototype did not support all interactions that were part of the concept, the video helped in communicating all the intended functionalities. In addition, the feedback we received showed that the concept addresses and interests all kinds of people. Controlling multiple devices in a home through a centralized controller is not a novelty. Yet, most existing ideas tend to involve a common remote control, an app or something similar as a control method - using a tangible device with such a simple interface is a new idea which is worth being explored further. The concept itself needs to be enhanced before it could be used for a finished product, whereby one important issue is the communication between several cubes and the control of the parameters before and while using the cube.

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ECOBEARS: DECREASING APPLIANCE WASTE USING AMBIENT FEEDBACK

NICK NIELSEN, SANDRA B. P. S. PEDERSEN, JENS A. SØRENSEN, NIKOLAI H. ØLLEGAARD
DEPARTMENT OF COMPUTER SCIENCE - AARHUS UNIVERSITY
{NERQ, SBPSP89, JAS2012, NARHVAL}@CS.AU.DK

ABSTRACT

This paper presents the EcoBear concept and describes the purpose of the project, which is to help creating awareness of appliance waste. Then, we explain the design process and design choices as well as discuss the preliminary evaluations and findings. Based on our findings, we highlight future work that has to be taken into account for the next iterations of our project.

INTRODUCTION

We have recently introduced the EcoBears concept (Nielsen et al. 2015). In this paper the concept will be briefly summarized and then we further elaborate our concept in regards to the iterative design process and the preliminary user evaluations. Based on our findings, we discuss the opportunities of EcoBears to create awareness of appliance waste and highlight potential future work.

The EcoBear (See Fig. 1) project is aiming to raise awareness of appliance waste and incorrect appliance use. As described in (Nielsen et al. 2015), appliance waste has become a big problem around the world. A recent report from the City of San Diego's Environmental Services Department in the U.S. (San Diego Environmental Services Department, 2012) states that the city's overall disposed waste during 2012 included 7,909 estimated tons of electronics (e.g. video displays, computer electronics, etc.) and 1,028 estimated tons of major appliances (e.g. washing machines, refrigerators, etc.). Similarly, the Middelfart recycling station in Denmark reported that flat-screens and refrigerators are their most common appliance waste during 2014 (René Poulsen – DR, 2014).

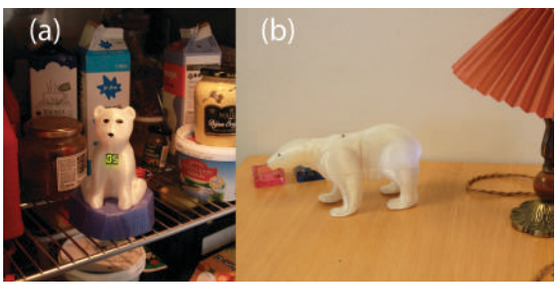

Figure 1: (a) The polar cub; (b) the mother bear.

The EcoBears are designed to raise awareness of this problem, while also helping to correctly calibrate and use the household fridge to conserve power and avoid sickness caused by food deterioration (FDA, 2011). With the increased focus on the environment, EcoBears' goal is to enhance existing appliances using ambient peripheral feedback and additional functionality to add value to old fridges to prevent premature disposal. EcoBears use symbolic features in regards to the polar bear avatars to create awareness of appliance waste, and the environmental effect of this, since polar bears are one of the most well-known animals whose habitat is affected by global warming. The EcoBears concept consists of two polar bears, a polar bear cub (Fig. 1a) and a mother polar bear (Fig. 1b). The cub is equipped with a temperature and light (photoresistor) sensors, a display, a radio transmitter and 3 LEDs and is designed to be placed inside the fridge. The adult bear is equipped with a light sensor, a radio receiver and 3 LEDs. The cub collects temperature data when it stands in the fridge and sends it to the adult bear that can be placed anywhere in the home e.g., the living room. If the cub detects that the temperature is too cold, it will start flashing blue, send the data to the mother bear, which also starts flashing blue. If the fridge is too warm the bears will flash red instead and when the temperature is in the correct range (4-6 degrees Celsius) the bears will have a constant, dimmed white light.

The EcoBears convey their state through ambient lighting. This is done as an attempt to make the EcoBears unobtrusive so the user may continue with their primary activity. When the EcoBears are in a neutral state, the bears will be in the user's peripheral attention, but as soon as the state changes from neutral to too warm or too cold the artifacts will require more

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attention and will move into the users focus of attention. The EcoBears are designed to be transparent in everyday use, and only require attention when there is a problem with the fridge.

For a more in-depth explanation of the EcoBears see (Nielsen et al. 2015).

In the following sections, we present the related work and the evaluations of the concept together with the findings. Then, we discuss the challenges and opportunities of the EcoBears concept as well as its relation to embodiment and the benefits of ambient interaction.

RELATED WORK

The idea of augmenting home appliances with technology is not new. For instance, the KitchenSense architecture has been proposed to connect various kitchen appliances through the use of input sensors, attentive digitally-augmented projections and a reasoning engine aiming to enhance appliance interactions to simplify control interfaces (Lee, C.- H. J., et al, 2006). In addition, more and more eco-feedback technology is being implemented to address sustainability challenges by augmenting everyday objects to support behavior change, aiming to reduce environmental impact (Arroyo, E., et al, 2005, Froehlich, J., el al., 2010, Heller, F., and Borchers, J., 2012). These technologies often use lighting mechanisms as attentive feedback and inform users about their water (Arroyo, E., et al, 2005) or power (Heller, F., & Borchers, J., 2012) consumption.

However, most of these technologies have been designed to be the focus of the user's attention, neglecting the fact that many interactions in people's everyday lives take place in the periphery of attention (Bakker, S., et al., 2012). As such, there is a need not only to design for the center but also for the periphery of attention (Weiser, M. & Brown, J., 1997) when augmenting human activities (Rogers, Y., 2009).

PRELIMINARY EVALUATIONS

The evaluation of the concept has been done in four sessions. The first one was a concept validation to get feedback regarding the design of the polar bear avatars, interaction and semantics of the lightning mechanisms. It was an informal interview with three potential users (2 male, 1 female - average age 27). They were asked to identify the avatars, articulate how the avatars differ from each other, and provide first impressions regarding functionality. Three additional sessions were conducted with eight potential users (6 female, 2 male - average age 53) to evaluate functionalities and get further feedback in the home setting. Two of these ended with semi-structured interviews and the last one was a focus group with a family (5 participants). All interviews and discussions were recorded, transcribed, and analyzed through an affinity diagram.

IDENTIFICATION AND SEMANTIC REPRESENTATION OF AVATARS

Overall, participants were able to immediately identify the symbolic abstraction of the avatars even making a distinction between the adult polar bear and her cub. A participant described the adult bear as "*dangerous, at least the mother*" and the cub avatar as "*A polar bear cub, sitting on a chunk of ice because it is blue*". Participants also perceived the relationship between the avatars as a bear family. For example, a participant stated by pointing to the avatars "*this one is definitely a polar bear, and this is probably its polar bear cub*". Another participant expressed why she thought it was appropriate to make the avatars look like a mother and a cub and place them on different positions: "*the cub is usually in the cave while the mother is outside making sure everything is okay before the cub can come out*". A further comment was given on why paying attention to the cub in the fridge is important: "*when it is small you think that you have to treat it well and pay attention to the temperature so the cub is feeling well*". Additional meanings were attached to the avatar's form. A participant expressed "*you think about temperature as soon as you see the avatars, or I do anyway, I wouldn't do that if the avatar was a monkey or a donkey*".

SEMANTIC ASSOCIATION OF COLOURS AND PASSIVE INTERACTION

Regarding the semantic association of colors, lighting and interaction, all participants were able to decode the color scheme and attach meaning to it. For instance, a participant stated "*red would be when you forgot to close the fridge... and blue would be when it is set for a lower temperature than it should*". Similarly, another participant mentioned "*When the polar bear cub flashes red it is too hot, and when it is blue it is too cold*". Besides the color semantic, participants were able to recognize the pulsating feedback while varying the intensity of light. A participant stated "*When it pulsates like it does, it is because you have to pay attention*". Furthermore, participants also differentiate between the flashing (red/blue) LEDs and the stable white LED. A participant said if "*it doesn't flash so it's something neutral*". The communication between the bears was also well perceived. For instance, a participant stated "*if the little bear flashes red and the big bear flashes red, then it is because the big bear tries to tell that there is something wrong with the little bear*".

THE POLAR BEARS AS AN EDUCATIONAL TOOL

Participants highlighted the potential of the avatars to support the communication of sustainability issues and to make people aware and do something about it. For instance, a participant confirmed this giving a valuable comment "*I have children and I might like to buy one of these because the children would have something they could put a face on like, I have to remember to shut the refrigerator door and remember to shut it properly because there will be a sound of some crying baby bear with red lights and stuff*". Another participant stated that "*There are many places it could be fun to have one. At the daycare... that is a good place to teach the kids about this stuff and to keep the fridge door closed*".

THE HOME SETTING AND BEYOND

Some participants also suggested the possible use of EcoBears in different settings and situations. For instance, A participants said: "*If you have the possibility to have more polar bear cubs, in more units, and then a central unit to supervise all the other, ehm, chiller refrigerator where there is 10 °C in the vegetable drawer, and 3/4 °C in the fridge and then the freezer that has to be -18 °C, and then that you have one central to keep an eye on the other ones*". Additional settings such as supermarkets and restaurants were suggested as well as other locations inside the home. A participant mentioned "*it would be smart to have one in the bedroom during a thunderstorm so you know that your fridge is still working*".

TECHNICAL CHALLENGES AND OBSERVATIONS IN THE HOME

We initially wanted to investigate if the ambient lights have the desired effect in the home even if a person might be performing a different primary activity. However, we experienced issues in all three home evaluations, since all refrigerators were too hot, and needed adjustment, which is an important finding in relation to possible food waste and deterioration issues. A technical issue that appeared during the second evaluation showed that the insulating material of the fridge and the 3D-printed models (See Fig. 1) blocked out the wireless signal. This issue was not unique to the second test as we experienced a similar issue with connectivity due to the walls in the participant's home that partly blocked the signal during the last test. We also observed that one of the fridges came from a respected brand, and was marked as A+ for energy efficiency. However, it did not have any smart features, making it a good candidate for the concept.

DISCUSSION

The preliminary evaluations showed that the participants were indeed able to understand the symbolic features of the bears and figure out the meaning of the ambient lights. Additionally the participants came up with more uses of the EcoBears, e.g. use of the polar bears in kindergartens, restaurants and supermarkets. The evaluations also gave important insight in how the electronics in the bears at times were not sufficient in the home settings and that participants had 'non-smart' refrigerators that were energy efficient, though lacking the smart features that the EcoBears are going to bring. While the evaluation determined that the participants were able to identify with and figure out the meaning of the polar bears, it is still hard to tell if the ambient and peripheral feedback of the bears are going to have the desired effect. Since the electronics were insufficient for conducting long term evaluations of the concept, it cannot be determined at this time if the EcoBears are going to have the desired effect in the long term.

In light of the Embodied Interaction topic at SIDeR15, it is relevant to present our discussions of what degree of embodiment was relevant for the EcoBear concept. As it is clear from our introduction, the EcoBear system is not an embodied system with direct interaction, and this is due to two main factors, which were very important when choosing the best design for our system. These are introduced and discussed in the following subsections.

DOES THE PROBLEM SPACE AFFORD EMBODIMENT?

The problem space for a regular fridge with an notification system using sound is the kitchen, and perhaps rooms nearby (depending on the intensity of the alarm). The EcoBear project extends the radius of specific rooms to include the entire house or flat, giving the users the option to place the mother bear wherever they find it most useful. It is not hard to define an embodied scenario, where the users could be notified of the temperature in the refrigerator, this could be done using e.g., vibrations in a smartwatch. This embodied interaction would expand the problem space beyond the home and the authors questioned if this was desirable. A simple scenario was discussed, and partially led to an exclusion of embodied interactions of this kind. Imagine that you are at a sports game with your friends, and you receive a notification from your refrigerator via your smartwatch. How do you respond? It could be that your flat mate/partner is simply restocking the fridge with new groceries, or perhaps the fridge is actually broken? You have no way of telling, because you are not near the refrigerator, and it would require further interactions to investigate the matter. This is one argument that goes against using direct embodied interaction for the EcoBear project.

SOCIAL VS. NON-SOCIAL AWARENESS

Another aspect that was discussed when it came to the bears, was how they could be used to afford social interaction. There are two obvious scenarios that would socially engage people with the current system. The first could be that visitors in the home would enquire about the mother bear, thus leading to a conversation of the system and perhaps even an opportunity for waste management. The second scenario could be the parent to child interaction, where a parent could use the bears to engage in a conversation with their children about waste management. Would these two scenarios be possible if an embodied interaction is used? Notifications and alarm systems used in e.g. smartphones and smart watches are examples of embodied technology that neither encourages social engagement and foster antisocial experiences

FUTURE WORK

The future work of the system could be broken into two different types of work, one should focus on the technical aspect of the project, and the second on the design. The two different aspects are discussed in the sections below.

Another aspect that could be tested is how the EcoBears add value to the old appliances, and if they could affect the awareness of the users in regards to

appliance waste, and perhaps even add enough value, to enable extended life of old appliances. This subject is not described further in this paper.

FUTURE TECHNICAL WORK

As discussed earlier, the EcoBears project failed to achieve proper test results in a real life setting and it still needs long term evaluations to determine if the bears will have the desired effect. The long term evaluations are especially important, to enable more accurate conclusions on what effect the polar bears will have, in regards to how the ambient peripheral feedback will work in practice. To enable these evaluations in the real home setting, a different technical setup would be needed, since the components used in the first version proved insufficient. A new system would need to achieve two primary goals. The first would be to enable a signal to pass through all different types of refrigerators, and the second would be to keep the system energy efficient in order to execute long term evaluation. In regards to logging data over longer periods, the system could be expanded to include a Wi-Fi module that could send user data to the cloud. This data could be used in conjunction with different techniques such as user-diaries etc. to further evaluate the use of the system.

Based on the evaluations using XBees as radios during the initial evaluations it was concluded that this type of communication would not be sufficient if the bears are to reliably communicate through multiple variations of refrigerator doors and interior walls. For further tests bluetooth low energy was discussed and an RFduino was tested. The RFduino is a low power, Arduino compatible platform for rapid development that features bluetooth low energy. Preliminary tests show that the RFduino is indeed able to communicate in refrigerators that the XBee modules were not able to communicate. The RFduino module would be suitable for further tests.

FUTURE DESIGN WORK

Two immediate design flaws were discovered during the first evaluations. The first was the lighting in the polar bears that was created using only a single LED for each color. This resulted in only a small part of the polar bears being lit up. In the next design iteration more LEDs should be added to strengthen the light and thus enhancing the pulsating effect in the bears. The second part concerns the physical size of the polar bear cub. It became clear that the cub might be too tall to fit in between the shelves and also too wide to fit into the shelves in the door of most regular fridges. This could be fixed by making the cub smaller. It might also make the cub more suitable for everyday long term use, if its footprint in the refrigerator was smaller, thus it might be an improvement to the overall design to have a smaller cub in the next iteration of the design.

CONCLUSION

The EcoBear project proposes the use of ambient lighting and symbolic representation to augment everyday appliances. The overall concept was validated through iterative short evaluations, but technical difficulties hampered long term evaluation in a real home setting. In the final part of the paper, a brief discussion of the concept and future work, which includes suggestions for a revamp of the technical system for the project, was described.

ACKNOWLEDGEMENTS

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THE RECIVIATOR - SMART HOMES BUILT FOR MODERN DAY SERVICE DEMANDS

JOHANNA GLEMBO
CHALMERS UNIVERSITY OF TECHNOLOGY
JOHANNA.GLEMBO@GMAIL.COM

IDA HÄGGLUND
CHALMERS UNIVERSITY OF TECHNOLOGY
IDAJAEHIE@GMAIL.COM

STEVEN TENG
CHALMERS UNIVERSITY OF TECHNOLOGY
TENG.STEVEN@GMAIL.COM

ABSTRACT
Our concept is a luxurious time saver for food shopping and food handling, that has a social dimension and a sustainable embodiment. The prototype consists of both a real-size interface on a touch TV screen, and a scaled model showing a functioning elevator built using Lego Mindstorm NXT, going between floors and delivering packages in different directions - directly into the kitchen. This was displayed during a two-day long exhibition allowing us to get valuable feedback from visitors. We found out that once the initial concept was understood, people got really excited and started visualising different ways of adding features and value to our concept. We conclude that this is a field for further investigation, it would reduce time spent on grocery shopping, travelling and waiting, plus allowing existing services to be even better, since the deliveries are stored properly and safely. All the technology used in this project already exists. It is the combination that is novel, and perhaps a little bit ahead of its time.

KEYWORDS
Collaboration; Concept house; Food; Elevator; Deliveries; Smart Home; Flexibility; Environmental Sustainability; Time effective; Space efficient; Common Storage; User Interface Design; Human Centred Design; Interaction Design; Communication; Futuristic; Building structure; Social Interface.

INTRODUCTION
What would make a 54 square meter apartment appeal to a family of four? This was our initial question since Swedish building company PEAB currently are looking for ways to attract new target groups to these smaller apartments, having especially families in mind. To answer this question we needed to ask another: What does families, with children living at home, value as much as living space?

BACKGROUND
Even though a large living space is something that many families want, being healthy and have time to spend both on each other and individually is of course more sought after. Lack of time to rest leads to stress, which in turn is a major cause for illness. [1]

A study on stress within the 27 countries in the European Union indicate that Sweden is the most stressed country of them all. [2] The study showed that those currently working are most likely to say that exposure to stress is one of the main health and safety risks at work. Those in Sweden are the most likely of all to mention stress. Two thirds, 67 %, of all the Swedish participants did this. In 18 Member States stress, depression or anxiety are the most mentioned health problems either caused or made worse by work. Almost half of all of those in Sweden who currently work mention these issues, compared to only 19% of the least stressed EU citizens, whom live in Romania and Slovakia. [2]

An article in the Swedish newspaper Svenska Dagbladet states that half of all Swedish parents with kids living at home feels pressured for time, and that the number one wish is to have more time for the children and for themselves [3]. Bronnie Ware, an Australian nurse that has worked in palliative care for a long time, found out that what people regret most on their death bed is that they worked too hard, did what was expected of them instead of what they wanted and that they did not make time for family and friends [4].

In Lucero, A., Castañeda, M., Bang A.L. and Buur, J. (2015). Embodied Interactions, Proceedings of Sider 15, March 27-28, Kolding, Denmark

METHOD

After the internal ideation phase a first stage concept was created and brought with us to early meetings with potential users and PEAB representatives. The user interviews where held one and one as well as family wise and consisted of user feedback on our concept as well as questions concerning their daily habits and additional feedback on use. During this phase we could start limit our target group by matching our concept with user needs, wants and habits to find our that our concept where best suited for families that wanted to have more time for each other. With PEAB, shorter presentations of concepts were held, followed by their comments. We had to rethink some parts of our ideas since ultimately they know the market and represents the building manufacturers. Our goal was to strive towards something that was realisable in the near future.

After evaluating our concepts and ideas we established that our target group are likely to trade living space for time, we needed to find a way to provide them with that. Therefore the next step was to look at how the adults in a family typically spends their time. We have categorised the time we spend each day into these four categories: sleep, work, chores and leisure. Arguably these categories will describe every productive individual of a society. In our concept we will attempt to reduce stress by reducing the amount on of time spent on chores and instead add it to leisure. Leisure time being the time you spend with friends, family or by yourself. This is the part that people want to have more of. [3]

The amount of sleeping time and working time is problematic, and frankly undesirable, for us to alter. That is a balance that we feel is best decided by each person or family without our meddling. Chores however is something that most of us want to do less, but that we all need to put time and effort into, albeit in various degrees. To free up this kind of time we needed to find a solution where the building itself could take care of at least one chore for us. This was indeed a challenge, but we kept on thinking, and focused primarily on food since it had turned out to be a major stress factor when we conducted the group interview during the ideation phase.

The parents talked about the stress of grocery shopping with kids, and that it was time consuming to travel back and forth to the store several times per week, waiting in line etcetera. When we asked them about existing home delivery services they answered that this was an improvement for them, but that it was still bad because existing services has a time interval, usually 4 hours, during which you need to be home and wait. That actually added a lot of stress. Another factor was that if you missed the delivery the food would just be left outside of the home, at risk of becoming stolen or go bad if the items are temperature sensitive.

CONCEPT AND DESIGN

We realised we were on to something: We would let the house store the food for us. Furthermore we wanted the apartments to feel luxurious and be able to connect other smart home functionalities in a good way. Besides all this, we really wanted to have a collaboration between neighbours so we wanted to make sure to utilise some kind of crowd delivery, and possibly add a social aspect to this concept. Lastly, for this to appeal to a modern family it is important that both concept and its realisation has a well thought out environmental aspect.

We decided to make a storage in the lower level of the house that would store the food, as well as other deliveries of course, in a safe manner and cold when needed, plus connect an elevator to this system. (See figure x.x) However, not any kind of elevator, but an elevator that leads directly into the kitchen of the apartment. To control the elevator and have a central unit for all the smart home technology in the apartment, we have an interface in the form of a touch TV. We thought about just having an app solution, but decided to go in the other direction and make it a focal point in the heart of the kitchen. This is because we are sure there could be more smart features in this apartment and thought it was nice to design for a way to gather them all in one place. Another reason for this is that we want to appeal to the modern family who spends a lot of time in the social area of the kitchen and the living room. The screen is rotatable and doubles as a TV for the living room. This enables facing the sofa towards the kitchen, which we hope will increase the social interaction in the families.

The different parts described above forms our unity. We did a play on words and named it “the Recivator”. The Recivator can of course deliver any kind of goods, provided it has the right size, but we focused on the food deliveries because of our interview findings. The design we came up with allows the delivery to be pushed out onto the kitchen counter. A strong motivation at this point onwards was to imagine never having to lift another grocery bag for the rest of our life’s.

Also imagine that you connect this system to your personal storage area, allowing you to order up whichever item you need at the moment. No more digging among moving boxes for futile attempts on finding whatever it is you are looking for. We got the inspiration from a wine cellar system in the book Smart Things: Ubiquitous Computing User Experience Design, that worked in a similar way. [5]

We expanded our design by the concept of crowd deliveries which could be done by making a deal with a food grocery company that they will deliver daily, or maybe even twice a day, if the residents order from them. This means a person can order small and still get the order without paying delivery costs, because the total sum of the house would most likely be higher than the required amount every time, thanks to the “strength in numbers” concept; many small orders will equal one large order.

To add a social element to this and strengthen the environmental aspect even more we thought up the “free for all” concept. The food stored in the house is kept safe, but what if someone is not ordering up the ordered items? They will go bad eventually. There will be a time limit to

get your food. To know if the time limit should be two days, a week or another length we would need to do a lot more testing, but after that time period the food order will be “free for all”. Then any neighbour can get the order delivered to the apartment, depending on who claims it first. There could also be a function releasing the food earlier if the owner knows that the food will not be brought up in time. This would decrease the risk of the food going to waste and adding value to the entire system. Who would not love getting free food from time to time? Other things that makes the Recivator good for the environment is that it significantly reduces the number of travels to and from the stores. In some cases grocery shopping is what makes a family get and keep a car, so we might even be able to reduce the number of cars in the city.

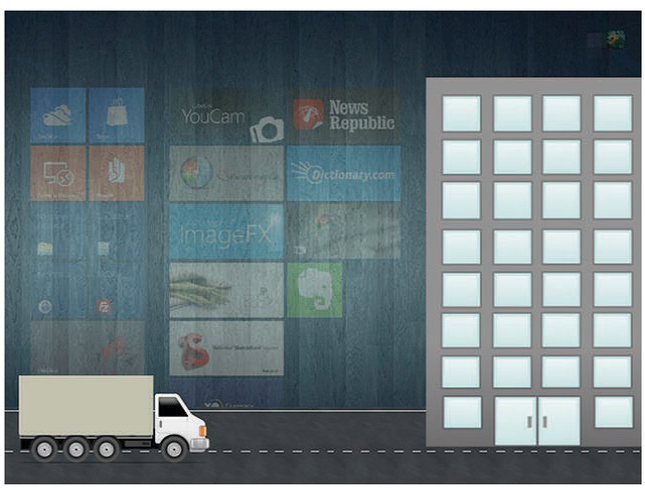

Figure 1. Our interface prototype in active state, showing what the screen looks like when there is a delivery on the way and no one uses the interface for other activities.

RESULTS

The prototype that we displayed was made of three different parts; an intersected house model, in the scale of 1:5, three stories high to show two kitchens on different floors on each side of an elevator, also showing the bottom floor where the groceries and other packages are stored; the elevator motor function that was programmed and built with Lego Mindstorms NXT and conveyer belts to move the packages in different directions; and finally a real size touch TV that showed our interface as a layer on top of a computer interface. To use the computer the user simply touch any part of the greyed out surface, see figure 1.

In order to test the prototypes we participated in a two-day long exhibition, showing visitors the concept and asking them for feedback. As we suspected the concept took a little bit of explaining but when we had done so, the users got enthusiastic and started to envision a lot of different scenarios where the Recivator could improve their own lives as well as others, resulting in a lot of valuable feedback.

We thought that people would object to the social aspects, but to our surprise everyone we talked to about this was positive and we got several suggestions about things that they wanted to be able to do that took the concept further than we would have dared to suggest. Another potential problem that we thought a lot about was that elderly people might have a hard time using the technology and that it would be problematic if this was the way to control things in the home, as well as receiving mail and getting important notifications about things related to the house. Instead this turned out to be an eager user group and the by far most common comment we got during the exhibition was that this would be a perfect solution for elderly.

Figure 2. Display of our three stories house model in scale 1:5, The elevator delivers a package from the basement store to floor 3, right onto the kitchen sink.

While many people thought about how this could improve living conditions for elderly, others focused on the collaborative aspect of the system. The possibilities to send and receive messages related to the house was highly appreciated. For instance if there is information regarding the house that the residents need to be aware of or to notify neighbours about special circumstances.

Taking the concept further, a couple of visitors suggested that a lot of the food should be commonly shared, talking about milk that is something many people want to have but that will go bad unless consumed. This would take the concept a lot deeper in the direction of collaboration and environmental thinking.

Figure 3. Close-up of the kitchen sink and elevator delivery.

DISCUSSION

The two main problems of our solution are the scope and the building cost. The large scope makes it harder to visualise than a more scaled down idea, and harder to visualise mean harder to present for stakeholders and investors. We could have done a smaller project with another focus, but we wanted to do a paradigm shift in the way we think about houses. The technology in society are growing at a high rate, but the houses do not follow this technological (r)evolution, which is a bit odd considering Sweden's high tech culture.

We have thought about only using a storage room in the entry level, letting the residents pick up things on their way up. This would save money. Yes, this would most likely save money during the construction, but we would lose all the social aspects as well as the luxury of being able to getting things rather effortless. Freshly baked bread could be delivered onto your kitchen counter just in time for breakfast.

We believe adding these values would lead to these houses being more coveted, which in turn would give them higher listings than old fashioned buildings that lack structure for smart home services.

There are no certainty that the free time the Recivator creates will be spent on leisure and non stressful activities. It may very well be the case that it will free up more time for work. Disregarding the direct positive impact the Recivator will have on the elderly and the retired, even if free time is put back into work, it would be beneficial in the long term assuming that more work hours equals more work progress. Without the stress of having to do these chores, and knowing that you can work overtime and still have food home for the kids will reduce stress.

More wide scale user studies and research has to be conducted in the field with real implementations to be sure of the exact outcomes of our concept. Given our estimations the concept would reduce the number car trips to the stores, but there is no data to suggest that the cars would not be used for other purposes when they no longer has to drive to the stores, and thus instead increasing the carbon dioxide pollution.

CONCLUSION

As one of our peers pointed out, the money always has to come from somewhere. If the stores would not have to exist, the cost of maintaining them would not exist either, and this would shift around costs, leading to lower price on food. The difference would be used to pay for a more expensive housing situation. Presuming that the costs would be a zero-sum equation – what would be the earnings?

Our answer is: The increased leisure time, the reduced stress, the feeling of luxury, the control centre for all smart home applications, the increased social activities between neighbours, the potential of increased social interaction within the families, the added information control via message boards and your storage items just a few screen clicks away.

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MINE(D) – DESIGNING EMPATHY

MARIE LOUISE JUUL SØNDERGAARD
AARHUS UNIVERSITY
MLJUUL@CAVI.AU.DK

NANNA JANSEN
AARHUS UNIVERSITY
NANNA_JANSEN@HOTMAIL.COM

ABSTRACT

In this paper, we investigate how the interaction between two contrasting soundscapes may foster curiosity, mental discomfort and empathy. Focusing on the dangerous mining industry, we designed Mine(d), an interactive sound installation with the illusion of two contrasting rooms symbolizing a caricatured uneven relation between the Western- and Third World countries. This paper describes how Mine(d) is mapping silly interaction and unpleasant sounds, with the aim of connecting game elements with serious political questions. This paper will discuss the potentials of using tactics of curiosity, mental discomfort and empathy, and argue that these tactics are of great value when designing for critique and debate of challenging themes, but also point out the great importance of user testing, response, and mapping interaction and sound.

INTRODUCTION

An estimate is that mining kills around 12.000 people every year, and though technology and security has improved mining is still a very risky industry (http://bbc.in/18tlEVY). The news about devastating mining accident is not absent, as late as May 2014 301 people died in a mine in Turkey. An interesting take on the bigger mining accidents is the effect of the news coverage. In 2010, 33 miners were rescued after being trapped for 69 days, after which they gained the status of heroes and were offered several gifts; the new iPod, football tickets, 10.000 dollars each, and a holiday to the Greek Islands. None of these men had to work in the mines again, but the same does not go for their co-workers, who had to keep working in the mines. Miners primarily dig for coal, but also luxury products can be traced back to the work of miners: valuable gems like gold and diamonds, and metals needed in modern technology. To keep the consumption in the Western countries flowing, the inhabitants in the Third World countries need to work. So while the Western countries keep consuming, the miners keep working without working conditions improving. Our goal with Mine(d) is to use this unbalance as the basis for investigating the possibility of enabling users to relate to the lives of the miners through alternative means.

Figure 1. Mine(d) – installation view at Raahauge

BACKGROUND

Mine(d) is a project made in two design courses: Sound and Interaction, and Design as Critical Praxis. The first course was focused on exploring different technologies and mapping interaction and sound, and the second on methods of critical design and material studies of leather (Dunne & Raby 2013, Wiberg 2013).

RELATED WORK

The following section will present related work that has been inspiring our design rationale. Our design goal for the design process has been to create something that would lead the user to experience physical discomfort, empathy, and being inquisitive about something hidden.

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CURIOSITY

Working with the material combination of leather and Plexiglas inspired us to work with the user's curiosity towards the interaction, and the user's desire to uncover the system. The leather side afforded brushing, while the brushing of the leather as seen from the Plexiglas side showed an uncomfortable, trapped hand. Inspired by the Schrödinger's Cat experiment; a scenario where a cat is locked in a box, and due to a random event making poison either infiltrate the box or not, the cat is simultaneously alive and dead, we have focused on something, that you cannot see, but you know is there, thereby sparking imagination.

MENTAL DISCOMFORT

Not knowing what is behind the leather may lead to discomfort by the user. We experienced, that the brush on leather made the observer feel uncomfortable, because it has the look of someone being trapped, which evoked empathy for the trapped person. A similar feeling is found in Shalekhet, an art installation focusing on mental discomfort and empathy made by Menashe Kadishman. Over 10,000 iron faces cover the floor in the Jewish Museum Berlin symbolizing Jews murdered in Europe, and all victims of violence and war. The installation challenges the guest by asking the ethical question of either stepping on the victims, or just staying outside the installation. Most people walk into the installation, and as a consequence of the faces being pushed against each other, they make a loud noise. This unpleasant experience foster reflection on the participant's own relation to the victims, hereby fostering empathy.

SERIOUS GAMES

September 12th is a so-called Newsgame, meaning that the game is based on actual news data, commenting on The War on Terror. The instructions to the game are simple; it is not a game - it is not possible to win or lose, the player only have the decision to fire, or not to fire. The game shows a Middle Eastern looking city, with burqa-dressed citizens and a few terrorists in the streets. The player controls the target and fires missiles by clicking the mouse button. The missiles are not very precise, and they often result in not only killing terrorist but also civilians. The player is unable to fire the missiles in rapid succession, as a delay is added between each fire, leaving the player time to think about its actions. The game has an interesting ability to link the amusement of gaming and the seriousness of The War on Terror.

DESCRIPTION OF MINE(D)

Mine(d) is an interactive sound installation focusing on the dangerous mining industry. The installation sets up an illusion of two contrasting rooms, one with cheerful sounds and one with unpleasant sounds, symbolizing a caricatured uneven relation between the consuming Western countries and the producing Third World countries. Approaching the installation users hear a cheerful karaoke version of Madonna's "Material Girl" and see a box with a doll on a RC car. This is the actual room all users experience.

To enter the contrasting hidden room, the user is asked to wear headphones playing an unpleasant soundscape while driving the RC car with the doll on top. The soundscape contains a smoldering background sound, a man breathing and coughing, and a knocking sound. On the box she not only sees the doll driving around, but also an indication of a dot pressing against the Plexiglas (through the leather).

What the user does not see, is that underneath the box's surface is another, bigger RC car, controlled by the dolls movements; a web cam is colour tracking the doll and is processed from MaxMSP to Arduino, which is controlling a hacked controller to the bigger RC car. The doll's movement also affects the knocking sound, since it is only played when the doll is moving. Consequently, the user's interaction with the doll brings something in the hidden room to life, and it is the aim that this interaction will cause some sort of curiosity and mental discomfort by the user.

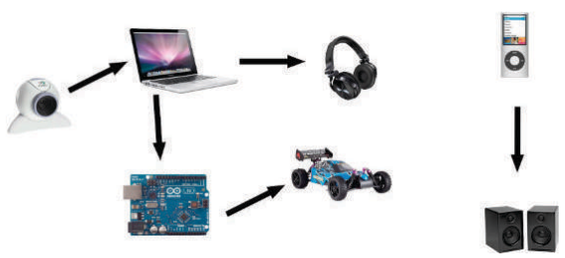

Figure 2. Technical diagram of interaction pattern

THE ILLUSION OF TWO ROOMS

With the construction of Mine(d) we had the goal to create the illusion of two rooms, one being the exhibition space (the actual room) and the other the imagined room existing underneath the leather/Plexiglas box (the hidden room).

THE ACTUAL ROOM

The first sound that meets the user is a medley of different karaoke versions of Madonna's "Material Girl". We wanted the sound that met the user to be happy, perky and emphasize the mood and life of the doll on the RC car, hereby welcoming the user. Iben Have (2008) explains how sounds can have an emotional function in TV and thereby show atmospheres and feelings of persons. The soundscape should help the user to understand, that the positive energy in the music is linked to the doll, which along with the look of the doll, should symbolize the caricatured life of the inhabitants in Western countries. Adding audio to the actual room also intended to drown the sound of the big RC car moving.

THE HIDDEN ROOM

The hidden room both refers to the actual location of the big RC car underneath the leather, as well as an imagined room that we are trying to create in the user's mind.

With sound and a sign with the text “Warning! Men working in shaft” above the installation, we tried to make the users see this imagined room as a mineshaft.

To create this conception we have used references to the TV medium. Bordwell & Thompson (2010) differentiate between diegetic and non-diegetic sound, meaning sounds which sources are visible on screen, and sounds which sources are not visible. The background sound in Mine(d)’s soundscape was added to make an illusion of being deep down in a place where something is smouldering. This effect was created by adding a low pass filter and a bit of echo to the recordings of the breathing/ coughing man and the knocking, to make the illusion of being underground in a closed space. To create a more emphatic feel by the user, we used the sound of just one man coughing and breathing heavily. We wanted the user to link the dot in the leather to this person, whereby the sound would be understood as a diegetic sound. To help the user make the connection, we included knocking sounds in the soundscape, to emphasize that something was stuck. Through this setup we hoped to facilitate the user’s empathy for the “miner” underneath the leather, resulting in the user imagining alternative narratives of mining. As the dot does not figuratively look like a miner, this link could be hard for the user to make, whereas the sound would be interpreted as non-diegetic. Still the general focus on the mining industry might facilitate a reflection about the user’s own role in the dilemmas between the Western- and Third World countries.

INTERACTION BETWEEN THE ROOMS

The doll and the headphones act as a physical manifesttation of the move from the actual room to the hidden room. This means, when the user controls the doll, she may see the doll as a representation or an embodied relation of herself, hereby extending one's bodily experience of the installation to be situated on top of the box. Apart from this the user hears the sounds from the hidden room below the surface, and hereby we thought the users would connect the sounds to the dot on the surface. For the user to get this link, and not just drive around, we designed a feedback in sense of the knocking sound and the dot. This means that it is only when the user moves the doll that the dot (the big RC car) will move and the knocking will sound. Krueger (1977) points out, that the most crucial role of the designer is to design the relation between the user and the system as a relationship between action and response. The response is the feedback that the user gets when interacting with the system, and it is needed to decode the system at a functional and reflective level.

The feedback in Mine(d) is quite binary, meaning we only detected movement or not-movement, and made the system act upon this. This was done to make it clear to the user, that the input was detected by the system giving a response in sound and movement. We wanted to make the response dependent on the doll’s x,y -position, but with the size of the big RC car this was impossible. Hereby the user had a limited influence, but we thought this would still be a clear influence on the system from the user’s perspective.

FINDINGS – DESIGN EXHIBITION

Mine(d) was exhibited in a small local shopping street in Aarhus, Denmark. The visitors were a mix of fellow students, family, friends and random passers-by. In the following we will explain and discuss the assumed interaction with, and interpretation of Mine(d), followed by how the users, the visitors at the exhibition, interacted with, interpreted and commented on Mine(d).

CURIOSITY

Based on the way the leather worked with the Plexiglas, and inspired by Schrödinger’s cat we wanted to make an installation that was able to evoke curiosity by the user. In this sense the user could be both the person interacting with Mine(d), and the person looking at somebody else interacting with Mine(d). The dot symbolizing the miner underneath should evoke the curiosity to explore the interaction, but also a curiosity about the thing underneath. The user watching the interaction should be intrigued about the dot of the miner but also the sounds in the headphones.

As we exhibited Mine(d), some of these expectations were met, as others were not. Most people visited the installation in pairs, which meant that one was interacting while the other was observing. The user interacting seemed to notice the dot pretty fast, as it started to move, but seemed to focus mostly on the doll she was controlling. The focus seemed to be on the interaction and not on what the dot was symbolizing. The observing users reacted similarly, asking the interacting user about the sounds in the headphones, more than about the dot.

MENTAL DISCOMFORT

The aim of the hidden room was to make an unpleasant contrast to the actual room, making a caricatured good and bad dichotomy. The user should have an unpleasant experience, making her feel lonely and cut off from the actual space. This is a tactic described as “un-comfortable interactions” (Benford 2012), where the user gets stimulated and challenged through mental, visceral or cultural discomfort. Mine(d) is working with cultural discomfort by creating interactions that invoke dark cultural associations. We thought this would be attained through the unpleasant sounds and the context of the dangerous mining industry, hereby confronting the user with the challenging theme of Western consumption of Third world mining. Benford argues (2012), that discomfort may lead to entertainment, enlightenment and sociality. As our focus was on enlightenment of the mining industry the cultural discomfort became a tactic for letting the user enter into the place of the miner, hereby fostering empathy.

Findings showed that the soundscape was not enough for the users to understand the link to the mining industry. They thought the soundscape was a bit unpleasant,

but it did not act as the intended shock, that we wanted it to be. It was not uncomfortable enough, which might be because of too fast a shift from a very silly world to a more serious one.

EMPATHY

The main focus of Mine(d) is to make the user think about how their life in the Western countries affects people in Third World countries. Through the soundscape in the headphones we want the user to experience the situation of the miners, and either feel the same discomfort or feel empathy for the miner's situation. One of the users expressed a discomfort about the sounds in the headphones but most of the users just seemed a bit confused. Another user asked whether the doll was sick, since it coughed, and was clearly linking the sounds in the headphones to the doll, not the dot underneath. We wanted the users to understand, that for the doll to go around, the miner in the hidden room must work. Instead the users seemed to focus mainly on the doll, linking the soundscape to her and only perceive the dot as part of an unserious gaming element. This could also be connected to the fact that Mine(d) does not give the user enough reflection time. The soundscape did not support the interaction as well as intended. People were unable to detect the knocking sound as a result of the doll driving/not driving. Some users made their own, misunderstood perceptions of feedback, e.g. knocking when driving in the corners, indicators that the interaction was not working optimally.

FUTURE WORK

Generally, Mine(d) did not give the user time for reflection. The mapping between interaction and sound confused the user, thus confusing the user about who to feel empathy for. We found that response really is the medium, as Krueger (1977) emphasized, and that the users need more feedback on their actions. A possible solution could be a more fluent translation of movement to sound, which in the design of music instruments is a way of encouraging bodily engagement [13]. A responsive soundscape where it is not the either-or-movement that triggers sounds, but also the direction you are moving, or the position you are moving to. To improve this we have though of an alternative setup (Figure 3).

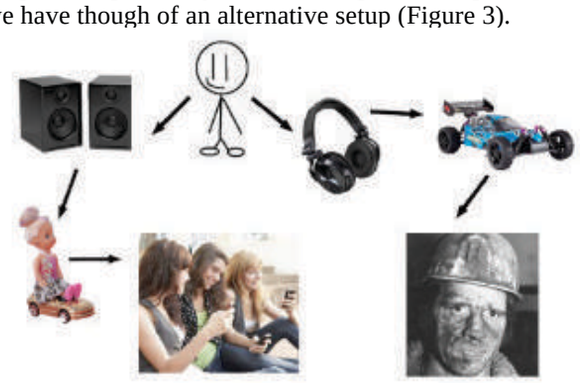

Figure 3. Interaction pattern in new construction of Mine(d)

The viewer hears and sees the doll, and is set in the role of the Western World inhabitants represented by the doll. The user interacting is controlling the dot, the big RC car, and is put into the hidden room and the role of the miner accompanied by an unpleasant soundscape. This setup will hopefully make it easier for the user to understand their role and who to feel empathy for, but this would have to be evaluated and tested through a similar exhibition setup.

CONCLUSION

In this paper, we investigated how the interaction between two contrasting soundscapes may foster curiosity, mental discomfort and empathy. We have been using Mine(d) as an insightful example, since the exhibition and user tests have proved it to be a difficult task. Empathy and reflection are subjective values, which need time to develop in the users mind, and are therefore hard to measure in user tests. Second, when designing for debate on political themes far from one's everyday life and culture, such as Third World issues, it might be hard for all users to relate to. When that is said, the investigation of Mine(d) proves to be a good example of the general importance of mapping between sound and interaction, as well as response. By testing Mine(d) with users we have found an alternative technical construction as presented in future work, but it will require testing to evaluate whether this mapping will appear better than the original. The analysis of Mine(d) has shown that tactics of curiosity, mental discomfort and empathy acts as a good catalyst of reflection and empathy on Third World issues, if the designer just remember to design breaks for reflection and a sensible narrative around the uncomfortable interaction.

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GEAR APP: AUTOMATED BICYCLE ROOFTOP STORAGE SYSTEM FOR SMART HOMES

ANYA ERNEST, AXEL PELLING, JUNTIMA NAWILAIJAROEN, VARUNA MUDUMBY, VASILEIOS GOLEMATIS

CHALMERS UNIVERSITY OF TECHNOLOGY

{ANYERN}, {VASGOL}, {JUNTIMA}, {VARUNA}, {PELLING}@STUDENT.CHALMERS.SE

ABSTRACT

As the amount of bicycles in large cities rises and outdoor space is becoming increasingly insufficient, a need for alternative storage spaces has emerged. Bike theft is also a major issue and is more frequent because of the huge number of bicycles. A secure automated rooftop bicycle storage system is proposed in the theme of “Smart homes”, enabling people to easily store and retrieve their bikes through this system with the use of a mobile application and RFID identification to establish safety and convenience.

INTRODUCTION

In an ever-changing world, the need for future vision is more important for businesses than building long lasting products. PEAB is a construction firm and their “products” live for more than a 100 years. By identifying which problem areas are predicted to expand in the future, PEAB can create more reliable concepts. One of the greatest issues in future city housing is space optimization. As ground space becomes more valuable, houses get taller and the interior areas get smaller. Cars are pushed out of the city and public transport, walking and biking increases. The amount of bicycles is expected to be tripled by 2025 (Trafikkontoret 2014).

As the number of bike commuters is increasing, the need for bigger and better storage of bikes becomes a demand. Furthermore, the limited space requires the generation of creative solutions for bike parking, utilizing currently unused spaces. The city of Gothenburg just recently closed the deadline for a competition on the topic.

Providing sufficient space for bikes is only one aspect of parking bikes. Security is one more major issue since as many as 60000 bikes are stolen each year (Brå 2014). Increasing convenience by ameliorating these problems is also needed to promote the use of bikes over other means of transportation especially in the context of a stressed morning situation. These problems cannot be ignored by the construction firms since the P Norm of Gothenburg says that “Parking for bikes by homes and offices shall be offered on the ground owned by the building.” and that “The parking areas shall be safe, of good quality, have weather protection and there should be opportunities to lock the bike indoors or in a fixed place.” (Parkeringspolicy för Göteborgs Stad 2009)

Most parking for bikes that is offered close to houses in Gothenburg are bike rooms that are often crammed with bikes and it is a hassle for people to retrieve their bikes from there. They are secure, but only until someone breaks open the door and picks the bikes that are of any value. The bike rooms also claim a lot of space that could be used for alternative neighborly activities.

CONCEPT

The aim of the project was based on the problems stated above and formulated as:

To create a secure system for bikes that is easy to use and that does not take space that can be claimed for alternative uses.

Looking at spaces that today are not used for anything else, below ground, façade and rooftop where identified. The earliest concept only made use of the façade but

In Lucero, A., Castañeda, M., Bang A.L. and Buur, J. (2015). Embodied Interactions, Proceedings of Sider 15, March 27-28, Kolding, Denmark

that made the bike weather exposed and also demanded a very complex system for storing and retrieving the bicycles.

Placing the bike parking underground was also investigated but was abandoned due to high costs and inconvenience if there was a power failure.

Sending the bike via the façade up to the rooftop therefore became the concept to be further investigated. Locking the bike onto the system using an RFID key and sending it to a specified terminal slot in a rotating cylindrical structure, resembling a carousel, on the rooftop.

Since it will take some time for the bike to travel down the façade, the owner is equipped with a smartphone application to call for the bike when getting ready to leave the apartment or getting closer to the home. The bike will then wait for the owner, locked by the RFID system. However if the owner does not show up for a specified time, a use-case based on user evaluation in future work, the bike will have to move back up. This will also be the case if another user calls for their bike – a queue will be created and if the first bike is not picked up, it will then be moved back up and the second in line will get a way to move down. If there were more than one access point, those would be used instead.

Information about time and location to pick up bike would be accessed via the smart phone application. It will also have a countdown timer for when it will be moved back up or when another user is queuing up.

The target time for the bike to get to the access point in the example house is considered to be less than five minutes. This time is based on what the bike commuters in the group found to be a reasonable time and need to be further evaluated and tested both on what is possible and what is stated as a demand from the users.

METHODS AND PROCESS

THEORETICAL BACKGROUND

In the early stages of the project the three main problems were elicited: space, security and convenience. By keeping these three in mind in all concept development the evaluation of concepts were more easily performed: “will the idea provide support in finding solutions for the stated problems?” Inspiration for this was collected from the effect mapping way of working (Ottersten and Balic 2007).

Given also the theme of “smart homes”, a vision-driven approach (Ishii et al. 2012) was followed. Ishii et al. (2012) underline that vision-driven design is critical in ‘fostering quantum leaps by looking beyond current day limitations’. Thus, the solution proposed by this paper is aiming to illustrate a vision of a bicycle storage system that could be potentially feasible in the future given the rapid technological advances and promoted by the emerging problems that are highlighted. Nevertheless, technological and monetary aspects were seriously considered. Initial ideas that introduced excessive costs or technologically unrealistic solutions were immediately abandoned.

The divergence methods (Jones 1992) include mainly benchmarking through online research and observation aiming to study existing creative solutions in the city of Gothenburg. The online research allowed the group to explore concepts and designs from many different parts of the world. By conducting early brainstorming and prototyping as a form of grounded theory (Hook 2014) too much knowledge around what is and is not possible was not acting as idea stoppers. Iterations with stakeholders with lo-fi prototypes allowed the concept to be developed further.

RESEARCH

The concept of a mechanical rooftop bike storage is already considered by engineers for the Amsterdam bicycle problem (Geere 2012), though not explained and implemented more than the concept level. The automated underground system of Japan (Laughing Squid 2013) is really impressive and is one working solution that uses space efficiently and securely below ground to store huge numbers of bicycles. It created serious considerations for using the basements of the building for bike storage, but was abandoned due to flood regulations (Göteborg stad 2012). A carousel type cylindrical bicycle parking system (Carousel 2014) seconds the idea of using a similar mechanically rotating structure for storing bikes on the roof. Inspiration was also gained by the “smart office” by Maverick (Maverick by Sigma 2014), where employees are able to book group rooms preemptively through their phones and check-in by swiping their phones by using the iBeacon system. This gave birth to the idea of using a mobile application for bike-retrieval and secure authentication using RFID tagging.

Testing of existing parking solutions was also performed in order to get a better understanding of how to connect the bike, how to place it, move it up the façade etc. The Gothenburg Central Station’s bicycle parking system was visited and promoted the idea of securing the bicycle on a metallic base, as it ensures stability, and smooth transportation over the façade railway system.

USER STUDY - STAKEHOLDERS

In the early stages the concept was presented to three bike commuters for the approval of the concept. The frustration of retrieving their bikes from the back of the bike room or to have their bikes stolen proved to be something that they had experienced several times before. For these reasons, the concepts introduced were conceived to be a great solution.

Interviews with both the chiefs of city development, Park & Nature and the bicycle planner of Gothenburg municipality were conducted. These were done to evaluate the design ideas and get their perspective on

bicycle storage. In both interviews, great feedback was received and a general interest in the concept and design was expressed. Bicycling is growing every year and the problem regarding where to store them all is something that is heavily discussed by the municipality. The interviewees also brought up the problem with different shaped bicycles, such as cargo bicycles that are on the increase.

PROTOTYPING

The earliest prototypes consisted of conceptual sketches, but the difficulty in conveying the vision onto paper was a setback, so 3D versions of the prototype were created for illustrating better what the final prototype would look like.

By starting the prototyping of the façade system early in the design process, some big challenges were identified and solved before the final prototype (Kuniavsky 2010). Several simple pulley systems out of Lego and cardboard were made to get an understanding of how the system could work. These early prototypes were only powered by hand, but these learning were made in order to implement the system in the final prototype.

RESULT

The final prototype is a 1:16 model of a house. The house has the dimensions 1x1x0.8 meters. It is built with a wooden frame and plywood façade and roof. The bicycle retrieval system is built with Lego parts and is powered by a Lego Mindstorms NXT controller (Lego 2014). The system can be used to bring the bicycle carriage up and down the façade (figures 1, 2).

Looking at a house with four floors, each floor with an apartment 54 m^2 gives an estimated rooftop of approximately 256 m^2, giving sides of 16x16 meters. Creating a rotating cylinder with a diameter of 16 meters. Each bike would only need 2 meters of the outer rim, and about one meter of the circumference. This would create parking for approximately 50 bikes giving space for 3.3 bikes per household.

In the final prototype the cylinder storage is made out of cardboard and transparent plastic sheets and is controlled by an Arduino (Arduino 2014) connected with a simple electronic circuit. It is used to spin the cylinder into position for loading the approaching bicycle.

The smartphone application (figure 3) is only on a start page of the design stage, allowing the user to get the bike, track the estimated time of arrival at the checkout and when it will be returned to the cylinder if not checked out.

Figure 1. Model Bicycle transported over the façade.

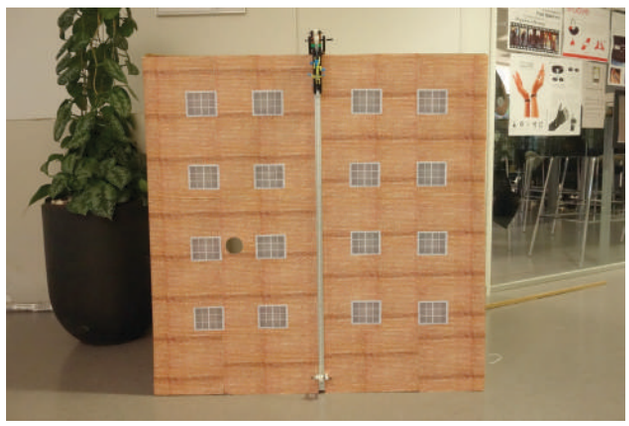

Figure 2. Final Model Prototype.

DISCUSSION

It is indisputable that there is a serious need for creative bike parking in future cities where cars have been moved out, but is this concept really the best way to store them? If the house was built around the aim of creating a secure, space saving and convenient bike storage system would this have been the ultimate solution? Climbing the façade is time consuming and the whole automated system is undoubtedly complex. In addition to this, automated systems are always exposed to the threat of a power fail or any other kind of mechanical problem.

Having things moving up on a rail using a wire or a chain will also create considerable noise, especially if the house is made of concrete. This means that the system needs to be also soundproof which will raise the costs further. Thus, emerging problems should be identified and the costs for avoiding them should be calculated.

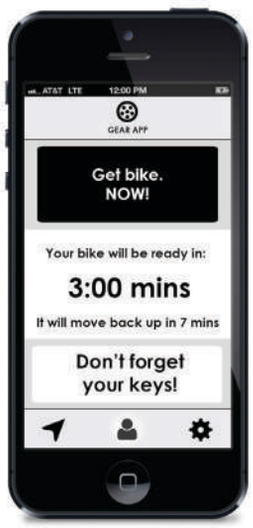

Figure 3. Prototype of the mobile application.

CONCLUSIONS

An automated rooftop bicycle storage system is one of several alternative solutions to the problems analyzed in the paper. Though, no ideal solution could be defined without being implemented in new residences and it is very difficult to enhance existing building with this system. The automated mechanical solution for transporting the bikes, coupled with the RFID identification and the mobile application promotes the theme of "Smart homes", as autonomous convenient solutions tend to be the path to the future. However, the cost is rising and the feasibility of the implementation in relation to a considerable customer value is controversial. Hence, the emerging idea, that will allow the users to retrieve and store their bikes manually in the roof by using the regular elevator, was considered seriously as an option.

The user study and research is a result of the constant rising need of new secure spaces for bicycle storage. The concept of using unoccupied spaces, like the roof and the facade, is a clear path towards a less bike-cluttering environment and safer bike storage. The combined insights and contributions of interaction designers, engineers and architects are essential for formulating an inarguably feasible solution.

FUTURE WORK

The project has only developed a concept prototype, and there is still a lot that need to be designed and developed. For example how the bike is moved from the rail of the façade into the cylinder.

There are a few outstanding issues regarding the user interaction that need to be further investigated. These include questions such as: What is a reasonable time for the bike to move down? If the bike is not checked out how fast should the bike move back up into the cylinder? And should there be a punishment system each time that happens?

Noticing how public bike parking is becoming of more importance, this system could also be adapted to be a public parking. How would the security then be handled if not by RFID?

This system could also be enhanced with services such as gamification features in the smartphone application or storage of rain clothes or helmets for example.

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THE MEMONILE

JOHN TURESSON; ANXIAO CHEN

MSC STUDENTS

COMPUTER SCIENCE, ROYAL INSTITUTE OF TECHNOLOGY

JOHNTU@KTH.SE; ANXIAO@KTH.SE

ERIK DAHLSTRÖM; DAN CARIÑO; NICLAS ERICSSON

BSC STUDENTS

MEDIA TECHNOLOGY, ROYAL INSTITUTE OF TECHNOLOGY

EDAHLS@KTH.SE; DCARINO@KTH.SE; NERICS@KTH.SE

ABSTRACT

Mobile phones and similar mobile, or wearable devices are widely used for everyday interactions. The interfaces, however, communicate a constant potential interaction to the user that is invasive on any other communication whenever the phone is close by. Though wearable technology is closer to the body than mobile phones, the field is yet focusing interactions with wearables to being more embodied and less invasive. In order to evaluate how technology can be made more "invisible" to the wearer while still providing functionality close to that of mobile phones, an interactive necklace was developed with the functionality of taking notes wherever and whenever. The prototype was showcased in a number of exhibitions. The feedback from the visitors suggest that there is an interest for such a device and non-invasive technology in general.

INTRODUCTION

The booming usage of cell phones and especially smart phones is greatly influencing our lives, serving as a conscious or unconscious distraction away from the surrounding environment (Smith 2012). The interaction might be interpreted as being invasive in some settings, arguably making the phone prone to trigger interaction as opposed to just covering a certain need. Still, phones being very portable, they provide a very accessible interaction to the user, whether it involves getting directions or playing games. The approaching (2015) Apple Watch is also paving commercial ground for wearable computers, essentially moving the common mobile touch screen interaction to the wrist. Though this may seem as a natural progression the question of what impact having a phone on your wrist will have on the user's attention arises as well as how this may affect the future of wearable technology.

Interaction in the field of wearable technology also addresses the features and forms of the wearables. In the field of HCI the shape and especially the functionality of wearable artifacts can be much more organic and have a less concrete purpose than what most users are accustomed to, though still presenting a more natural experience (Wright et al. 2008). This paper explores the possibilities of extending basic functionality of and interaction with a mobile phone to a more accessible and less invasive wearable artifact, trying to put off load from the constant awareness and distraction typically present for mobile phone users. The aim is thus not to find a replacement for the mobile phone but rather create a complimentary artifact, investigating the boundaries of interaction with portable and wearable technology. The topic of this paper revolves around the work on the Memonile, a wireless device worn as a necklace that can be used to write down notes to be viewed at a later time. (The work also gives an insight in the impact of having workable, interactive prototypes.)

BACKGROUND AND PREVIOUS WORK

Designing wearable technology involves thinking not only about how a person interacts with a wearable artifact, but also how it can be worn and be part of everyday use scenarios and contexts. With for example mobile phones, which could be considered as a wearable technology product to some extent, when there is not a constant interaction going on there is rather a potential interaction, considering that the phone can receive notifications or phone calls at any time. This

In Lucero, A., Castañeda, M., Bang A.L. and Buur, J. (2015). Embodied Interactions, Proceedings of Sider 15, March 27-28, Kolding, Denmark

potential interaction and the notion of the phone holding information that is waiting to be viewed might be distracting and lead to a frequent checking of the phone. While being invasive to the user it can also interrupt the communication with other people, which apart from perhaps being ignorant may also be futile interaction (such as "killing time"). The view on mobile phone usage and its impact being very scattered among different users, the necessity of addressing this issue can be discussed as being more or less important. One of the more challenging aspects of wearable computing is perhaps how to put more emphasis on the interaction qualities and make the user think less about performing a specific task.

A recent trend (2015) is the wearable cameras that automatically takes photos during the day. The initially crowd funded Narrative Clip by Narrative[1] was one of the first cameras of its kind to hit the market with the design of a small rectangle clip-on that can be attached to for example a shirt. It takes two pictures every minute resulting in a vast amount of images at the end of the day. A more "sophisticated" take on the same theme is the Autographer[2] automatic camera that can be worn as a necklace and uses a combination of light, acceleration, orientation and temperature sensors to find good moments for taking a photograph, removing the need for the user to actively hold the camera and take photos. Maybe the most interesting aspect of these cameras is the automatic functionality. Since wearables are so close to the body, they are also exposed to the same or close to the same sensory input as the wearer.

DESIGN

Here is presented the idea of the Memonile, a composition of the Latin words memo (memo) and monile (necklace), which is a wireless device with a touch sensitive surface that hangs around the neck as a necklace. Though the touch surface is a sensor that can be used as input for multiple interactions, the specific prototype used the touch surface as input for taking notes. The Memonile thus provides a way for the user to save notes or messages for themselves that can be viewed at a later time, on another device different from the Memonile (currently the mobile phone). The device was also designed to have little to no feedback when pointing at the touch surface, completely leaving out the screen normally part of most touch screens.

One aspect of the project was creating an interactive prototype, therefore leading to the project being managed by exploring the interaction through interactive prototyping. The project work was divided into three parts: an introductory brainstorming with low fidelity prototyping, exploration of electronics and functionality and the work on a final interactive prototype.

[1] Narrative, http://getnarrative.com/

[2] Autographer, http://www.autographer.com/

PROTOTYPING

During a set of brainstorming sessions an overall function and design was discussed. In order to assess the aim of the project the starting point was set to find a concept balance between usability and exploring interesting interactions. The idea of remembering and saving private messages for later review created a number of ideas involving tangible and more embodied designs. The focus was put both on leaving a more abstract trace that could be experienced on a lower level, as well as designs more connected to actual note taking with pen and paper. Eventually the idea related to pen and paper was chosen because of the time span of the project and the aim of getting a workable prototype.

When designing technology to be wearable it is often required to be small, mainly because there is still a clear distinction between technology and garments or jewelry. Prototyping being a key part of the project the Arduino platform was considered early on. The wireless aspects of the device had a big impact on the choosing of technology platform leading eventually to the rFlea, a small Arduino based board with built-in wireless functionality, developed by Jordi Solsona Belenguer, PhD student in the authors' University Department. Communicating via Ant+ with the mobile phone the pairing and battery life are efficient, leaving more space to focus on the prototyping. As for the sensors used in the prototype we looked into different kinds of solutions for a touch surface. Discussing ways of having an array of one-dimensional sensors to provide a more organic surface, we chose to use the same resistive touch surface used in the Nintendo DS, being the only touch surface without a display that we could find.

Figure 1: A low fidelity prototype made with cardboard and paper (right) and the touch sensor used in the final prototype (left).

Figure 2: The final interactive prototype, the Memonile.

A cardboard prototype was then created based on the brainstorming and platform exploration, seen in Figure 1. The shape was heavily influenced on the used touch sensor since it took up more surface area than the other components combined. It was quickly found that the orientation of the device would present an issue since the way it is being held affects both the comfort and the positioning of a pointing device (stylus), button or LED. A small evaluation was carried out on ten people who got to wear and try the prototype while being asked questions about how they would use it for different scenarios. All ten people held the device in their left hand, all being right handed, of whom six held the device on the side and four held it upright like a mobile phone. Most people would like to use some kind of stylus for pointing while only two wanted to use their fingers. No comments were made on the shape or the situation of the device.

INTERACTIVE PROTOTYPE

With the feedback from the evaluation we made some adjustments to the final design. Since the prototype had two holds for the neckband constraining the turning of the device they were instead combined to one centered hold and the length of the neck band made adjustable, mostly from observing the users in the evaluation. Following the aesthetics of the low fidelity prototype wood was chosen as the main material for the case because of its similarity to the softness of cardboard while still being perceived as sturdy. Using wood we could also use a laser cutter to quickly design and cut the pieces for the physical form, while at the same time getting a natural look on the device. A small stylus was also crafted with a magnet on one end so that it could be easily attached and detached from the side of the device.

The final setup consisted of the Memonile necklace, with a resistive touch screen, a stylus and a notification LED (discussed later) as seen in Figure 2, connected to a mobile phone managing the data from the touch screen and the displaying of the data. The interaction with the Memonile consisted of drawing a note on the touch surface with the note then being automatically saved to the mobile phone. A note can then be reviewed on the phone at a later time.

DISCUSSION

The final prototype was demoed at a number of open exhibitions. For some exhibition visitors, the concept of the Memonile was immediately recognized as something that would be helpful for taking short and simple notes. Those people appreciated the design as well, because of the device “looking nice”. Aesthetics of technology is of course applicable to most devices, but since the Memonile is still in a prototype state it must be stressed that none commented on the device feeling cheap or unfinished. Maybe one of the more justified questions was: How is it different from having a mobile phone hanging around your neck? Comparing the Memonile to a mobile phone is inevitable because of the similarities in their designs. However, the amount of people seeing the device rather as an extension with less technological feel justifies that there is a demand for non-invasive artifacts.

As for the state of the prototype, the software can easily be changed without opening or modifying the Memonile, acquiring for it to be used for future evaluations. The LED was eventually added to the device only with possible future applications in mind, later spawning ideas of how for example the Memonile could display notifications to the user. Though physical prototyping typically requires technological and electronic skills (Avrahami and Hudson 2002), putting the time on implementing a robust platform brings the possibility of easily changing the interaction. At the same time, increasing availability of 3D-printers and laser cutters makes it more likely that such tools are available even for smaller companies or studies which further accommodates for putting emphasis on making interactive prototypes.

CONCLUSION

Assessing the issue of invasive technology and devices, such as the mobile phone, an interactive prototype was made. The prototype (Memonile) evaluated how the interaction with technology could be made less invasive and more natural, in the sense of feeling less technological. Results from exhibitions suggest that the experience of technology being invasive for some people is triggering the need for less technology-focused artifacts. While the work on the Memonile needs to be more thoroughly tested and evaluated, it serves perhaps as a guide for future work within the field of wearable technology.

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DEMOS

WEARABLE WELLNESS: USER-INNOVATION IN THE EARLY STAGE OF A PRODUCT INVENTION

BARTOSZ ROZYCKI
M.SC. STUDENT IT PRODUCT DESIGN
BAROZ13@STUDENT.SDU.DK

ABSTRACT

We live in a world full of rush and a 'relaxed state of being' might increasingly play a role in today's fast paced society to overcome contemporary stress and related illnesses such as burn-outs. The Sleephones concept is a wearable wellness device that aims to support relaxation by combing music with massage elements. In this project I explored how potential users communicated in an embodied way, by exploring how the product mock-up could be positioned in very different ways on their bodies, complemented with an articulation of that particular experience in the moment. The potential users were provided with 6 different scenarios that inspired appropriation of the Sleephones. In the further development of Sleephones these videos became essential to re-enact the potential use of this early stage wearable product invention.

INTRODUCTION

User-driven workshops are ideal occasions to meet potential stakeholders and user centered design offers dozens of tools in order to engage users into the development of new design, services, or in this case a product invention: Collective video analyses, tangible interaction, hidden cameras, to questionnaires, full experiences or workshops, interviews and more, all these methods are flexible and can be combined to full-day or speedworkshops with a variety of activities for instance the use, test and discussion of the product appearance, instructions or tangible prototypes. Whatever method you choose as Designer, the goal remains always the same, that is finding the right way to get the most out of the activities in order to set the right direction for the future design of the present product, service, marketing or business model. Putting the user into the center to get valuable and effective feedback on an idea, strategy or design early, avoids the potential danger of heading towards a direction that does not meet the true expectations of people in their actual use environments and times of use. Furthermore you access an effective source to evaluate your view on the design, literally through the senses of your stakeholders, leading you to new and hopefully unexpected comments. Via the integration of hand-on activities that lets participants join your world in an embodied way, increases the chance of an initiation that each individual needs in order to contribute to design with passion and commitment. In this project ten individual co-design speed workshops with the early stage concept "Sleephones" were performed in order to show what difference a tangible prototype makes in such a workshop and how you can simulate limitless use-scenarios as soon as workshop participants are starting to get into the world you are designing for. Furthermore the aspect of the value of the use of qualitative tools in form of a well-crafted product design proposal that was brought to the table was explored in this project.

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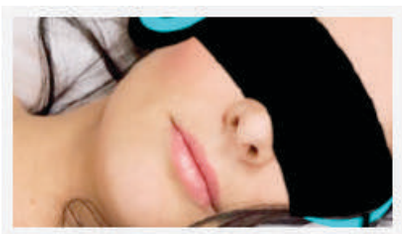
THE 6 USE-CASES

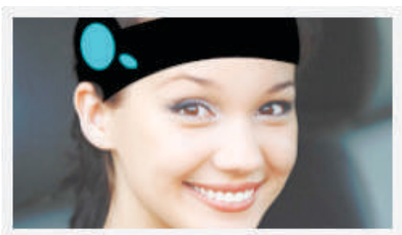
1. RELAX YOUR NECK

2. RELAX YOUR BACK

3. FALL ASLEEP



4. RELAX YOUR FOREHEAD

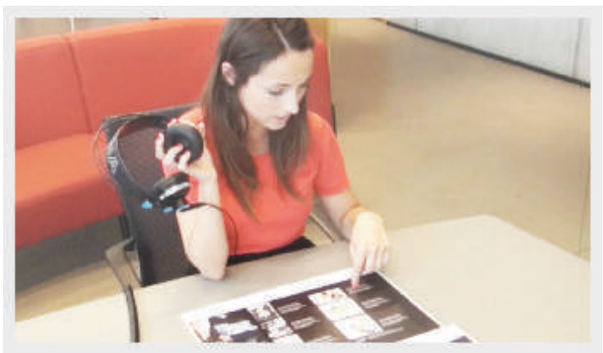


5. RELAX YOUR SHOULDER

6. RELAX YOUR LEGS

METHOD

The development of the Sleephones design concept was supported by a method experiment that I call “Silent Speed Workshop” consisting out of a cross mix of user-centered design methods in individual spontaneous 15 Min. activities with potential users around a tangible mock-up of the product idea, an illustrated product description and 6 potential use-scenarios, as for instance individual neck relaxation, for a simulation in one of the predicted use environments that was an office.



The main activity of the workshop for the participants was to firstly get familiar with the general idea of the concept by reading through the product description and the use-instruction. The facilitator remained silent during the complete workshop, in order to let the product instruction and design speak for itself. Afterwards the participants started to act out the suggested scenarios with the tangible mock up and think out loud their thoughts guided by three open questions.

1. Do Sleephones help you in this situation?
2. What do you think about Sleephones?
3. How do you think the Sleephones could be improved in this specific situation?

The activities were recorded on video to re-enact the potential use of the product invention. One main intention was to of course see the reactions of the users after they have been spontaneously invited into the activities without the chance to prepare or to make thoughts in advance, as if you see a product in the shelf of for instance an airport store for the first time. By throwing the user into the cold water we can observe how such a new product fits into their life when they get in touch with it for the first time. What do the users think about the story the product is telling? Is everything clear and the design appealing? During the actual scenario-act-outs with a headphone, the participant’s body movements revealed various details in the handling of the product and the well crafted product instructions served as test if the packaging and design could be implemented in the suggested way in the final product. Through the silence of the facilitator during the complete activity the evaluation of the sole product concepts design appeal was guaranteed.

Most methods in the user-centered design pool follow the same goal: Get information on what people really want and it can be a big challenge to get there.

Workshops are next to field observations, interviews, questionnaires and so forth, one way to bypass this dilemma. Embodied user involvement and "hands-on activities" hereby can boost the experience and the outcome for further improvement of a concept when it comes to the teached and experienced methodologies here in our master course.

In addition, the creation and illustration of scenarios is not only cheap and fast but globally helps designers and innovators to find unmistakable guidance in the design:

> "Sharing and developing scenarios helps to control uncertainties of design work, while sharpening and strengthening design goals." (Rosson & Carrol 2002)

Further "The insights from users enables the interaction of other stakeholders as well" (Grayham et al. 1998) as in our case prospective engineers who will deal with industrial design and manufacturing of the suggested product concept. User-driven innovation, as the conducted activities in this project, presumed that they are thoughtfully designed, serve as engaging ways to identify reactions, thoughts and true needs related to the design we try to put in peoples every days.

In the end it comes to the facilitators creativity and ability as facilitators to choose, design and use effective methods that engage and motivate participants, cause: "The first rule of user-driven research is to never ask anyone what they want." (Hall 2013) and so our task is to guide them towards a recognition and revelation of their true needs and here embodiment helps users to dive into the world and experiences we design for them.

FINDINGS

This is what I did in this project: Letting potential users get the hands on and embody them with a new product concept design, letting them think out loud and explore the product use to reveal their intuitive wishes. During the activities the setting and set of tools revealed the following potentials in the design of new inventions:

1. TEST YOUR STORY

Do users understand and relate to the story the product, service, marketing or business design tells? The method qualifies to test your complete story design.

2. OBSERVE THE USE

This aspect is specifically related to how the potential users use their own bodies to interact with the product to derive concrete product interaction specifications.

3. TEST POTENTIAL USE

By illustrating realistic use-scenarios you can easily test your predictions of your concept. Cheap and fast.

4. COLLECT NEW VOICES

New improvements on the overall design, functionality and use of a concept as well as unexpected comments lie in the early involvement of potential users.

5. FIND EARLY ADOPTORS

In the pool of participants you find people that are more engaged and inspired than others. You see what kind of person could become potential lead-customers later on.

6. CO-DESIGN THE EXPERIENCE

If your story and tools reach a specific level of quality and relevance people become very active and have fun to evolve the experience in collaboration with you.

The complete and compelling product story of "Sleephones" by a guiding product instruction with realistic use-cases as well as the tangible product mockup in the workshop made the difference in the outcome and contribution. Due to the involvement of the body, the participants seemed relate more to it, and by getting their hands on the concept and test how they would use it and how they would feel they seemed to get a better picture of how it could function.

During the workshop two key challenges of the Sleepphones concept were unveiled: The product has to be highly adjustable to any part of the body at any time or movement by using innovative materials, mechanics, algorithms to also guarantee an effective massage for different types of bodies. Since low quality would probably not function well or last long the participants see this product more in the premium segment.

Other factors for the surprising activeness of the people was the quality and completeness of the design proposal as well as the fact that the participants got the feeling that they really could make the difference in the future product design. Also the choice of the predicted use environment, the office space, worked out well and other tests at home and on the go are recommended.

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THE PERIPIPE: A SIP 'N' PUFF REMOTE CONTROL FOR MUSIC PLAYBACK

TOMMY FELDT[1]
TFELDT@KTH.SE

SHAUN MENDONSA[1]
MENDONSA@KTH.SE

ANDREAS RAU[1]
ARAU@KTH.SE

SARAH FREILICH[1]
SARFRE@KTH.SE

DANIEL MOLIN[1]
DMOL@KTH.SE

[1] MEDIA TECHNOLOGY AND INTERACTION DESIGN, ROYAL INSTITUTE OF TECHNOLOGY

ABSTRACT

We introduce the *Peripipe*, a tangible remote control for a music player in the shape of a wooden smoking pipe. The interaction is based on breath control, using sips and puffs as control commands. The Peripipe detects changes in the air pressure and wirelessly sends commands to a smartphone running the music player. Additionally, the Peripipe provides fumeovisual feedback, using color-illuminated smoke to display the system status. With the form factor, the materials used, the interaction through breath, and the ephemeral feedback we aim to emphasize the emotional component of listening to music that, in our eyes, is not very well reflected in traditional remote controls.

INTRODUCTION

Currently, physical remote controls for music playback are commonly being designed as rectangular pieces of plastics, employing multiple buttons that map the desired functionality to the controller. Graphical user interfaces on computers or smartphones make use of similar metaphors, using mostly virtual knobs and buttons. However, we argue that these conventional controls for music players, while functional, remain detached from the emotional experience that is listening to music.

Designing a remote control for a music player, we wanted the method of interaction to correspond with the qualities of the action performed. As the use of breath is both natural (used since your birth), emotionally loaded (blowing out candles on a birthday cake) and connected to music (wind instruments), we feel that it might be an appropriate metaphor for the purpose of controlling music playback.

Figure 1: Video demonstration at http://vimeo.com/118474696.

Previous implementations of breath-controlled interfaces for accessibility applications have demonstrated that it is possible to achieve a very high level of control by changing the air pressure using one's mouth (Gerdtman and Lindén 2010). Other wind-controllers, including the *ePipe* (Hughes et al. 2004) and *The Pipe* (Scavone 2003), have explored the value of breath control as a means for musical expression. To complement this, we explore how a sip-and-puff artifact can be used for control by triggering a limited number of discrete actions, such as *play*, *pause* and *next song*.

The Peripipe is handcrafted from Swedish cherry wood and shaped as a smoking pipe. Partly, this was an attempt to make use of the unique aesthetics and qualities that organic materials bring to interactive artifacts (Fernaeus et al. 2014). Additionally, the form factor of the Peripipe carries cultural value in itself, as smoking pipes have been around for a long time and have historical connotations of relaxation (Apperson 1916). Inspired by the ephemeral interfaces of Sylvester et al. (2010), the

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Peripipe gives the user feedback in the form of illuminated smoke (see figure 1) as a way to retain an experiential connection to the act of pipe smoking.

DESIGN

The Peripipe consists of a wooden smoking pipe with an enlarged custom-made bowl, an *rFlea* Arduino microcontroller with ANT+ wireless capabilities, an atmospheric pressure sensor, an RGB LED light, a 9V battery and a miniature smoke generator. The rFlea Arduino, the sensor and the LED are all powered by a small rechargeable LiPo battery, while the smoke generator receives its power from the 9V battery.

The atmospheric pressure sensor is placed inside the bowl of the original smoking pipe, which is sealed with a cork, forming an air-tight container. This makes it possible to detect small changes in air pressure—either negative or positive—induced by the user applying their breath to the stem of the pipe.

FUNCTIONALITY

A program running on the rFlea Arduino continuously monitors the voltage values of the atmospheric pressure sensor. Changes are detected by comparing each new sensor value with the ambient pressure measured when the device was powered on. If the detected change is above a certain signal noise threshold, the user has performed an input action and the software goes to the appropriate state. The state changes are then sent wirelessly from the rFlea to a smartphone over the ANT+ protocol and interpreted as commands.

The Peripipe is programmed to distinguish between six distinct types of user inputs: sips, double-sips, puffs, double-puffs, long sips, and long puffs. Sips and puffs are defined as one short inhalation or exhalation into the pipe lasting no longer than 0.4 seconds. If the user inhales or exhales into the pipe for a longer duration, the Peripipe detects a long sip/puff instead. The user can also perform double-sips and double-puffs by doing a second single sip or puff within 0.6 seconds of the first one ending.

The Peripipe gives visual feedback for user actions in the form of illuminated smoke, thanks to an RGB LED and a miniature smoke generator. Interactions involving positive changes in the air pressure (puffs, double-puffs and long puffs) are accompanied by a red light pulse. The pulse corresponds to the input type, with single pulses representing puffs, two pulses for double-puffs etc. Negative pressure changes (sips, double-sips and long sips) use blue light instead. The light serves not only as a reminder of what action has just been performed, but also as an indication of possible further interactions. For instance, the user can perform a double-puff as long as the feedback light from the first puff has not yet faded completely.

In the present prototype, the smoke is controlled using a separate on-off-switch. The pipe is thus smoking throughout the duration of its usage. The original intention was to have the smoke come out in small puffs when an action is performed. However, this would have required additional hardware and a larger wooden bowl, and was therefore left for future design iterations

MUSIC CONTROL

We have mapped the different actions a user can perform with the pipe to the standard controls of a music player: Play, pause, next track, previous track and volume. As playing and pausing the music are the most basic of the mentioned operations, they map to the basic pipe interaction, i.e. a single puff/sip. Skipping a track or returning to the previous one is done with two consecutive puffs or sips, respectively. Changing the volume requires a more continuous type of interaction, hence a long puff raises and a long sip lowers the volume. The corresponding visual feedback indicates the change with the brightness of the light that accords with the value of the volume. Although more actions and interactions were tested (like “puff-sip” to rewind 10 seconds), we found them quite hard to master. For a limited-application artifact like the Peripipe, there might be a value in itself to keep the functionality simplistic and easy to grasp for a new user.

CONCLUSION

With the Peripipe, we have explored the possibilities of creating a meaningful and usable remote control using unconventional modalities. For future work, we would like to evaluate how well the artefact is able to communicate our design intentions to new users. Another aspect to examine is how the users perceive the connection between input and action.

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MEYA – CRAFTING AN INTERACTIVE BAG WITH E-TEXTILE SENSORS AND ACTUATORS

Video Presentation: http://vimeo.com/109738492

MOA BERGSMARK
MSC STUDENT
MEDIA TECHNOLOGY AND
INTERACTION DESIGN
KTH STOCKHOLM SWEDEN,
MOABE@KTH.SE

YELENA KOSELNIK
MSC STUDENT
MEDIA TECHNOLOGY AND
INTERACTION DESIGN
KTH STOCKHOLM SWEDEN,
KOSELNIK@KTH.SE

EVERT LAGERBERG
MSC STUDENT
MEDIA TECHNOLOGY AND
INTERACTION DESIGN
KTH STOCKHOLM SWEDEN,
EVERTLA@KTH.SE

ANNA MOVIN
MSC STUDENT
MEDIA TECHNOLOGY AND
INTERACTION DESIGN
KTH STOCKHOLM SWEDEN,
MOVIN@KTH.SE

ABSTRACT

We explore the design of tangible remote controls made from e-textile crafting materials such as conductive thread and resistive yarn. Our design consists of a leather handbag that communicates wirelessly through ANT+ protocol with an Android mobile phone to both remotely control the phone and react to incoming calls. We experiment with how technology can be incorporated in classical functional and fashionable details of a handbag.

INTRODUCTION

Within the area of Internet of Things there are many interesting design opportunities to incorporate technology into traditional crafting and remodeling of physical everyday objects. However, often today this does not go beyond concealing the actual technology within the object (Fernaeus 2014). Craft materials enable us as designers to personalize technology and make it feel unique. They also enable us to design artifacts which function can be determined by form and/or feel (Perner-Wilson 2011). In this project we experimented with classical features of a leather bag and traditional crafting materials to create sensors and actuators.

TECHNOLOGY AND CRAFTING

In our working prototype, a leather bag communicates wirelessly through ANT+ protocol with an Android mobile phone to both remotely control the mobile phone and react to incoming calls. A snap fastener[https://vimeo.com/107827100], a two-part

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metal button which is a common element in clothing design, holds the two handles of the bag together. Sewing the metal parts of the button with conductive thread allows the opening and closing of the fastener to act as a switch which remotely controls the ring/silent mode of the mobile phone.

A padded ball hangs freely from the side of the bag. The inside of the ball is winded with a tubular knit stretch sensor[https://vimeo.com/109679822] made of resistive yarn. A squeeze of the ball will change the yarns resistance allowing it to be used as a sensor. This will remotely reject an incoming call to the mobile phone.

The face of the bag is constructed of two layers of fabric, each with different attributes. The first layer is a spangled black fabric with good reflection properties. The second layer consists of a black mesh fabric which falls loosely from the top side of the bag. Eight LEDs are sewn with conductive thread on the inside of the mesh. They are directed so that their light reflect on the spangled fabric and creates a faint glowing pattern. A servo motor inside of the bag can contract and relax the mesh fabric, creating a smooth motion of the bag's surface[https://vimeo.com/108095173].

INTERACTION

The bags functions allow the user to interact with his mobile phone without having to take it out of the bag and be distracted by it. While the fastener is snapped closed, the ringing signal will be on. When the phone is ringing, the user will receive feedback in the form of a smooth motion of the fabric on the face of the bag, together with a faint glow. If in an inconvenient situation, the user can simply squeeze the ball to reject the call. When the user opens the bag, and thus the snap fastener, the phone will automatically be switched to silent.

The user can quite easily operate the sensors, both the snap fastener and the squeeze ball, without directing his gaze and using only his hands. With a quick stroke, the state of the snap fastener can easily be recognized and changed if desired. To operate the ball the user just has to reach out and give a little squeeze to the ball.

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ACKNOWLEDGEMENTS

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Figure 1: Our working prototype incorporates technology in classical, functional and fashionable details of a hand bag

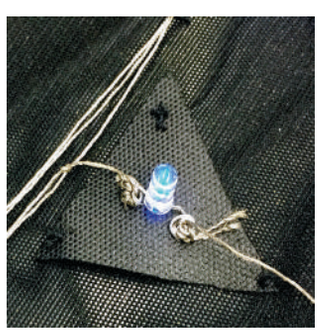

Figure 2: LED sewn with conductive thread

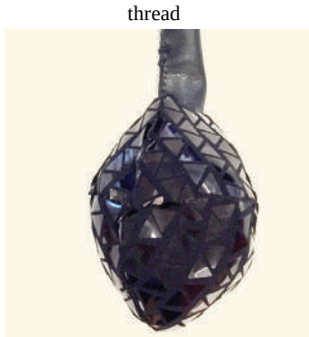

Figure 3: A squeeze ball constructed from resistive yarn

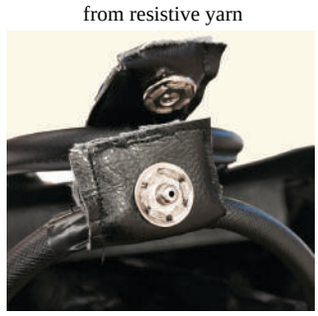

Figure 3: A snap fastener's surfaces are sewn with conductive thread

THE HEALING GAME : A LIFESAVING GAME

MARTIJN VAN DEN BROECK
UNIVERSITY OF TECHNOLOGY EINDHOVEN
INFO@MARTIJNVANDENBROECK.COM

ABSTRACT

Nanotechnology will radically impact people's lives. It may significantly improve people's lives but it may also have unforeseen downsides. Hence, there is an urgent need to have a public debate on the potential impact of these new technologies. This paper explores opening up the debate of how nanotechnology can impact the relationship people have with their health and body. The Healing Game is a speculative product, presented in the form a realistic, functioning demo for iPad. It was exhibited at a variety of exhibitions and opened up the intended debate.

INTRODUCTION

Nanotechnology (NT) is a rapidly progressing, emerging field of science that deals with the manipulation of structures on an atomic and molecular scale – the size of one billionth of a meter. Advances will have a tremendous impact on fields such as materials, electronics, and medicine.

Although many people are aware that nanotechnology is very small, there is little discussion of how this emerging technology will change our everyday lives. Nanotechnology radically intervenes with our notion of what is natural. It may help to realize our dreams and significantly improve our lives, but it may also have unforeseen downsides. Hence, there is an urgent need to have a public debate on the potential impact of these new technologies.

This paper explores opening up the debate of how nanotechnology can impact the relationship people have with their health and body.

METHOD

By presenting a quite extreme future scenario through a realistic demo it becomes easier to believe and to grasp. The Healing Game functions as a scenario for potential a technological future; helping people decide what future they actually want. Besides that, it opens up the public debate concerning various relevant nanotechnology topics such as self-enhancement and the use of smarter medicines. In order to reach a high amount of people, the demonstration of The Healing Game was exhibited at various exhibitions. Most importantly, the Healing Game became a fixed part of the "Nano Supermarket", a travelling exhibition that has received of 45,000 visitors since it's opening in 2011. Thanks to this, the concept has been demonstrated at many more exhibitions such as the Article Festival in Norway and the Cure & Care at the Taiwan Design Museum.

DEMONSTRATION

The Healing Game is a game inside the player's own body. The player swallows an intelligent pill, containing a nanoscale capsule equipped with a small camera and a laser and a substance that makes cancer cells glow. Next, he controls the capsule and goes on a "seek and destroy" mission inside his own body to get healthier.

GAME MECHANICS

In terms of game mechanics, the aim of the game is to avoid the white characters, representing antibodies. Naturally, they attack everything unfamiliar to the body. Meanwhile the player should look for green, glowing cancer cells and destroy them using the laser attached to the capsule.

GAME INTERACTION

To address the largest potential target audience, much usability testing was done to make the demo easily playable. Console controllers turned out too difficult to handle, especially for older people. The iPad however, turned out to offer the most accessible gaming

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experience. The positions of the buttons have been carefully considered and were informed by usability testing. In the final game, players can position their left thumb on the joystick and their right thumb on the shoot button.

GAME SCENARIOS

Just as any other game the player either wins or loses. Winning is achieved the player destroys enough glowing cancer cells. When the player takes substantial damage from the antibodies, he loses. As a result, the capsule will become waste and ends up in the player's blood stream.

TECHNICAL DESCRIPTION

The demo can be visited through a browser at http://martijnvandenbroeck.com/game/demo/ . It is a playable version The Healing Game.

PLATFROM

The game is developed using HTML5, making it playable through all major browsers.

DEMO MODE

The demonstration is equipped with a demo mode which automatically activates when no person is playing. This demonstrates the game as well but also invites the player to start.

DISCUSSION

The Healing Game aimed to open up the debate of how nanotechnology can impact the relationship people have with their health and body. By becoming part of the travelling exhibition "Nano Supermarket" the demo has been exposed to a large group of people. This large exposure stimulated the intended debate.

During this debate, many questions were raised. Some of these questions are outlined next. As medicines get smarter, does this means people will allow highly intelligent tiny robots into their bodies, would they prefer to be in control of the robot themselves or would they be more cautious with these nano robots? If people can actually see diseases in their bodies how will this change their perception of health and how will the profession of doctors change?

Furthermore, exhibition visitors have proposed potential further applications. People do not need to be ill to be able to play the game. They can use the Healing Game as a preventive tool as well. Checking your body will become something as easy as brushing your teeth. It will therefore change how people look at diseases and their own body.

Finally, the Healing Game can be used as an explorative and educational tool. It can improve our understanding of our biological processes: how diseases develop and how cells grow and age for example.

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FORESTRY 2020: A MULTIMODAL INTERFACE IN A SEMIAUTOMATED VEHICLE

TRIEUVY LUU

UMEÅ INSTITUTE OF DESIGN

TRIEUVY@TRIEUVYLUU.NL

EZGI SABIR

UMEÅ INSTITUTE OF DESIGN

EZSA0001@STUDENT.UMU.SE

ABSTRACT

Watch our demo video:
http://youtu.be/d71l6tJGLHc

The current state of the forestry industry shows that operating complex harvester vehicles brings new complications to the users. It takes many years to train the users to be proficient at operating such complex machines. In addition, working for many years exhaust the operators mentally. In our project, Forestry 2020, we designed a multimodal interaction for the future harvester machine. According to forestry industry, we are moving towards highly automated and smart forestry machines. In this paper, we discuss how semi-automation is the answer for the needs of the operators in future setting. Our aim was to combine the best qualities of human operators and automated machinery. Our proposal for Forestry 2020 is built on three modalities: an augmented GUI that gives the operator an overview on his tasks, a futuristic controller that invites the operator to initiate automated actions and a haptic behavior that helps the operator to feel in control of the operation by giving him a clear understanding of the machine's state. The new interface design aims for an enhanced future work state of the operators by lowering their mental workload. It also significantly cuts down the training time which takes three years for beginner operators.

1. INTRODUCTION

This project was carried out over 8 weeks as part of the "Professional Users" course. The harvester is a forestry machine that is able to cut and slice trees. Through expert interviews, we were informed that the harvester crane can process up to 130 trees an hour depending on the skill level of the operator. The client explained to us that the harvester crane's current interface requires high number of individual actuators being controlled manually(Figure 1).

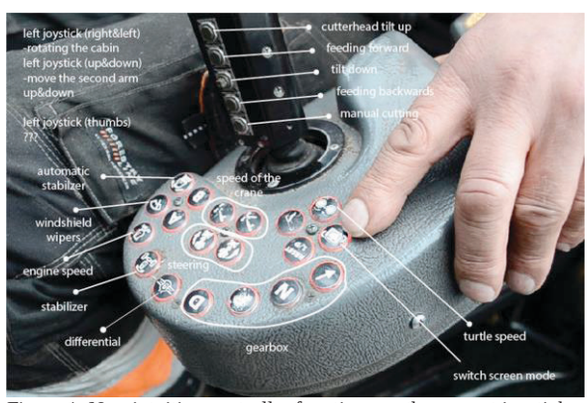

Figure 1. Non-intuitive controller functions on the current joystick.

To effectively control the harvester crane head, operators must be able to control six actuators simultaneously. At the same time, they are expected to plan and overview the work strategically. This workload is extremely intensive. Therefore, it takes several years to become confident with operating the crane.

2. THE STATE OF FORESTRY AND SEMI-AUTOMATION

The first forestry machines were designed 30 years ago. Since that time, there has been no radical changes in the user interface. Today, the mechanical speed and endurance of forest machines have increased to such an extent that Westerberg claims operators are now becoming the bottleneck in the process (Westerberg, 2014). Faster machines can no longer improve the overall production as long as operators cannot keep up with that speed. Furthermore, Westerberg also provides answers and claims that semi-automation is the answer for today's problem of reducing the gap between fast machines and slow operators. This literature research

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encouraged us to base our design concept around semi-automation.

3. SEMI-AUTOMATION AND INTERACTION

As our team moved into semi-automation, we created concepts around this topic. In order to gain a better understanding of semi-automation, we used the bodystorming technique on ourselves to validate and reflect(Schleicher, 2010). This bodystorming activity was about measuring and reflecting upon the level of semi-automation that is required to feel comfortable with completing a task. The bodystorming setup consisted of a sheet of paper with dots drawn on it and a marker attached to several wires. (Figure 2.)

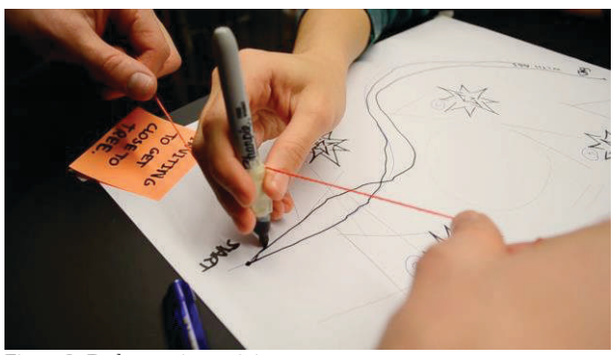

Figure 2. Bodystorming activity.

The dots represented the trees. The operator of the pen was asked to mark the trees with the marker. While the operator was executing the task, we adjusted the level of automation by strengthening/loosening the wires. After bodystorming, we raised the question how automation can invite the operator to initiate an action, rather than forcing the operator. As inviting and forcing are closely related, we designed a gearbox that would differentiate between forcing and inviting. (Figure 3.)

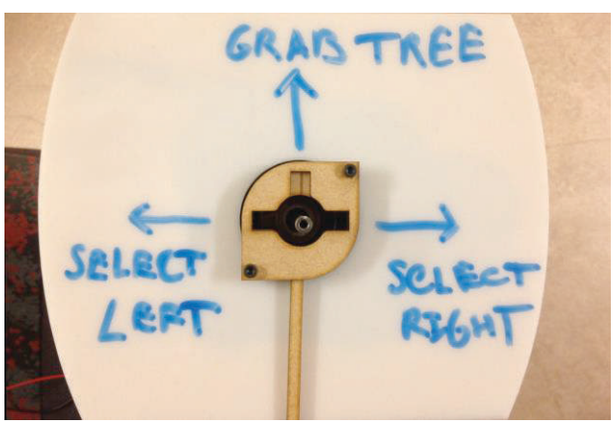

Figure 3. The gearbox of the controller.

The gearbox works as follows: when automation is available, the system enables the automated action by opening the direction that would initiate the automated action. In this way, the operator would be in control of initiating his automated tasks. To further argue for this, we believed that combining the best of human and best of automation creates the greatest efficiency. The best qualities of operators are their decision making and planning skills. Shiriaev points out that semi-automation helps reducing the operators' cognitive workload and allow the users to change their focus from low-level crane control to more high-level task planning(Shiriaev, 2013). These learnings conveyed us to address our design to the best of the operators.

4. MULTIMODAL INTERFACE: LAYERS OF MODALITIES

Our proposal is built on three interaction levels: an augmented GUI, a futuristic controller and a haptic behavior. (Figure 4.)

Figure 4. Watch our demo on http://youtu.be/d71l6tJGLHc

Augmented GUI - It gives the operator an overview on his tasks. Augmentation benefits the operator as it makes the task easier by showing relevant information and informing the operator on the automated actions.
Physical controller - The new controller is able to invite the operator to initiate automated actions.
Haptic feedback - It makes the operator to feel in control of the operation by giving him a clear understanding of the machine's state.

5. DISCUSSIONS

Forestry 2020 is a concept proposal as a futuristic multimodal interaction system for harvester operators. Forest is an unique environment where users need to be aware of multiple information and operate at the same time. Multimodal interfaces enable more natural and effective interaction since different kinds of content can be conveyed in the modes to which they are best suited(Oviatt, 1997). Current interaction system for the harvester vehicle uses visual and auditory feedback through different modalities. Tackling the problem with a user-centered design approach, we propose sensory feedback to be included in the multimodal interaction. The proposed sensory feedback would benefit the operator by lowering his mental workload which is caused by making frequent decisions in their work environment. In the future, we will be having more highly automated systems. This is the reason we believe the subject of how automation will communicate with the users through multimodal interaction is an interesting topic within the interaction design field. We proposed an answer on this subject with our case study

BILBORD: A FAMILY-FOCUSED INTERACTIVE SYSTEM FOR DRIVERLESS CARS

ADAM DUNFORD
CHALMERS UNIVERSITY OF TECHNOLOGY
DUNFORD@STUDENT.CHALMERS.SE

ALMA CASTILLO ANTOLIN
CHALMERS UNIVERSITY OF TECHNOLOGY
ANTOLIN@STUDENT.CHALMERS.SE

ABSTRACT

This demo shows an interactive solution for family entertainment in a driverless car involving personal entertainment devices that can be digitally and physically connected.

INTRODUCTION

With a driverless vehicle, a family can fully focus on each other while traveling. Yet personal electronic devices may prevent this interaction. This paper describes the proposed functionality of a solution. A video demonstration of BilBord is available at: http://youtu.be/e9-YlEa2bfM

TECHNICAL DESCRIPTION

The BilBord system described in (Castillo and Dunford, 2015) uses a set of tablets for each passenger. With facial or voice recognition with its front-facing camera and microphone, each touch-enabled tablet recognizes the current user and personalizes the interface with age-appropriate games and applications, connected to a shared network to allow collaborative play and parental controls.

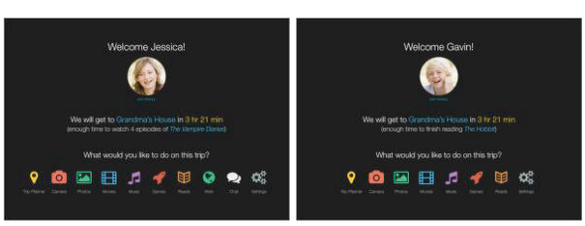

Fig. 1. Each user is recognized and presented with options specific to their account (as determined and managed by a parent).

TRIP PLANNING

The map software allows the family to plan trips together. They can choose different itineraries given the length or related experience (i.e. sightseeing), planning what they want to see and enjoy the ride itself. As they travel, contextual information will automatically prompt, such as the need to refill the gas or an interesting attraction nearby. The family is free to enjoy each other, not worrying about logistics.

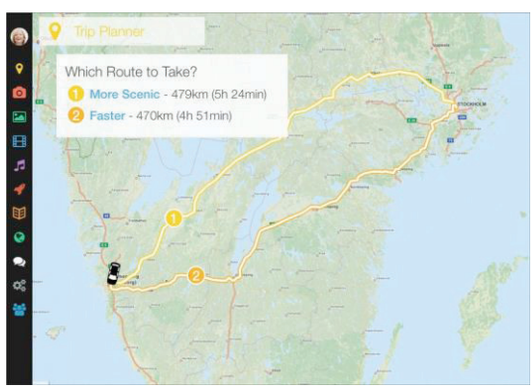

Fig. 2. The trip planner allows for collaboration along the way.

GAMES

While existing network games would provide a likely base for BilBord, we also conceived of collaborative games specifically designed for this system.

For example, “Add-On” allows the family to sketch on the same virtual canvas either using their individual tablets connected over the network or by putting several devices together and creating a larger canvas.

Another game, “Photo Finder”, challenges family members to take a picture of items outside the car. The one that takes a picture of that item first wins, engaging the whole family in a competitive activity that also explores the environment around them while traveling.

MUSIC SHARING

The music app offers a shared playlist where all family members suggest different songs for the car’s stereo. Each member can either up or down-vote songs on the list, so that they disappear if they have a sufficient amount of negative votes. This makes it possible to

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create a list that is appealing to the whole family. The system will balance the songs so that a significant amount of songs from each person gets played, and everyone feels represented.

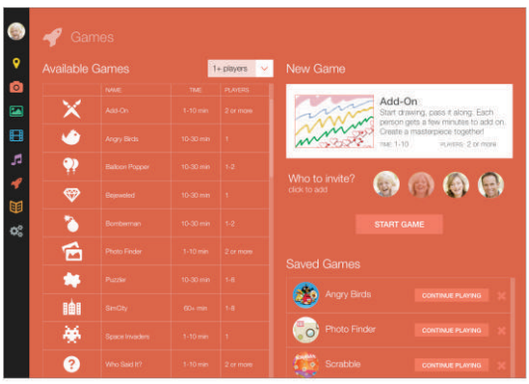

Fig. 3. Games can be played individually or with others in the vehicle.

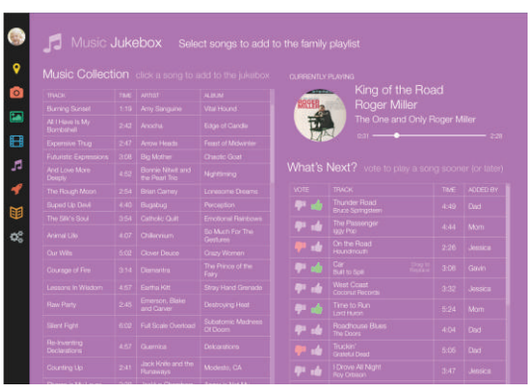

Fig. 4. Shared music playlists let everyone have a say

A similar function could be used for watching movies or sharing other media such that all can participate.

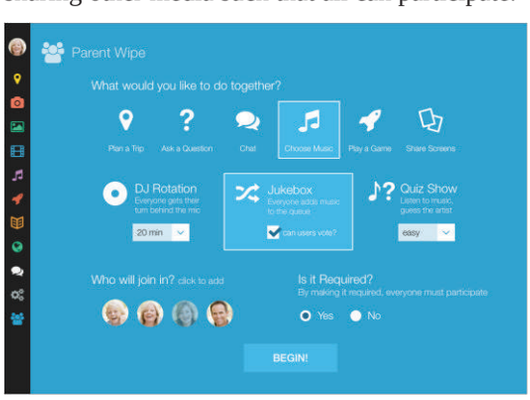

Fig. 5. Parent mode allows shared interaction across devices

PARENT MODE

While much of BilBord's interactivity comes with casual networked communication between family members, Parent Mode is an active form of device management. It lets parents either suggest or force the family to partake in an activity, such as choosing a restaurant, ordering lunch, adding music to the shared playlist or playing a game. This system is focused on giving some power to the parents to regain their children's attention inside the car, yet is flexible enough so that not all family members are required to participate (such as less than enthusiastic teenagers). In this way, families interact with each other, not just in parallel on their own devices.

CONNECTING TABLETS

In addition to the network connection and shared games and activities, BilBord devices can be physically attached to one another, creating a larger screen that can let the whole family interact together.

This larger surface encourages face-to-face interaction, resembling a board game enriched by technology.

Fig. 6. Multiple BilBord tablets connect to share a surface

CONCLUSION

BilBord combines the best in personal entertainment with the advantage of shared space to encourage a flexible environment for family travel. Individual accounts with customized content on your own device means each family member can enjoy travel as they wish. Yet age-appropriate content, parental controls, and shared activities offer parents ways to ensure the family is having greater interaction along the way.

This system provides a new dimension to traditional car entertainment systems as it enhances interaction and communication between family members. Unlike other pieces of technology, it can be used both separately and together in one or several common activities. The chosen themes adapt to the car environment as they control the trip, the car inner environment and the family entertainment, making BilBord a great solution for future driverless travel.

ACKNOWLEDGMENTS

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Clickable prototype: http://invis.io/H91JO7NRS

Video demonstration: http://youtu.be/e9-YlEa2bf

SYNAESTHES: SPECULATIVE PROTOTYPE

EDIT EMESE VIZER
KOLDING DESIGN SCHOOL
CONTACT@EDITVIZER.NET

ABSTRACT

Synaesthes is the physical outcome of a design through research project, which by speculating and imagining extreme future scenarios explores the area of archiving and accessing past experiences. In its form it is a fully functional prototype, and stands as proof of concept.

KEYWORDS

demo installation, design through research, design fiction, interaction design, senses, synaesthesia, memory, reminiscence, experience

INTRODUCTION

The interactive prototype was developed as the result of a series of design experiments that range widely from qualitative research based on material experiments, taste and smell sample tests, experiments inspired by reminiscence therapy, pastiche scenarios to digital sound design and frequency studies, among others.

The starting point of the design research was established as a speculative and extreme future scenario, in which each single individual has the same memory chip implanted, so that individual past experiences are no more accessible. Meanings and values are designed and controlled by an unknown higher power, and the individual has no affect on and decision regarding his stored memories.

The design research project aims to answer the following question: What if our memories are controlled, and homogenized on an individual basis.

The outcome aims to answer this question via a speculative design sketch building around the use of senses, which closely investigates synaesthesia as an important element of the design experiments.

It also considers the users in the extreme future scenario, and explores alternative ways of discovering, archiving and accessing memories, so that these are not to be decoded by the controlling power, but only the individual himself.

TECHNICAL DESCRIPTION

The user meets a relatively simple installation setup consisting of a tangible user interface, a set of speakers or headphones, and a computer. The latter displays an application created in the programming software Max MSP specifically for the interactive prototype.

Figure 1: Total view of prototype

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The interface guides the user through 9 steps, each dedicated to a short action. To sum up the steps the user is asked to walk through a recipe for making scented fresh dough:

1) choosing and mixing the flavours

2) indicating the amount of drops of each chosen flavour (a maximum of 3 drops of each essence is allowed by the system); momentary switches are installed for this reason

3) indicating when the essence is done; a momentary switch of a different colour is installed for this reason

4) mixing the ingredients for the dough,

5) by emptying 3 different fillings into a mixing bowl

6) using a mixing spoon to blend the ingredients

7) working this sticky dough into a firm one

8) use a cookie cutter to shape a key out of the dough, and finally

9) place the key-shaped dough into place (indicated by an engraved key shape on the wooden interface, implementing a switch button), which will activate, play and save a soundscape file being formed from the individual essence mix

Now the user is able to find the saved sound file on the computer desktop, and use his USB to take it with him. Each file is archived with an individual numeric code, existing of the current date and time and the actual drop mix.

These steps are illustrated in the explanatory video [1].

In the speculative future design context some of the above described steps are corresponding to some extended functions.

When asking for an essence mix, the user is actually asked for mixing his ’special atmosphere’, and has to pick 0-3 drops of the moods ‘warmth’, ‘depth’, ‘focus’ and ‘fresh’. These are in reality referring to aroma flavours of mint, vanilla, coffee and citrus. Moreover the dough-made key functions as an accessing key in itself – as it hardens within a short amount of time, the user is capable of taking it with him, and collect a series of these individual keys. Not only the individually mixed scent is able to evoke memories (past experiences), but it leaves the design space to open for implementation of a home device capable of decoding the essence mixes in forms of the corresponding soundscapes.

ACKNOWLEDGMENTS

The design research project was developed during the course ‘Future Spaces’ at the Kolding Design School during Fall 2013. The author would like thank the two instructors, Eva Knutz and Thomas Markussen, for their passionate and visionary teaching and their guidance.

REFERENCING

[1] Link to documentation video: https://vimeo.com/storiesonwhite/synaesthes

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