SIDeR '18

FLUX.

May 18–19 | 2018
Helsinki | Finland

PROCEEDINGS OF SIDeR '18
14th Student Interaction Design Research Conference

Edited by Andrés Lucero, Maria Karyda,
Ilyena Hirskyj-Douglas & Oldouz Moslemian

Aalto University

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FOREWORD /

Located in Arabianranta, the birthplace of Helsinki, the old Arabia ceramics factory has housed the former University of Art and Design Helsinki (now part of Aalto University) since 1986. In the summer of 2018 we will be relocating to the new Väre building in the neighboring city of Espoo. We feel extremely lucky to be able to say goodbye to the Arabia campus by organizing one last conference in this historic venue: the Student Interaction Design Research conference (SIDeR).

The theme of this year's SIDeR conference is Flux. Flux describes a state of constant movement, transformation, and change. The boundaries between disciplines such as technology, engineering, biology, arts, and design are shifting and dissolving. As practitioners and researchers, we have to embrace this uncertainty and nourish the arising uncharted potentials. As interactions permeate all facets of our lives, the agencies of the human and machine are increasingly intertwined, resulting in novel design concepts and artefacts. The book that you are holding in your hands is a collection of fresh, stimulating, and diverse interaction design research work related to the aforementioned continuous transformations.

We have successfully extended SIDeR's original motto – this should be about students presenting to students – to this is 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 paper has been peer reviewed by one student, plus one fellow academic to ensure quality.

Together with graduate students, we have prepared an exhilarating program for these two days, with a mixture of keynote lecture, workshops, poster 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 invaluable effort and persistence of the Aalto students involved in organizing this current edition of the conference. 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 and Maria Karyda
Espoo, May 2018

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ORGANIZATION /

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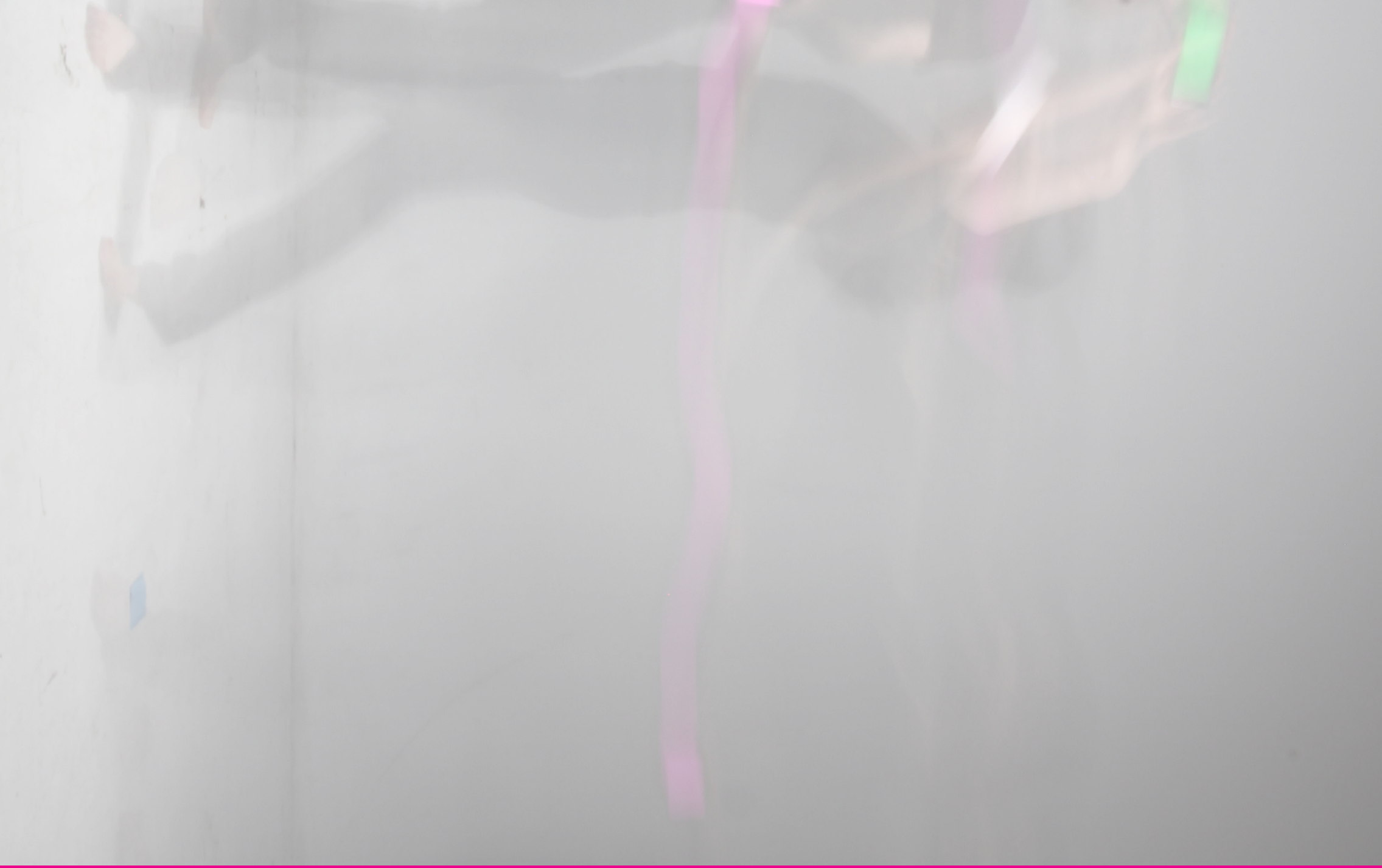


KEYNOTE & INDUSTRIAL PANEL

KEYNOTE SPEAKER & INDUSTRIAL PANELISTS /

KEYNOTE SPEAKER

ROBB MITCHELL is an assistant professor, social interaction design at the University of Southern Denmark, Kolding.

A graduate of Environmental Art at Glasgow School of Art, his research and practice draw upon a diverse background that includes community development, market research, music promotion, cultural management, science communication and new media curating. This has ranged from bright lights, big city stuff with Ministry of Sound and Franz Ferdinand to activities with children and the elderly on the remote Scottish island of Orkney.

A common thread running through most of his work has been developing novel artefacts, environments, and processes that bring people closer together whether creatively, socially and professionally.

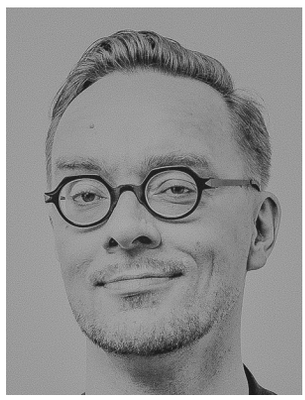
INDUSTRIAL PANELIST (MODERATOR)

ANTTI SALOVAARA (PI) is an adjunct professor of computer science in University of Helsinki.

He holds a PhD in cognitive science. He studies creative uses of IT, such as repurposing, workarounds and unexpected use, to create knowledge on how to make systems more adaptable for different needs.

Antti is interested in creativity in knowledge work and the role of ICT use in those processes. His research involves both individual-level studies on creative cognitive processes as well as development of new models and theories for understanding the organizational factors that may hinder or facilitate creativity in information systems use.

INDUSTRIAL PANELIST



SAMI NIEMELÄ is one of the founders and the creative director of an advanced design firm Nordkapp headquartered in Helsinki, and working all over the world. In his daily work he helps companies find their way in a fast moving world, specializing in discovering the cracks and using what grows there as a fuel in creating culture shaping strategies, products and services.

On the side, he co-founded IxDA Helsinki in 2008, co-chaired sold out 1200 strong Interaction 16 conference in Helsinki, has been invited to judge several competitions such as the Webbys and advices ambitious startups. Sami also holds several international patents and is an internationally awarded designer and a strategist.

INDUSTRIAL PANELIST

LAURA TURKKI is a strategic service designer

Laura has over 15 years of experience in user-centric service design and digital implementation. She has worked both in-house & as a consultant and her previous employers include Adage and Nordea. She currently works on strategic design, value design, concepts, emotions and ecosystems at Adventure Club Helsinki. Laura has judged & received several Vuoden huiput design awards.

INDUSTRIAL PANELIST

SEVERI UUSITALO is a Lecturer of Digital design at Aalto University's Department of Design. He also consults regularly in the field of UX design and design management to stay aware of development of the field in practice.

Severi has worked as an interaction designer and UX researcher at Nokia Research Center and later at Rovio. Severi is an industrial design alumnus from Aalto's predecessor TaiK, and has deepened his understanding with studies at Tampere Univ. of Technology, Univ. of Tampere, and Aalto, especially in areas related to HCI and UX design. His current research interest is in computational design, in the context of industrial design. Severi has authored or co-authored 20 granted US patents mainly from his time at Nokia.

WORKSHOPS

WORKSHOPS /

WORKSHOP 01: DESIGNING TECHNOLOGY FOR DOG TO DOG INTERACTION

A workshop in Animal Centred Computer Interaction.

This workshop will explore the field of ACI, focusing specifically on dog-computer interaction and how to design technology for dog-to-dog interfaces that address the needs, wants, and limitations of the dog end-user. In this workshop we will investigate the relationship between dogs to capture their behaviour in a user centric way to draw up user requirements.

The field of Animal-Computer Interaction (ACI) focuses on the interaction between animals and computer technology. Whilst animals have used technology for a long time, systems to support this use, and investigation into their interaction is a new and upcoming field.

ORGANIZERS

Ilyena Hirskyj-Douglas is a Postdoctoral researcher at Multimodal and Nomadic Interaction Group at Aalto University. She has acquired her Ph.D in Animal Computer Interaction at the University of Central Lancashire, England.

Andrés Lucero is a professor of Interaction Design at Aalto University. His work focuses on the design and evaluation of novel interaction techniques for mobile devices and other interactive surfaces.

WORKSHOP 02: EXPLORATORY DEFORMATION

A creative form-finding task with sheet materials.

The aim of this improvisational physical exploration exercise is to allow the participants to practice tectonic form-finding by grasping and deforming various sheet materials with high tensile strength.

In this workshop the participants will develop an understanding of physical material properties and the advantages and limitations in the preliminary stages of design. At the end of the workshop, all prototypes will be gathered and will be evaluated based on how the haptic feedback received through the materials leads to different creative design strategies during the process.

ORGANIZERS

Emrecan Gulay is a first-year Doctoral Candidate at Embodied Design Group at Aalto University. He completed his MA degree at University for the Creative Arts Canterbury, UK.

Tania Chumaira is a first-year Doctoral Candidate at Embodied Design Group at Aalto University. She obtained her MA degree at The Bartlett School of Architecture, University College London, UK.

WORKSHOP 03: ONE SENSOR CHALLENGE

An Arduino based makerthon with one Sensor.

The aim of "one sensor challenge" is to design a fun controlling interface out of a single 6DOF motion sensor. Students will play with signal processing and input techniques.

In this workshop, participants will develop a program that interprets signals from 6DOF sensor (3-axis accelerometer + 3-axis gyroscope) into a keyboard command. They will take an idea about signal processing techniques, information theory, and a concept of activation point setting. The participants will be evaluated by playing a game using their device and recording the score.

ORGANIZERS

Janin Koch is a Doctoral candidate at User Interfaces Research Group at Aalto University. She has earned her masters' degree from the Technical University Darmstadt, Germany.

Sunjun Kim is a Postdoctoral Researcher at Aalto University. He completed his Ph.D. studies in Computer Sciences at KAIST, South Korea.

WORKSHOP 04: DESIGN STUDIO PRACTICES

A LIVE Theory Building Workshop

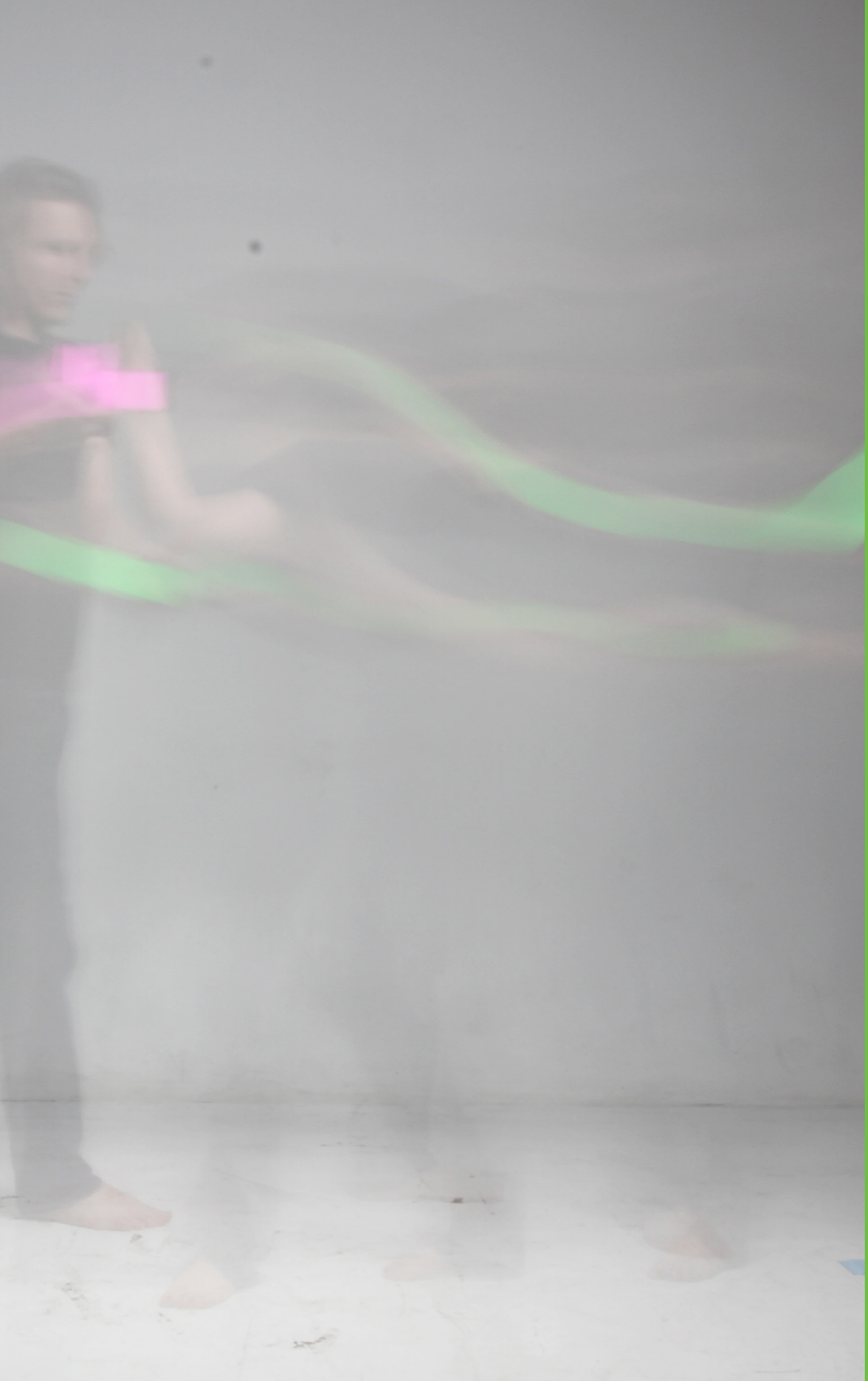
In this workshop we will introduce you to the basics of citizen science and figuring out new potentials for design research. We aim to build a new theory together on design studio practices. 'Build' refers to hands-on fun to get insights into other people's design spaces and the chance to put your own experiences in a much larger perspective.

This workshop is the grand finale of a Citizen Design Research project. Our goal is to find the most exciting Interaction Design Studio in the world! At this moment, pictures and stories from design studios around the world are piling up on our site. Join us and help gather data and analyse it.

ORGANIZERS

Nele Schmidt is a graduate student of IT Product Design at SDU in Kolding and holds a bachelor degree in Interaction Design Engineering.

Kamila Halabura is a graduate student of IT Product Design at SDU in Kolding, with a background in Digital Concept Development and Brand Management.



PAPERS

MATTER //

MARTINA ERIKSSON, SHIBASHANKAR SAHOO & CAROLYN WEGNER |
AERO: A TANGIBLE VENTILATION INTERFACE FOR A CRITICAL HEALTHCARE CONTEXT

PAUL BIEDERMANN & JEKATERINA ALEKSEJEVA |
SMART WEARABLE DESIGN – EXPLORING BODY AND TECHNOLOGY INTERACTION THROUGH TANGIBLE INTERFACES

EMRECAN GULAY |
EVOLUTIONARY TRANSITION: GENERATIVE DATA FLOW BETWEEN PHYSICAL AND DIGITAL REALMS

AERO: A TANGIBLE VENTILATION INTERFACE FOR A CRITICAL HEALTHCARE CONTEXT

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ABSTRACT
Our current understanding of the translation of subjective data into numbers in user interfaces has limited our capacity to perceive the intrinsic meaning associated with data and its source. Here, we envision a systemic tangible interaction framework that connects the user and data source by combining data physicalization and tangible manipulation. We illustrate the application of this framework through a case study in the critical context of an anesthesia ventilator machine, where connection between data source, i.e patient, and user, i.e nurse, is vital. The framework enables the users to monitor, communicate, and manipulate the tangible data in real time. This thereby establishes a deeper connection between the data source and the user. Lastly, we analyze the challenges, limitations and future scope of the framework in this professional context through five prototypes - Fabric, Jellyfish, Projection, Organic, and Hybrid.

INTRODUCTION
In all the recent developments in the tangible interactions, the research community has been focusing on the theoretical definition and concept explorations. A study of tangible user interfaces in a complex context has always been a challenge. In this project, we apply the tangible user interfaces in a professional healthcare context where safety is critical. By implementing TUIs in such a context, we learned more about challenges in the area of data communication, manipulation, usability, and system complexity. This helped us to open up possibilities for the research on the existing domain of tangible interfaces.

GUIs facilitate precise and diverse data communication and manipulation with pixels on screens, which can change the form, position, or properties, and color, size, and animation. However, it lacks in affordance and takes little advantage of hand-eye coordination. Everything looks and feels the same, and there is little differentiation in appearance and actions. The only way left to make a product communicate its functions is through icons and text labels, which requires reading and interpretation. We aim to design an artifact that communicates its purpose through its forms. Therefore, a natural shift from the virtual world GUIs to physical world TUIs seems an inevitable choice. We take this opportunity to push the boundary of tangible interaction by

placing the TUIs in a critical context. This study broadens our understanding of the systemic structure and the complex relationships between multiple intelligent actors and artifacts.
So far, the development of tangible interaction has paved the path towards the sensory richness and action-potential of physical objects as carriers of meaning in interaction (Djajadiningrat et. al., 2004). Because they address all the senses, physical objects offer more room for expressiveness than screen-based elements. Data physicalization enables the user to interpret data with an artifact whose geometry or material properties encodes data and supports cognition, communication, and decision making (Alexander et. al., 2015). We implement our insights from these studies in our design process.

In the first half of paper, we explore the ways to communicate and make data tangible through various prototypes and address the challenges associated with it. In the second half, we propose the tangible interaction framework that combines the data physicalization and tangible manipulation into one cohesive and dynamic system that connects data, data-source, and the user. We have developed this framework by embracing and understanding human-machine interaction in the critical context of the hospital. The following case studies present a series of explorations and insights derived from the ongoing design process.

CASE STUDY

We began our case study by looking at the interface for a ventilator machine used in the surgery, observing its interactions, functions and data communication. From here, we developed a series of prototypes that addressed the shortcomings and explored potential data communication opportunities that were revealed from our initial study in the hospital context.

INTERFACES USED IN THE HOSPITAL

Figure 1: Currently used GUIs in the hospital

During the critical process of ventilation, the breathing data is translated into parameters on the graphical user interface (GUI) (Figure 1). Our field survey and qualitative interviews revealed that even though these parameters on a display contain essential information, they do not take advantage of the complete potential of computational technology. This leads to cognitive overload, steep learning curve and inefficient decision making. In most of the cases, the nurses perform numerous mental calculation using these parameters just as hints to understand the invisible phenomena of breathing. When a complex invisible phenomenon like breathing is represented numerically and graphically through parameters like respiration rate, tidal volume, alveolar pressure (refer to glossary), it dilutes the rich human quality. Hence, moving forward with this idea, we designed artifacts to solve the limitations of GUI to facilitate a better translation of the breathing data with data physicality. We attempt to transfer emotionally rich input from the patient to the nurse while retaining the usability of interaction. This gives the user the opportunity for the users to directly control the data itself, by providing the nurse with the ability to manipulate precisely.

DATA PHYSICALIZATION

We explored various ways to communicate the breathing data through data physicalization.

FABRIC

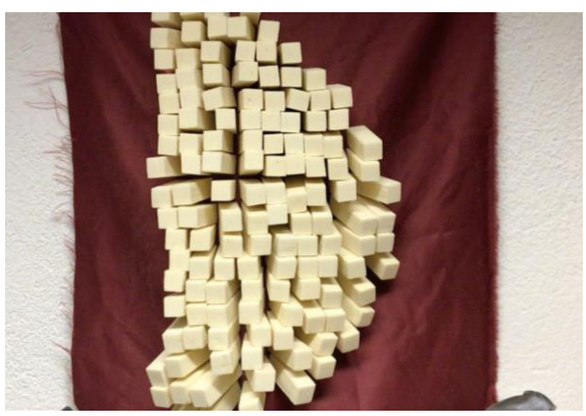

Figure 2: Fabric, a prototype simulating the respiration rate

In our first prototype called Fabric, we tried to mimic respiration rate of the internal lungs. In this case, the pixel data could be easily manifested in the form tangible objects (Bonanni et. al, 2022). Unlike GUIs, this representation of data in a physical form (Figure 2) gave us a novel alternative mode of communication.

JELLYFISH

Figure 3: The manual pump consists of a rubber valve to push air into the lungs

Today's manual ventilation (Figure 3) provides lots of hidden and qualitative information about the patient condition that can only be read by professional nurses. For example, the change in the muscle relaxation inside the lung during anesthesia is an information that can be felt faster through a tactile interface than a GUI. Thus, we created an artifact where we tried to transfer that emotionally rich input from the patient lungs to the nurse by exploring a different type of physical variables e.g. resistance, pressure, stiffness to mimic the haptic feedback. The quality of feedback was further enhanced by a tactility (Figure 4).

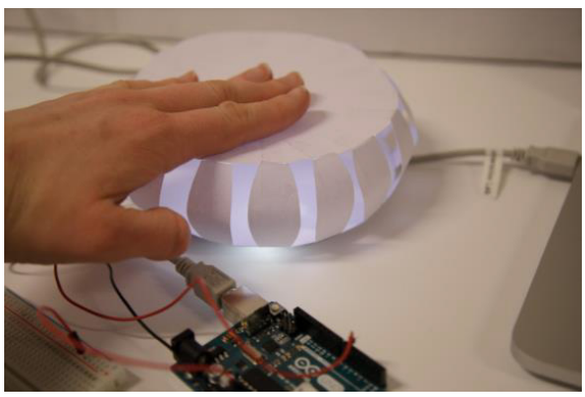

Figure 4: The jellyfish simulates respiration rate through a haptic feedback

CHALLENGES

The primary challenges were the amount of patient data that was needed to be layered, timed, and communicated precisely to its user through this physical medium. The diversity of information and precision in the medical context posed a major challenge for us in physicalization because of lack of precision and data abstraction. We realized that not every type of data can be physicalized in a critical context as some data can be qualitative, quantitative or hybrid data.

QUANTITATIVE DATA

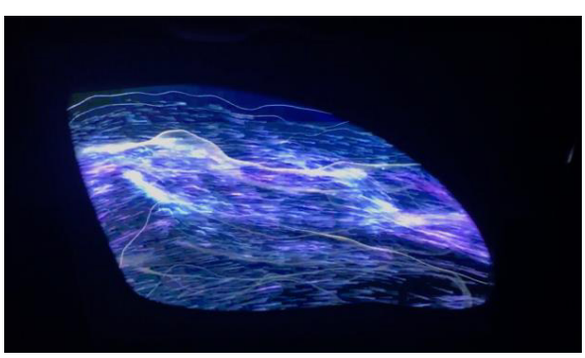

Figure 5: The projection prototype displaying the gas flow inside the lung

Some values such as partial pressure of carbon dioxide and oxygen that can indicate the effectiveness of ventilation require accuracy to fractional parameters. We tried to communicate this accurate data through an animated sequence that we projected onto a surface. We simulated the particular functions of a patient's airway with a visualization of internal gas flow. We believe that this method of data communication can be abstracted to this degree since our aim is to provide the user with immediate quality of information. (Figure 5)

QUALITATIVE DATA

Some values such as delivered pressures, volumes, breathing pattern, and gas flow inside the lungs are more visual and subjective and can be communicated in more abstracted modalities.

HYBRID DATA

Figure 6: The organic prototype displays how a lung collapse could be physically expressed

Some data require multiple parameters in terms of quality and quantity. For example, a condition called partial collapse of lungs, is hard to detect as it requires several GUI parameters to guess. So we designed the Organic prototype (Figure 6) to physically materialize the lung collapse which might not have been possible with numerical parameters.

After we studied different ways of communicating the data and feedback, we combined the data into a hybrid artifact. Here, we explore the ways in which we can take diverse data inputs with a range of expressive needs, and translate them into a coherent method of communication. We explore the intersections of tangibility, visualization, and dynamic physicalization with the data derived from the professional medical system setting. In the next section, we describe the tangible hybrid designed for a critical healthcare context.

TANGIBLE HYBRID

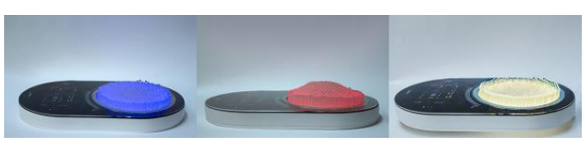

Figure 7: Tangible Hybrid normal, high, low pressure state

Figure 8: Tangible Hybrid direct touch and fine tune manipulation

The Tangible Hybrid (Figure 7) is an interface that

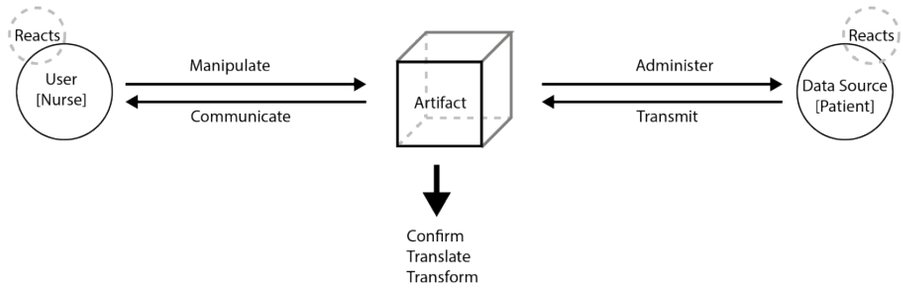

Figure 9: System complexity in tangible interaction

embraces the humanization of data. Unlike GUIs, data is communicated and manipulated to the professional users through data physicalization. The interface translates the breathing graph to a dynamic shape that a user can access through one's peripheral vision. It is further assisted by the visual and haptic modality of breathing frequency to ensure that the professional users receive the necessary, precise feedback in this safety critical context. This physical data can further be manipulated through two stage manipulation (Figure 8). First, there is a rough adjustment by gently pressing the physical data. Second, a fine tune dial to adjust the values.

EVALUATION

Going further, we evaluated the interface on the basis of intuitiveness and interpretation. The focus group, consisting of professional anesthesia nurses, successfully accepted this interface, stating that this could be an excellent tool for caring for the patient in an intensive care unit long term. Some of the manipulation challenges, like direct contact, seemed debatable because of the hygiene in this context. Every device has to be sterilized before and after the operation. This requires detachability of tangible product from the base.

TOWARDS SYSTEM COMPLEXITY IN TANGIBLE INTERACTION

During the research on ventilation for anesthesia, we observed that the nurse (user) and patient (data-source) mutually interact and manipulate values through a machine (artifact). The nurse's action on the machine influences the patient. The patient in turn influences the data displayed on the machine. This displayed data prompts the nurse to take actions on machine. This creates a complex system involving multiple intelligent user interacting with data (Figure 9).

Current use of graphical user interfaces hides this system complexity of interaction, reducing it into mere numbers and dials on the screen making it harder for the user in visualization, decision making, and manipulation.

DISCUSSION

Through the application of tangible interaction in a critical context, we encountered many design problems that helped us identify various research opportunities. These opportunities included the emotional meaning of data, communication, manipulation, dynamic affordance, and systemic complexity in tangible interaction. Among the research issues that we explored, we learned that when we look at tangible interfaces as a bridge between digital and physical world, it leads to issues in communication, manipulation, usability, scalability, and application. To solve this, we had two approaches. First, we solve each of these issues by zooming into each of them on a micro level. Second, we zoom out and understand the bigger picture. The method is still an open question to the research community.

CONCLUSION

We reflect on the nurse, patient, and machine in hospital ecosystem in the case study to understand the application of tangible interface in a context and address the challenges associated with it. Further, we realize that instead of treating TUIs as a bridge (between digital and physical world), we can start looking them as a part of an ecosystem in the larger context where multiple intelligent actors and artifacts mutually influence the outcome. In the future, we imagine the seamless collaboration between intelligent actors like AI (Artificial intelligence) , environment and human in a cohesive system, where tangibles become the medium of communication. With the advancement of smart materials, we envision more of these smart interfaces, used in the professional user context.

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SMART WEARABLE DESIGN – EXPLORING BODY AND TECHNOLOGY INTERACTION THROUGH TANGIBLE INTERFACES

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ABSTRACT
The following paper focuses on the process, stages of prototyping and decision making, while designing a product towards the unknown within the field of wearable technologies and embodied design. The aim of the project was to design a wearable corresponding to Technology Readiness level 3, obtaining its properties through iterative engagement with bodily feelings, technology, context and expert.

INTRODUCTION
During the first phase of field research different environments were approached in order to define a context and profession to design for. The collected impressions were physicalized in form of mood and material boards to enhance the ideation process (Beuthel, Wilde 2017). After evaluating these environments, the team decided to design a functional prototype for hikers to sense the weight distribution while backpacking. The main reasons for that were personal experience, interest in the topic through its variety and the backpack itself as an already existing wearable to be assisted with interactive functions. One of the primary ideas was to create an intuitive and interactive way to support hikers with the weight distribution of their backpack, suitable for different body types. The research and prototyping was done in a build - test - reflect approach throughout two iterations and is still ongoing.

1ST. ITERATION
The first iteration consisted of three phases: (1.) the creation of a prototype to collect data of weight distribution while carrying a backpack. (2.) User tests involving data collection, capturing video and Sketching. (3.) Qualitative interviews to interpret the quantitative data and mutual reflections on the test runs.

CREATION OF THE FIRST PROTOTYPE
Since the keystone in developing a wearable is the

body itself, the primary task was to explore how backpacking is perceived through the body. For that, pressure sensors from velostat (a piezo resistive material, which changes its resistance under tension) were created, to test the pressure on shoulders and hips while carrying a backpack.

Figure 1: Positioning of the soft pressure sensors (left) and data collection set up (right)

After primary tests and stable results from the sensors the first prototype was built. The base consisted of a vest shaped garment holding 4 sensors on the left shoulder, right shoulder, left hip, right hip (identified main pressure points). All sensors are transmitting their respective data to an Arduino 101 microprocessor, which receives and prints out the readings in the serial monitor. Using this setup, a self-observation test was performed to acknowledge and confirm the approach as a suitable method for data collection in this specific use case. Once the parameters were visualized in MS Excel, displaying the raw data and the moving average to smoothen out the data, it appeared to be possible to assign various peaks with a certain walking behaviour (figure 2).

USER STUDY

The next step was to test and videotape users hiking and engaging with the prototype in combination with a trekking backpack. Two short sessions of 10 - 15 minutes each were conducted to get an initial understanding of how the walking behaviour influences the pressure laying on the body. To simulate mountainous terrain, we had participants walking up and downstairs.

Figure 2: Sensor readings comparing walking upstairs and walking downstairs (RS – Right Shoulder, RH – Right Hip, LH – Left Hip, LS – Left Shoulder)

As the point of interest was to explore the pressure changes over a longer period of time, a second test of 3 hours hiking on different grounds was conducted. The produced data sets were synchronized with the video material which enabled the comparison between the peaks of the data and the corresponding frame in the video. The main findings of these tests were that rest rapping the backpack as well as changes in the body posture, gradually decreased the pressure values on all four points. Within the timespan of this project it was too time consuming to create a detailed analysis of all conducted data to define direct links between the individual straps and their impact on the overall pressure. In general, adjusting a backpack to an “ideal” weight distribution (by most hiking professionals described as 80 [hips] / 20 [shoulder] distribution) was a big issue since every person comes with a different body type, posture and attitude on wearing a backpack. Although it was possible to assign walking patterns in the quantitative results, there was a necessity of understanding what it represents in detail and how to communicate this data to the user in the most sensitive way. Therefore, open interview sessions were conducted to ask experienced hikers and novices on their experience while hiking and how to implement it to an actual prototype in this context.

DATA EVALUATION

The interview results showed that experienced hikers developed a sense, described by many participants as an instinct, which would allow them to adjust their backpack to a more comfortable position by just listening to their bodies. Other critical points were the desire to travel as light as possible, therefore not having space for additional weight coming from the vest and to be disconnected from modern society and technology to “reconnect with nature”.

Further observations showed that participants, new to hiking, were having struggles on wearing the backpack and fixing it to a for them comfortable position. Also, statements from experienced hikers who had troubles with their backpack during their early attempts, lead to new aspirations: instead of designing for a target group who doesn’t necessarily see a need in such device, the focus shifted to creating a tool, supposed to support and educate new hikers in understanding their backpack, its functions and the influence on long term hikes.

2ND. ITERATION

The next step was to develop a wearable that communicates the current pressure as well as its continuous change through tactile feedback. This new objective brought up two new challenges: what kind of feedback will be perceived by the user as natural and intuitive? and which body location is most sensitive for this kind of feedback? The difficulty here was that the backpack produces tangible noise in form of friction and temperature increase on the areas touching the human body (e.g. shoulders, back and hips). Accordingly, one of the main specs had to be that the

feedback would not be interfered by this noise.

TACTILE FEEDBACK TEST

In order to research this dilemma and find a suitable solution, the method of choice was embodying temporal forms (Wilde, Vallgårda 2017), to explore tactile feedbacks and their influence on the body. The props were created out of stimulators to communicate four independent values. Feedbacks were explored through sound (buzzer), vibration (vibration motors) and mechanical impact (stepper motor).

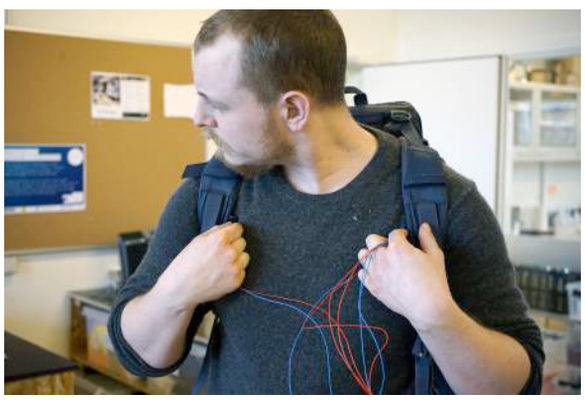

Figure 3: Exploring tangible feedback (vibration motors)

Sound was the first approach as it is commonly used for all kinds of notifications (e.g. email, incoming calls or text messages), at the same time it appeared to be difficult to imagine where it can be placed in terms of the usability. This choice of exploring sound was an attempt of staying in the unknown and letting the technology lead the way through the exploration (Wilde & Underwood, 2018). The sound feedback was constructed as a chain of four connected buzzers, each to be independently placed and moved around. The same setup was also tested with four vibration motors to explore several opportunities. Vibration was chosen because of the pleasant and stimulating feedback it can provide, as well as the possibility to connect its intensity with pressure change. The mechanical impact was used to explore strange or odd alternatives with the goal of disrupting the body and destabilizing the perception in order to evoke possible new interpretation forms (Wilde et al., 2017). For that a servo motor was attached to a textile strap that then could be tied to the body. The tangible feedback was provided by the rotation of the motor wings, which would, controlled by a potentiometer, twist up the clothing of the wearer.

To explore the different possibilities for the location of the feedback, participants were asked to wear a backpack and move the stimulators on the body to their preferred position while moving. All buzzers and vibration motors were running simultaneously to let the participants independently discover their preferences and bring up suggestions. The most distinct attitude was observed towards the setup with the servo motor, with the feedback that it creates a burning feeling and on more sensitive body parts even the notion of being cut. The sound feedback seemed to be more positive but appeared to be challenging in terms of distinguishing which buzzer belongs to which body part.

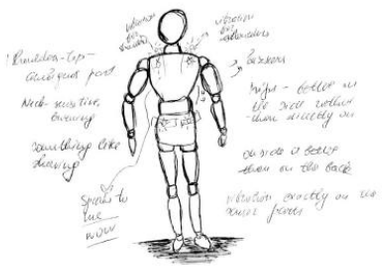

Figure 4: Body test map

Specially the buzzers located further from the ears could not be located by the participants. Also, the fact that all four buzzers were running at the same time, created a chaotic and confusing environment that was present not only for the user but as well to everyone around. As many participants claimed to prefer the feedback to be personal and not meant to be shared with their environment, the buzzer approach has been discarded.

The most positive feedback of all stimulators was received for the vibration approach. The participants enjoyed the feeling and were more courageous in exploring different locations. Interestingly, a similar feedback was observed from different users who claimed the body part would ‘speak’ to them, while they were placing the vibrators slightly above their armpits. All observations were collected on a body test map (Figure 4) to sum up the explorations. Generally, the majority of participants preferred the feedback as close as possible to the actual positions, where the pressure appears (shoulders and hips).

CREATION OF THE SECOND PROTOTYPE

After the positions were defined the construction of the next prototype could begin. One of the main specs were to design it in an unobtrusive way, applying the guidelines for dynamic wearability (Gemperle et. al, 1998) or ideally modular with the ability to attach it to any kind of backpack instead the body.

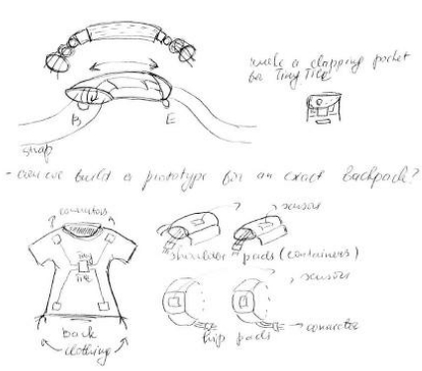

Figure 5: Modular system design

Through the development process many challenges were faced in the transmission of precise sensor data with a modular, wireless prototype. As the primary approach of one garment with all sensors attached to it proved to be reliable and relatively easy to implement, it also became the preliminary base of the second version. This time with more aesthetically approaching and robust materials than in the first prototype.

Figure 6: Soft switches

The tactile feedback test showed that the simultaneous running vibration motors were indistinguishable for many users, it would create difficulties in perceiving all the information at the same time. To solve this problem, soft switches for each stimulator were designed, to individually switch on or off each vibration motor (Figure 6).

This setup gives the user the opportunity to concentrate on a single body part or to compare individual body parts to each other. In this case one could decide what he or she wants to feel – for instance the user could compare shoulders to hips or the left side to the right side. The soft switches were incorporated within the aesthetics of the wearable (neutral colour for the vest and bright red colour for an easy indication of the switch).

They were designed in an arrow-shaped form to point out to which body part they refer. Another important introduction to the new prototype was a zipper, to keep the sensors in the correct position to read sensor data from all four pressure points.

CONCLUSION

This paper guided through the various stages of a design process and illuminated some of the decision making within the team and co-design processes in collaboration with other stakeholders. As the final wearable product is not completed yet it is too early to conclude the final outcome of the project.

Nevertheless, the so far completed stages revealed various valuable insights for the researchers and other involved in the process on how to support novice backpackers.

Figure 7: Second prototype

ACKNOWLEDGEMENTS

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EVOLUTIONARY TRANSITION: GENERATIVE DATA FLOW BETWEEN PHYSICAL AND DIGITAL REALMS

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ABSTRACT
The aim of this study is to investigate the process and evolution of a prototype for bridging the gap between manual and digital manipulations by employing the feedback as a new type of form generator. Feedback extracted from a subsequent transition phase between digital and analog design, testing and manufacturing techniques will be utilized in generative 'form-finding' processes of the architectural form. By consolidating the lack of testing and empirical research in the field, this paper can elucidate the changing relationship between technology and design to introduce a new perspective for architects, designers, future designers and design educators.

INTRODUCTION
As design thinking shifted away from the conventional design methods towards digital generative tools, the significance of basic physical properties (e.g., gravity, materiality and tactility) diminished. The rapid transition to computational design methods, has left some of the advantages of the craftsmanship behind. In addition to the computation, the integration of digital and robotic fabrication technologies deprioritized the influence of the designer. Thus, the role of the designer started to become vague all through the prototyping processes. In this paper, we present a transitional method that aims to reutilize the manual dexterity of the designer, while at the same time benefiting from rapid prototyping technologies and computer-aided design software (Agkathidis, 2016).

The focus of this work is the generative progress of a creative, responsive and multipurpose construct rather than a finalized artefact (Fig.1). Therefore, a combination of research and making will be carried out by producing research prototypes that correlate the tangible results with the theory. Design skills and creative contributions will play an important role to enrich the prototype development process and to generate new design knowledge. Physical prototypes will be analysed as sources of feedback for the further exploration of technical opportunities. Our objective is to extract supplementary feedback from each digital

and physical state of the morphing process. Thus, with the implementation of digital fabrication tools, hand crafting procedures will provide a substantial tactual information to support the digital findings.

This research will be seeking answers for two main questions: How can we utilize a hybrid transition between digital and analog design, testing and fabrication in the exploratory stages of a design? What is the generative role of the feedback obtained through tangible interactions with meshes created by 3D scanners and the algorithmic logic?

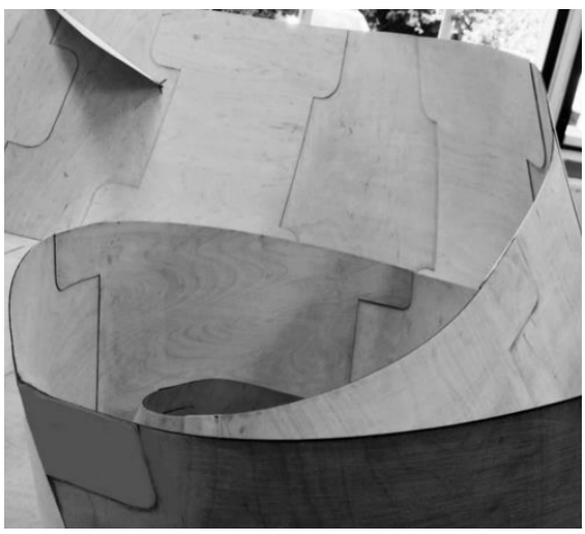

Figure 1: Assembled loop structure.

BACKGROUND

The development of computational methods extended the complexity of the design space and facilitated the formation of novel discoveries. As Frazer states; “A very large number of evolutionary steps can be generated in a short space of time and the emergent forms are often unexpected.” (Frazer, 1995). Thus, the course of the fundamental form-generation process has evolved and digital tools provided opportunities for exploring bespoke, unexpected geometric creations.

Although the formidable power of computation developed a novel creative thinking and eliminated technical limitations for efficiency, computation altered the balance between design context and implementation of the new technology. Therefore, the tools themselves started to become more important than design intentions and processes (Agkathidis, 2016). Agkathidis suggests; “By testing digital findings with physical prototypes, designers can begin to assess whether a complex solution is really offering spatial aesthetic and programmatic qualities to a project.” (Agkathidis, 2016). By designing an integrated workflow, the focus can shift into examination of the entire creative process instead of anisolated end-product. Ambiguities of computer augmented human thinking can be compensated by tangible model making.

RELATED WORK

The widespread availability of advanced computer software among design students and practitioners raises questions about the purpose and the extent of applying emergent digital tools. Fluidization of the digital and physical design techniques offer solutions to reconnect designers with each morphological stage of the design. As one of the first architectural milestones during the 1990s, Gehry Partners’ Walt Disney Hall project went through a series of sequential transition processes between digital and analog design techniques.

Kolarevic described this formal transformation as ‘digital morphogenesis’, a continuous structural development process (Hermann, 2004). Szulda followed a similar methodology by using 3D scanners to transfer physical prototypes to a design software (Dunn, 2012). Z.-R.Chen et al. presented design workflow diagrams that suggest new digital form finding and fabrication processes (Chen et al, 2015). From a pedagogical perspective, Agkathidis tested a design method on students which allowed them to switch between digital and analogue techniques (Agkathidis, 2016). There has been a variety of research and experimentation in the field. From the design point of view, current and past research are approaching to digital and physical processes as two separate realms without suggesting hybrid solutions for creating an effective feedback cycle.

On the other hand, there are other works that study interactive design methods and technologies to virtualize physical prototypes for creating tangible interactions with the digitized information. For instance, active LENS provides a tangible user interface that binds physical instruments to the digital 3D data (Ishii et al, 1997). By using the physical proxy, Sheng. et al. tested a tangible manipulation method which detects and digitally simulates hand motions applied on sponge and clay materials (Sheng et al, 2006). Later on, Leithinger et al. proposed a tectonic exploration process to allow tactile manipulation over cubical surfaces (Leithinger et al, 2011) . Solid surfaces were in dialogue with the digital 3D model that is simultaneously changing with the movements of the cubicles. With the integration of mobile devices Boring et al. created an interactive media façade (Boring et al, 2011). Boring’s research showed that built-in mobile device sensors can be utilized to manipulate a distant display.

Although above mentioned works developed techniques to achieve a flow of data between the digital and physical world, there is still a lack of empirical research that investigates the designers’ and computer’s roles throughout the evolutionary stages of the form-finding. Our work aims to explore the transitional workflow to merge manual and digital testing, designing and manufacturing processes with the creative impact of the designer. For our previous

work, we have tested a loop process that integrates digital and physical procedures (Agkathidis, 2016). The following section will anatomize each transitional workflow with the obtained feedback.

A MOBIUS PROCESS

PHYSICAL IMPROVISATIONAL MANIPULATION

As a starting point, a physical improvisational alteration process allows the designer to 'grasp and manipulate' physical materials and architectural surfaces (Ishii et al, 1997). By conducting a series of form manipulation experiments (i.e., folding, twisting, wrapping, pressing, etc.), with various types of sheet materials, a morphological evolution of a form has been commenced. Non-Euclidian, linear displaced curved surfaces were explored and a form was selected to further iterate on the virtual platform. The physical involvement of the designer initiated an understanding of material properties, advantages and limitations. According to Groth, the act of making is a haptic cognitive process which creates a communication between 'mind and material' (Groth, 2017). This is an important quality of physical testing that the existing digital technologies are not yet providing (Fig. 2).

Figure 2: Laser cutting and engraving process

DIGITIZING PHYSICAL OBJECTS

To initiate a dialog between physical object and virtual platform, we tested camera mounted 3D and laser scanners to obtain a digital model. Scanners can trace the contours of a physical object and translate the information as a 3D model or a point cloud data. By testing the scanning devices, we were able to generate a model with a portable camera mounted scanner to further manipulate its formal characteristics. Existing 3D scanner software only allows limited manipulation, which smoothens the surfaces of the structure. Thus, we transferred the scanned 3D model to the Unity Game Engine and tested its capabilities in terms of basic manipulative interaction (i.e., changing the scale, duplicating, stretching, etc.). We have created a Virtual Reality simulation with the manipulated 3D models to receive experiential feedback from randomly selected participants. According to Ishii; "The interactions between people and cyberspace are now largely confined to traditional GUI (Graphical User Interface)- based boxes sitting on desktops and laptops" (Ishii et al, 1997). In this experiment, our interaction with the 3D model could not go beyond direct manipulation with a mouse, controller and keyboard. Thus, the digital feedback extracted was not sufficient enough to comprehend the morphological potential of a linear displaced geometry.

PHYSICAL REFINEMENT AND ALGORITHMIC TRANSLATION

With the digital feedback received from the 3D scanning processes, we have switched to the physical production phase to refine the initial physical prototype. After analyzing the previous tactual and digital information, a material selection has been made. Digital fabrication machines were jointly utilized with conventional crafting procedures to create a loop structure made out of laminated flexible plywood. After intensive material testing, laser cut and engraved pieces of plywood were physically bent by heat gun and laminated to each other by polyurethane binder. Next, the refined physical model was translated into a digital data by implementing algorithmic logic -a mathematical setting of instructions- as a generative accelerator. According to Terzidis; "An algorithm is a Computational procedure for addressing a problem in a finite number of steps. It involves deduction, induction, abstraction, generalization and structured logic." (Terzidis, 2006).

We have conducted structural analysis with the algorithmic model generated with Grasshopper and Kangaroo plugins for the Rhinoceros software (Fig. 3.). The algorithmic manipulation process reduced the need to physically reproduce the prototype while altering geometric relationships. Nevertheless, before building a construct at a scale of 1:1, a mock-up model was crafted to detect the information that digital tools failed to provide. The transition was particularly important to determine the restrictions of the software being used and how manual crafting can provide a considerable physical feedback for developing accurate algorithmic settings. The accumulated digital and physical feedback helped us to discover new structural solutions and we have introduced a physical cross stitching method between two laminated surfaces. Complexity and diversity of the structural formations increased throughout the entire transitional process.

CREATING THE EVOLUTIONARY TRANSITION

In our previous work and experimentation, due to insufficient hybridization of digital and physical procedures, further exploration of virtual interaction tools became necessary. Both in 3D scanning and algorithmic translation phases, there were issues with the tactile manipulability of the virtual 3D models. For the future, along with physical crafting processes

we plan to further investigate the digitization aspect, where we transfer a physically built model into virtual platforms by using 3D scanners and the algorithmic logic. 3D input technologies such as; the Leap Motion1 tracker, touch displays and mobile devices will be tested and implemented to the 3D scanning phase. Therefore, scanning processes will enable designers to perform complex computational alterations easier. Using virtual interaction tools will augment the physical tactility of a model on a digital display. Boring suggests that; "Mobile phones nowadays are equipped with a variety of sensors, including sensors such as accelerometers, gyroscopes and electronic compasses, which can provide information on the orientation, movement and acceleration of the mobile device within a reference space." (Boring et al.2011). Thus, built-in digital sensors and display of mobile devices will be tested to interact with the 3D scanned component. Various scanning devices will be used and their limitations will be identified before testing digital feedback with a prototype.

Virtual interaction technologies will also be integrated to algorithmic modelling process translated from a physically refined prototype. In addition to Kangaroo2 and Grasshopper3 plug-ins, Stormcloud4 plug-in for the Rhinoceros software, which is a design space exploration tool, will be utilized (Åkesson et al, 2017) Potential 3D virtual input devices will be tested to expand users' ability to tactually explore novel design solutions with the algorithmic model. Following the algorithmic alteration process, structural analysis software such as Karamba5 or Autodesk's Dynamo6 can be implemented to obtain a real-time physical performance feedback (Åkesson et al, 2017) .

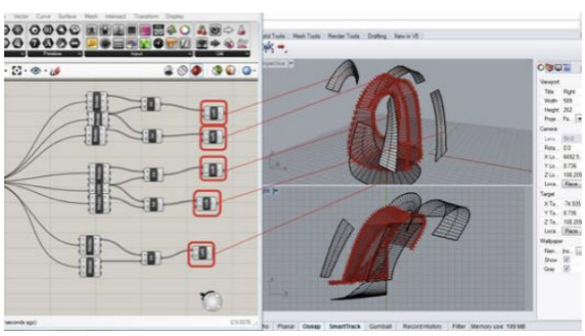

Figure 3: Algorithmic translation.

CONCLUSION

Testing various 3D input technologies and digital design software has the potential to expand the course of the transitional method presented in this research. By exploring the physical interactivity with the digital tools, we aim to achieve tangible interactions with complex virtual geometries which are translated from a physical reality. Findings of these experiments can assist us for designing seamless loop processes between the physical and digital realities. Once we are able to reduce the contradiction between virtual and real-world interaction, we can further test our integrated method with people to determine its generative impact as from the early creative stages of the design and expressive form-finding processes. Our transitional method can replace the distorted creative thinking with a multidimensional comprehension of digital design and fabrication tools.

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SENSATION //

SHUBHAM KESHARWANI, PALLLAVI YELLAMELLI & KATHIRAVAN SUBRAMANIAM |
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COGNITION

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EFFECT OF AURAL ENVIRONMENTS ON CREATIVE COGNITION

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ABSTRACT
With the advent of mobile computing, we have seen the influx of applications that, help in boosting your productivity, like note taking applications, timers and task managers (Messinger, 2015). Recently, based on studies (Mehta et al., 2012), applications that claim to enhance productivity using specialized music have become very popular. It has been found that moderate levels of noise can actually increase performance on creative tasks (Mehta et al., 2012). This paper explores the possibility of using the same platform to enhance one's creativity. The research aims at understanding how cognitive load varies when exposed to various types of measured auditory stimuli. In this pilot study, we aim to identify the effect various kinds of auditory stimuli have on the creative thinking abilities of individuals.

INTRODUCTION
Creativity is an aspect of personality that is characterized by novel and appropriate ideas and processes while cognition is thinking, and the ability of the brain to process, store, retrieve and retain information (Schiering, 2017). The cognitive abilities of an individual are influenced by his environment. When we talk about the environment it is focused on these three stimuli i.e., Visual, Auditory and Olfactory.

The setting of the environment and the elements present in it will add up to the visual stimuli. The type of noises, either the music or the noises made by the people and other responsible factors will act as auditory stimuli. Finally, the smell of all the previously mentioned factors will influence the olfactory senses.

These three stimuli will help us understand and define the ambient environments. Our study concentrates on how auditory stimuli influences creative thinking abilities. Our base hypothesis was derived from the research on effects of sound on visual realism and completion time in cel-shaded video games (Rojas et al., 2015). This study revolves around how cognitive load in individuals is altered with respect to ambient music. We tried to understand the influence of the various type of noises on users creativity using globally accepted indices which will be explained further in the following sections.

METHODOLOGY

Two experiments were conducted to understand the creative thinking of an individual exposed to various aural environments. The participants were tested under White noise (Relaxing White Noise, 2015), Classical music (Halidon Music, 2017) and Liquid Funk (Sound Territory, 2015) music in the background for both the experiments. The choice of these audio tracks was based on a survey conducted to understand what type of music students preferred when working on creative problems. The audio files were sourced from YouTube.

EXPERIMENT 1

A convenience sample of 15 design students was taken, 3 sets with 5 participants each were tested within the three aural environments. The participants were tested with a mobile game called 'Monument Valley', on an Android enabled device. At each level the player had to lead princess Ida, the protagonist through mazes created using optical illusions and impossible objects. Players had to manipulate the world around her to reach various platforms. Players had to rely on their creative thinking capabilities to find solutions to the posed problems, as the game environment defies the laws of physics and general visual perception. The participants were made to wear headphones for the auditory stimuli. And only the first three levels were considered for the experiment.

All the participants were screened to ensure that they had no experience playing it or information about the gameplay prior to the experiment. The time taken to complete each level was recorded. The average time per level with all the three environments was calculated.

EXPERIMENT 2

A convenience sample of 14 was taken and was tested on 3 different sets of question papers, each paper had the same difficulty level and was tested with one of the aural environments. In this experiment, we used three globally standardised tests to measure creativity.

1) Incomplete figure (TTCT)
2) Alternative uses (AUT)
3) Remote Associates (RAT)

TTCT, Tolerance Test of Creative Thinking as developed by psychologist Ellis Paul Torrance (Torrance, 1966). It involves IQ testing and other simple problem-solving skills. The participants are given a random shape and asked to complete the figure. It is scored based on these measuring indexes, uncommon subject matter, implied stories, humor, original perspective, and completeness.

Alternatives uses test involves flexibility in thinking within the given time. It was developed by J.P. Guilford (Guilford, 1960). The participants are asked to give alternative uses to a random object of daily usage and are evaluated based on fluency (how many uses you can come up), originality (how novel those answers are), flexibility (how many areas your answers cover) and elaboration (level of detail in responses).

RAT, Remote Associates test developed by Professor Sarnoff Mednick and Martha T. Mednick in 1962 (Mednick & Mednick, 1962), involves persons creative potential. The participants are given three words and asked to come up with the fourth word that connects to all the three words. It is scored based on the accuracy and response time.

All 14 participants took the test in a controlled exam environment(maintained at 50 dB decibel level). Each question was supposed to be answered within a 3-minute time limit, making each paper last for 9 minutes. The three different audio tracks were played on a speaker for each set of question paper during the test.

TEST FOR NULL HYPOTHESIS

To check the significant difference between group means, ANOVA test was done on the data. Through this test, we can figure out if the null hypothesis can be negated or check for alternate (Kim, H.Y. 2014) . Using strip chart the data is plotted (Figure: 1). In the plots, x-axis is the type of auditory stimuli (A-White noise, B- Classical C-Liquid funk) where A, B, and C are the audio tracks and y-axis is the score.

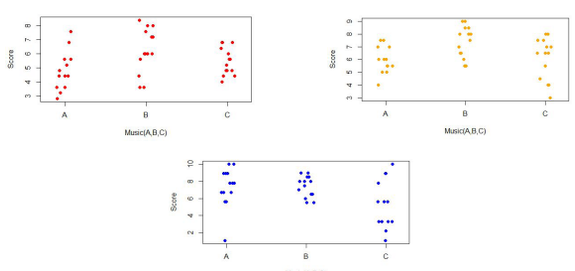

Figure 1: Plots of Scores of Question 1(red), 2(orange) and 3(blue)

Analysis of variance was done on the data. The probability of getting test statistic (standardized value) for question 1 is 0.041, question 2 is 0.015, question 3 is 0.024. The $p < 0.05$ in all the three questions and can be neglected.

Before interpreting the null hypothesis we looked at

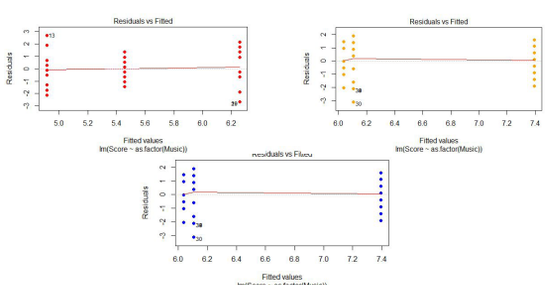

Figure 2: Residuals vs Fitted plot of Q 1(red), 2(orange) & 3(blue)

the plots of residuals to see whether our assumptions underlying the fit of the analysis of variance model are indeed valid. The standardized residuals vs fitted values were plotted (Figure: 2). The overall variance is relatively homogenous in audio tracks A, B, and C in all the questions.

The other assumption is normality in terms of the overall distribution of the residuals. Here we use Q-Q (Quantile-Quantile) plot to evaluate this assumption. The normal Q-Q plot (Figure: 3) follows a straight line. In Question 1, 2 and 3 we have a little skew in our data which is the positive right-hand skew and can be neglected.

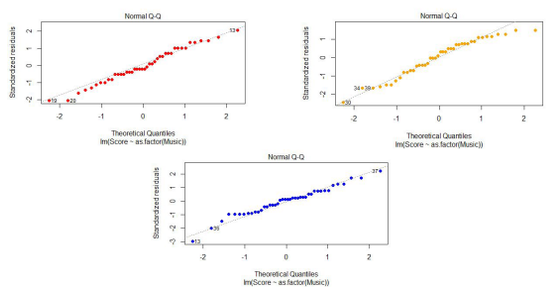

Figure 3: Normal Q-Q plot of Question 1(red), 2(orange) and 3(blue)

The probability of getting the test statistic is very small if the null hypothesis is true. So we can reject the null hypothesis.

The auditory stimuli (A ,B and C) seem to give different yields, By doing the post hoc test we can find where lies the difference. Is it in one of the music is different from all the rest or they are all different from each other. Two Key Honestly Significant Difference (Turkey HSD) test is another form of doing the analysis of variance on the overall analysis. In question 1, the big difference is observed in diff (C-B) = -0.8, In question 2, diff (C-B) = -1.28, In question 3, diff (C-B) = -2.07. Which means B and C are the ones that differ from one another when compared to A - B and A - C.

OBSERVATIONS AND RESULTS

EXPERIMENT 1

The feedback received from the participants was that white noise did not help but also was not a distraction. 3 out of 5 participants tried to quit after repeated attempts, one quit at Level III. Classical music was relaxing and helped them to think better, and find solutions easily. Liquid Funk being fast-paced created a sense of urgency and made them try to complete the levels at a faster pace.

	Level II	Level III
White noise	0:02:34	0:06:13
Classical music	0:01:29	**0:03:52**
Liquid Funk	**0:01:24**	0:04:29

Table 1: Average timings per scenario (n=5), at Level I and Level II

The outcomes of the first level were not considered as it was where the participants were getting familiarised with the game. At level II the most confusing trigger (illusion) of the game had been tackled at the first level hence speed played a greater role than creativity and problem-solving capability. At the third level, a new trigger was introduced (slider), which shifted the weight towards problem-solving capability of the player, and speed was rendered less important.
The average timings per level for the three aural environments were, as listed in Table 1.
At level II participants listening to Classical music took 6% higher time than Liquid Funk. Whereas participants listening to White noise took 83% more time in comparison to Liquid Funk. At level III participants listening to Classical music performed the best. Where time taken to finish the level, of Liquid Funk sample was 16% greater and White noise sample was 61% greater than Classical music.

Overall, participants gave better performance with Classical music.

EXPERIMENT 2

The points scored by participants in each of the questions per aural environment was recorded. Average of their scores per question per music type was calculated and tabulated in Table 2.

	TTCT	AUT	RAT
White noise	4.9	6.0	**7.3**
Classical music	**6.3**	**7.4**	6.2
Liquid Funk	5.5	6.1	5.3

Table 2: Average score per scenario (n=14), for TTCT, AUT and RAT

The average score per music type for each of the tests were compared. Participants scored best with white noise in Q3 (RAT). While Classical music made them perform best when it came to Q1 (TTCT) and Q2 (AUT). However the scores achieved in each of the tests for different categories of music are independent and not comparable to each other.

Below is the comparison of anticipated performance vs actual performance. The participants with the tick mark correctly guessed the auditory scenario they had performed the best in.

Sample	White Noise	Classical	Liquid Funk	Correctness of prediction
1	7.2	7.4	7.4	✓
2	4.4	5.7	3.6	✓
3	6.6	5.4	5.2	✗
4	7.2	6.2	6.0	✓

5	5.7	5.7	4.9	✓
6	4.8	6.7	5.3	✓
7	7.4	7.8	5.3	✓
8	5.5	7.2	4.6	✗
9	6.1	7.2	7.7	✗
10	5.4	7.7	5.6	✓
11	6.4	6.0	5.5	✗
12	6.4	7.4	3.9	✗
13	5.4	6.8	6.0	✗
14	6.7	5.5	7.7	✓

Table 3: Score per sample for each scenario and their expected outcome

64% of the participants scored highest with Classical music, 28% with White noise and 21% with Liquid Funk. While 57% of participants correctly guessed the aural environment they had performed the best in. Classical music turned out to be most effective in bringing out the creativity in the participants.

DISCUSSIONS

EXPERIMENT I

When we look at the timings posted by participants for the second level of the game. The timings of the participants listening to Liquid Funk performed the best, reinforcing the feedback received, which stated that it worked better for repetitive tasks where speed played a greater role. While at third level participants listening to Classical music gave the best performance, as with this level the focus had been shifted towards the problem-solving capability and speed became secondary in order to complete the level with maximum efficiency.

EXPERIMENT 2

As observed White noise helped participants in avoiding distractions and focus better, but they could perform better only in objective questions Q3(RAT). Classical music due to its mellow nature helped participants think and concentrate better, and brought out their creativity, which was observed in Q1(TTCT) & Q2(AUT). As per the participant's feedback, Liquid Funk due to its fast pace, engaged the brain and made the brain act fast, but did not help in solving the problems or boost creativity. It was considered better for task-based problems, where less thinking was involved. White noise helped participants in avoiding distractions and focus better, but had a lesser effect in enhancing one's creativity. Classical music due to its mellow nature helped participants think and concentrate better.

Our findings agree with the research done on effects of music on cel-shaded games which concluded that noises which induce a lot of cognitive load will, in turn, restrict an individual's cognition (Rojas et. al., 2015). The second experiment was done based on the global indices used to measure creativity. Here it is understood that Classical music proved to be more effective. The participants were able to realise the effect of these auditory stimuli on their creative thinking, which eventually reflected in the results.

LIMITATIONS

This study is limited by convenience sampling of design students who regularly employ their creative abilities. It can be taken forward with a more diverse sample in order to understand the pattern further.

CONCLUSIONS

The study provided valued insights on the effect of aural environments on an individual's creative cognition and problem-solving capabilities. The positive effect of classical music is much greater than the others. However, the underlying reason behind the outcomes remains unclear. This pilot study provides us with the direction to take this research further, by looking at the effects of different aural environments on the creativity of students and professionals from varied backgrounds.

This study gave us the base concept to develop mobile and computer applications that can enhance users creativity and problem-solving abilities. The solution is very cost effective and can be easily implemented.

ACKNOWLEDGMENT

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SENSORY FEEDBACK DEVICES FOR LANGUAGE LEARNERS

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ABSTRACT
The research presented here aims to explore the question of "Can sensory feedback devices be used to support communication between non-native speakers and native speakers of a language?". This question is posed with the aim of finding out how sensory feedback devices can impact the behaviours of intercultural and multilingual communicators and to confirm the assumption that, yes, sensory feedback devices can be used to support communication between non-native and native speakers. In this case, a 'Sensory Feedback Device' is specified by any device that can provide haptic, visual or auditory feedback when the speech cannot be understood. A series of controlled experiments with native speaker and nonnative speaker participants were conducted in order to better understand and evaluate the impact sensory feedback devices have on the native speakers' speech traits and prosody. The outcome of these experiments is presented through speech tempo analysis and statistical analysis of the acoustic measurements. As a result, it is evident that visual feedback devices reduce the rate of speech tempo in the speaker. This result encourages a positive change in the comprehensibility of the speaker. These results could be implemented into relevant fields such as speech therapy, multilingual communication and language learning.

INTRODUCTION
It has been openly postulated that native speakers of a language are the worst communicators (Morrison, 2016), that is to say that L2 speakers find it difficult to understand L1. This is especially the case if the L1 is not familiar or adjusted to communicating with L2 speakers. This paper explores the different ways in which sensory feedback devices can impact communication between L1 and L2 speakers.

The main reason for undertaking this research have been ignited through personal interests in language learning and communication, improving the cognitive and memory abilities of humans and making better use of the information that is already abundant in our daily environments.

Moreover, the main theme revolves around the question: Can sensory feedback devices be used to support communication between non-native speakers and native speakers of a language? To delve deeper into this question is to explore the problems that people who use a second language experience when in conversation, for example, the more fluent speaker is not understood properly because he/she speaks too quickly or uses irregular and informal speech such as slang. Furthermore, it will be explored if feedback, be it visual, audio or other, help to regulate more fluent speakers' speech in order to improve comprehension levels and simply study the effects of such a feedback

on the social scenario.

As defined (Kiff, 2009) *Sensory feedback is feedback provided within the sensory systems where information from sensory receptors is returned along the afferent pathways so the brain can monitor the consequence of actions.* Within the scope of this project sensory feedback is further specified by haptic, visual or auditory feedback. Within this research, sensory feedback will be explored to the extent of- what the effects are within the given context of the research and how effective, ineffective or disruptive they can be in this context of communication between native and non-native speakers. The sensory feedback device should act as an active mediator within conversation between natives and non-natives. This should be done in order to address the common underlining issues of accent (or clarity) and speed of speech of the native speaker. However, this should be achieved without significant disruption to the flow of the conversation and without highlighting the embarrassment of the non-native when they do not understand what has been said.

Through the creation of 3 separate sensory feedback prototypes we have been able to conduct conversational experiments in order to test and analyse to what extent visual and haptic feedback devices impact on a native speakers' speech tempo. As a result, we can determine that the L1 speakers are positively affected by visual sensory feedback, in that they reduce their speech tempo to facilitate a higher comprehensibility rate.

METHOD

2.1. PRELIMINARY RESEARCH

As a start to this research 3 participants were called for preliminary explorative interviews (Crabtree, 2010), these participants were non-native English speakers (L2 English) from different cultural backgrounds that had lived for some time abroad within a primarily L1 English environment. As such these participants became key informants (Crabtree, 2010) as they had more experience and knowledge of the subject than the interviewer. Three fundamental factors that both common and identified as a hurdle to understanding native speakers among all of the key informants were:

- Speed of speech
- Accent
- Colloquial terms

2.2. BREACHING EXPERIMENTS

A series of breaching experiments (Crabtree, 2010) were carried out to explore the effects that different types of sensory feedback devices had on conversational contexts. This was done with the aim of discovering what types and formats of sensory feedback devices work best within this context to fulfill the research. For these experiments 3 rapid prototypes were created.

The first rapid prototype acted as an auditory sensory feedback device, essentially this prototype consisted of a small buzzer that would be activated via radio remote.

The second rapid prototype acted as a haptic sensory feedback device, in essence this consisted of a small vibration motor, similar to those found in modern mobile phones which was activated via radio remote.

The third rapid prototype acted as a visual sensory feedback device, in essence this consisted of a series of red LEDs which were triggered via radio remote.

Participants for these experiments were chosen randomly within a lunch cafeteria, and no notation of their cultural background was taken as these experiments were used solely as a tool to investigate the sensory feedback devices.

As a result, it was determined that the auditory feedback was too disruptive to conversations and would negatively impact the flow of these kinds of interactions and speech. The haptic feedback device was to a lesser extent disruptive and seen to influence the conversation slightly. The visual feedback prototype was the least disruptive to speech and the conversations in general.

2.3. SENSORY FEEDBACK DEVICE PROTOTYPING

To summarise the design idea, in a perfect scenario, would be that the sensory feedback devices would be connected to a speech recognition software, which can interpret the speech of the native speaker: when the software fails to comprehend the speech, the feedback device is triggered. However, speech recognition software for lengthy dialog is not easily accessible, open source speech recognition software is very limited and used mainly for control purposes not cataloging dialog. Due to lack of resources and limited accessibility to the proper tools of speech recognition, it will not be implemented into the prototypes within this cycle of the research but is considered as a future work in this research. Nonetheless this can be combatted by making use of certain implementation techniques such as, Wizard of Oz technique.

As a conclusion and deductive interpretation of the findings of this preliminary research, the sensory feedback device acts as an active mediator within conversation between natives and non-natives. This is done in order to address the common underlining issues of accent (or clarity) and speed of speech of the native speaker. However, this should be done without significant disruption to the flow of the conversation. Following from the rapid prototypes, 3 new high fidelity prototypes were created. Two of the three devices are visual feedback devices and the remaining one is a haptic feedback device. The two visual feedback devices differ in that one visual feedback device, named the LED block, is placed in a neutral position and is not aimed at directly at any one

communicator. The other visual feedback device, named the LED badge, can be worn by the L2 and is directed at L1. Finally, the haptic sensory feedback device is a vibrating sleeve which is worn by the L1 and vibrates when the device is triggered, which is only noticeable to the L1.

2.4. CONVERSATIONAL EXPERIMENT

A conversational experiment is conducted to test the research question using the prototypes. This experiment consisted of 3 participants and 1 facilitator. Two of the three participants were L1 from the UK and USA respectively, whilst the third participant was a L2 non-native speaker from Iran.

2.4.1. PARTICIPANT ROLES

In this setup the L2 participant would act as the interviewer and ask open-ended questions to L1 participants, in order to get the L1 participants to speak for lengthy periods uninterrupted. The L1 participants simply have to respond to conversation questions and would be interviewed at separate times as to keep the experiment a surprise and not affect the results due to familiarity with the test setup.

The role of the facilitator is to introduce the experiment, ensure the device is triggered at the chosen intervals when the L1 is speaking, to ensure that the conversation does not end without recording the necessary data, and to make observations.

2.4.2. THE WIZARD OF OZ

As explained previously the devices will be triggered without speech recognition technology. This means that the facilitator must trigger the devices himself, hidden and under the guise that a speech recognition technology is at work triggering the devices. This is a key element of the experiment because if the participants knew that the technology was not acting on their how it recognises their speech but randomly selected by the facilitator, then they would not change their behaviours in a genuine or authentic manner. Thus, this would corrupt and invalidate the results.

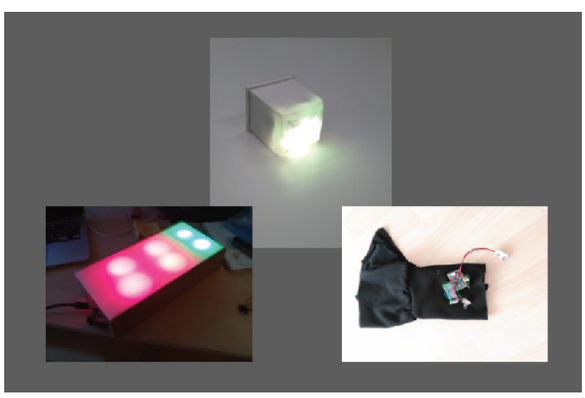

Figure 1: Sensory Feedback Prototypes (LED box left, Vibration right, LED badge top)

To ensure the participants believe in the Wizard of Oz and to not influence their behaviours only vital information about the experiment is explained. The L1 participants are told only that these devices, through speech recognition software, will provide feedback on the comprehensibility of their speech. It is important to note that we did not explain that if the device was triggered you must speak slower or clearer, again, otherwise this would have influenced their natural behaviours and reacts to the devices.
The facilitator acts as the Wizard of Oz and must trigger the device via Bluetooth unnoticed by the L1 participant at intervals during the L1 speech.

2.4.3. RECORDING AND GENERAL SETUP

In order to provide reliable quantitative data, it is important to acquire enough data samples. For this experiment the chosen minimum number of samples is 15 per device. 15 samples are a good amount because it can be assumed that some of the time the devices may go unnoticed at any point or cause a shock at first, the more samples are taken the more reliable the data will be. At the same time there needs to be a limit to the amount of samples in order to keep conversations going; the native speaker should not run out of things to say. Taking 15 samples would take approximately 3 minutes which is not too much time for the conversation to run dry. This means each device must be triggered 8 times per participant in order to provide at least 15 (16 in total) samples for each device.

During the experiment the devices will be triggered at the will of the facilitator, leaving, at minimum, a 5 second gap between the activation of the device. This is done because a 5 second before and after sample recording will be taken after each trigger for a speech tempo analysis. Other than this constraint the device is triggered more or less at the will of the facilitator during the speech of the native speaker.

Once the device has been triggered 8 times, the conversation is stopped by the facilitator and the device is replaced with the next sensory feedback device and so on until all sensory feedback devices have been used in the experiment by each participant.

The entire experiment is recorded with video and audio.

3. RESULTS

As speed of speech was earlier identified as a main factor in understanding L1 speakers by the key informants and that it can be easily identified, isolated and measured- speed of speech has been chosen as the key measured and analysed property. In order to determine the speed of the native speakers' speech (or better known as speech tempo), a frequency count was made through auditory observations upon the before and after audio sample recordings.

Essentially, a frequency count is the number of syllables spoken within the time frame - the higher the amount of syllables within the 5 second sample - the

faster the native speaker is talking.

The results of the total speech tempo analysis for each device can be seen in tables Table 1, Table 2 and Table 3.

Device Sample	Speech Tempo 5s Before	Speech Tempo 5s After
Vibration 1	24	20
Vibration 2	18	29
Vibration 3	22	5
Vibration 4	10	19
Vibration 5	16	19
Vibration 6	20	20
Vibration 7	21	24
Vibration 8	20	21
Vibration 9	12	8
Vibration 10	17	19
Vibration 11	16	20
Vibration 12	20	17
Vibration 13	10	10
Vibration 14	12	6
Vibration 15	4	7
Vibration 16	18	17
Total Average	16.25	16.3125

Table 1: Vibration Device Speech Tempo

From the results shown in Table 1, the Vibration Device does not provide a clear cut answer and on average the sensory feedback device actually slightly increases the speech tempo of the L1. This shows us that haptic feedback devices of this kind do not aid communication between L1 and L2 speakers.

Device Sample	Speech Tempo 5s Before	Speech Tempo 5s After
Block 1	8	15
Block 2	14	10
Block 3	22	12
Block 4	17	16
Block 5	24	2
Block 6	22	19
Block 7	17	11
Block 8	9	21
Block 9	16	13
Block 10	20	16
Block 11	15	13
Block 12	17	5
Block 13	15	11
Block 14	21	11
Block 15	17	7
Block 16	5	0
Total Average	16.1875	11.375

Table 2: LED Block Device Speech Tempo

As seen in Table 2 the LED Block does cause a fairly positive reaction. On average the speech tempo drops by almost 5 syllables.

Device Sample	Speech Tempo 5s Before	Speech Tempo 5s After
Badge1	25	24
Badge2	12	21
Badge3	26	18
Badge4	13	19
Badge5	27	22
Badge6	27	19
Badge7	23	3
Badge8	6	19
Badge9	15	14
Badge10	12	12
Badge11	15	19
Badge12	16	12
Badge13	15	13
Badge14	14	12
Badge15	22	17
Total Average	17.86666667	16.26666667

Table 3: LED Badge Device Speech Tempo

It can be seen, in Table 3, that the LED Badge does cause some, yet limited, impact in speech tempo. With the average speech tempo dropping by about 1.5 syllables after the device is triggered.

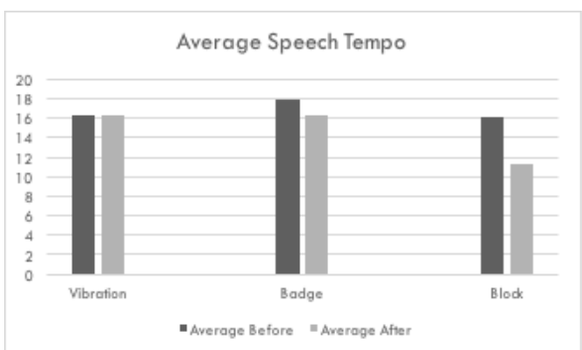

Figure 2: Average Speech Tempo

When comparing the effects of the feedback devices on speech tempo it can be observed, in Figure , that visual feedback seems to have a larger impact on speech tempo and haptic feedback. Through this analysis it is found that the Visual Feedback Block is the most effective at reducing speech tempo, whilst the LED Badge does have a slight positive impact but not as large as the Block. The Vibration Device however does not have any noticeable impact on the speech tempo from this analysis.

CONCLUSIONS

To conclude, this research project set out to explore sensory feedback devices within the realm of communication. Through preliminary research interviews an insight was gained into communication challenges through the eyes of key informants.

This provoked rapid prototyping and breaching experiments to further explore the impact of sensory feedback devices within a social context. Using that as a base, further iterations were designed and refined in

order to conduct a controlled lab test and analysis.

Figure 3: Visual Feedback Block during experimentation

Upon analysis of the test it was found that visual sensory feedback devices can have a positive impact as a mediator of communication between a native and non-native speaker in that it can lower the speech tempo of the L1 which in turn is linked to better comprehensibility by L2 speakers.

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INFORMATION //

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INFORMATION

HOW TO SOLVE ERGONOMIC PROBLEMS THROUGH AESTHETICALLY CONSIDERED DESIGN

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ABSTRACT
The goal of this paper is to show how ergonomic problems can be solved or improved through the use of Aesthetics. Our proposal is that such a goal can be reached when the core of design concepts would be understood better when design perspective would be applied without reducing it to a countable and engineering entity. In order to show that, first we introduce the design concepts, applications and challenges design with ergonomics, then we propose our hypothesis about possible interaction between aesthetics and ergonomics, aiming to go beyond mere calculation. Afterwards we report our case study, which is designing a bath seat for handicapped, we assess practically the validity of our hypothesis and we generate guidelines for further improvement. The framework for this study, applying design viewpoint for solving ergonomic problems has been emerged from Heidegger discourse, using the concept of Das-sein and how tools and products would redefine our relation with the world, or the way our relation with the world has been redefined.

INTRODUCTION
The role of Design in solving ergonomic problems is a bit problematic. There were very few researches in the field of Human Factors to prove that aesthetically considered objects can function better. One of the studies was mentioned in Emotional Design Book by Donald Norman, in which Norman reports a controversial study to show that aesthetically considered public phone was functionally better than ordinarily designed phone (Norman, 2004). It seems that the role of design would be more than beautification of product; it affects the usability and functionality of product as well. However the role of design in human factors domain needs to be better defined. We believe one challenge is that instead of putting design in the core part of the solution, it is reduced to mere quantified situation and it gives no more innovative result (Wartenberg, 2013). First we review critically the role of Industrial design as applicable in human factors domain, then we present our hypotheses about the possible role of design, afterwards we present our study and finally we generate results from our study in order to prove how and in which way design and ergonomics can generate better solutions.

PROBLEM FORMULATION
2.1 BASICS:
The question of design being applied in the field of human factors have always been important, moreover

our challenge was to show in which way design can applied in more scientific fields without losing its' originality and novelty. Few studies have been generated in this field.

The increasing role of Design in product perception has been increased widely. While the role of MBA (Master of Business Administration) would be considered as commercialization of ideas and concepts (Allen et. al., 2007); the role of design has been considered as making the idea, meaningful (Krippendorff, 2006), understandable (Norman, 2013), acceptable, tangible (Hummels) and pleasant (Blythe, 2004), something which is beyond just beautification of products for sale. However the challenge is how to apply design viewpoint in the field of human factors without losing its originality and novelty. In order to show that, we need to generate a hypothesis of how such concepts can be applied, we also need to define a viewpoint for the field of design, in other words what do we mean by design and in which way we define its' originality.

2.2 CHALLENGES OF DEFINING DESIGN:

The main challenges in defining design are that this field of study has been hardly rationalized. According to Delft Design Guide, while there are huge amount of logic for transition from form to function, there can hardly scientifically provable methods to help us go the opposite (Van Boeijen, 2013). Maybe that is the reason why design methods are not so many or the role of intuition and artistic value has been considered strongly in design. We try to bypass the possible debate and redefine design in a designer-ly way (Cross, 2007).

2.3. REDEFINING DESIGN, A HEIDEGGERIAN PERSPECTIVE:

Without entering the debate about possible methods or methodology, we try to reconstruct the way design looks at the problems, which sounds with prior importance. We propose that design has a lot to do with position and with placement of human in the real world. For us emotions are carriers of direction to the world, whether talking ontologically or materialistically. This direction is beyond mere calculation, we are directed toward something. For us Design redefined the way we are das-seined in the world. Of course this argumentation is extracted from discourse of Heidegger (Heidegger, 2008). For us tools and products are carriers to remind us the message that in which way and how we are directed toward the world.

This is beyond mere calculation. This logic comes from Phenomenology, helping us redefine reality by moving from Nomen (unknown) to Phenomenon (known). Again without considering what reality is, we translate practically the role of phenomenology and logic of Unknown to Known into direction, orientation and destination, we believe that emotions are reminders of direction and orientation. Tools, instruments and products help us redefine our position and placement in the world, whether positively or negatively.

This kind of research has been unconsciously been defined and improved recently. Design driven innovation claims that design redefines the meaning of the product, although it does not explicitly defines what they mean by Meaning! (Verganti, 2009) This translation (Direction, orientation, destination) or in other words, this model helps us understand what needs to be done in order to generate better concept, without reducing emotions into numerical data.

2.4. CHALLENGES OF EMOTIONS AND REDUCTIONIST VIEW:

Heidegger again claims that in translating art into field of science, there are very few and exceptional situations in which the role of art has been understood. This happens for metaphysics as well. Although meta-physicists claim that they go beyond physics, they use the same methods as physics (Wartenberg, 2013). The result would be that they consume the nature, meaning reducing, owning and ruining the nature without understanding the other aspects of the nature, only seeing what can be seen and can be calculated (Lemay, 2007). However art does the opposite, it gives you a horizon of what cannot be seen or has not been calculated. We think that such an argumentation would lead us toward Terms such as Awareness and Consciousness, awareness would sound more physical and consciousness would sound more cultural-historical.

One the other hand the role of emotion would have been more discussed, mainly by Antonio Damasio in his book Descartes Error (Damasio, 2005). Although Descartes was successful in generating the idea that human function is translatable into a machine, in which human mechanisms are calculate-able and reproducible, he did a mistake by proposing that emotions are separated from physical aspects and would be needed to be analyzed separately with different methods. Damasio tried to prove that they cannot be separated, emotions are not separate-able from logic and if emotions would be harmed, logical part of the brain would not function as well.

2.5 RESEARCH QUESTIONS AND HYPOTHESIS:

Based on the mentioned above we believe that aesthetically aware design, or in other words emotional design, can facilitate and generate better ergonomic solutions. This is our scientific hypothesis. The main question would be which model of aesthetically aware design can generate better effective solutions for ergonomically durable

design. In order to explore that, we conduct a study on the role of ergonomics applied in design, we use current methods and models of aesthetics applied in ergonomics and finally we comment on how and in which way these models can be elaborated, improved or change.

CASE STUDY REPORT

3.1 PROBLEM DEFINITION:

The product chosen for study is something to help handicapped wash themselves better. The product was the result of Master Project of first author in the field of Industrial Design, being supervised by the second author. The handicapped were mostly paraplegic handicapped and they needed better support.

3.2 PROBLEM INTERPRETATION & DESIGN:

We claimed that merely scientific design would pull out the spirit out of the design. Not only functional aspects in designing the products are important, but also the role of emotion should be considered. Regarding our manifest about design as process of making things tangible and acceptable, we found out that there are a lotto do with current bathroom chair for handicapped. Both numerical models (use of golden ratio in design) and cultural models (giving the feeling of Independence to the handicapped) were given. According to our interview and further assessment, it seems that a mixture of associating solutions considering cultural consciousness and physical awareness being applied in product design would generate much more fruitful results. Regarding our argumentation with the concept of Das-sein, the current situation makes handicapped dependent on his/her relatives and such a relation makes them sad and depressed. Therefore in order to generate a better solution a tool should be designed in a way that could change the relation, meaning that it should give them the feeling of independence. To conclude, not only emotions should be considered in this process, but the direction, orientation and context within which those emotions are being shown should be considered and change as well. In other words, as products are not neutral and embed emotions (Desmet et al., 2013), emotions are not also neutral and embed context and situation. This does not deny scientific study on emotion, but does encourage complementary research on culture and other interpretations of context embedding emotions.

Based on mentioned above, a prototype considering physical and cultural emotions were designed as shown. The product is considered to be portable, and all washing equipments have their adaptable placements on the chair. Regarding physical aspects of emotions, the main texture for the seat was chosen to be wood, giving more natural feeling and the dimensions were reconsidered by Golden ration relations. As shown in the pictures below:

Figure 1: A preliminary Sketch of Bathing Seat for Handicapped

Figure 2: Computer rendering of Bathing Seat for Handicapped

Figure 3: Computer rendering of Bathing Seat for Handicapped

3.3. CONCLUSION

After making the prototype, an evaluation of the product was conducted by asking 20 handicapped paraplegic users, 10 male and 10 female participants were questioned and these results were obtained. This hypothesis shows that, according to Heidegger's theory, looking at a person (disabled) and providing individual autonomy increases the quality of life.

Ergonomic problems can be solved by designing and using a golden ratio for the size of the bathroom chair. The final test is categorized as a table after the prototype is produced and the questionnaire is filled in by users. The consultants of the Welfare Organization of Iran helped us in this project. A study using Kansei Engineering method was given that showed 75% of adjectives were adaptable with the request of users for this study.

Item questioned	Percentage of Participants answered
Comfort in use	Yes (65%)
Comfort during taking bath	Very Much (85%)
Accessing the bathing equipment	Excellent (90%)
Satisfied with the color	Yes (90%)
Beauty of the chair in comparison to other additional tools	Very much (100%)
Appropriateness of dimension for sitting and taking bath	Appropriate (60%)
Quality of Material used	Excellent (45%)
Helping independence and self organization	Very much (75%)

Table 1: The results of the experience of using the chair for the disabled

DISCUSSIONS AND FINAL REMARKS

As mentioned, the use of Design concepts in ergonomics is an emerging and plausible trend. The main challenge is reduction such an application to numbering and reducing the phenomenon into something calculate-able. In order to prevent this we tried to generate different models for applying ergonomics in the field of research. We classify the role of aesthetically inspired design through three models:

Numeric Models: Such as generating Golden Ratio in Designing the tool, or adapting the dimensions of user with the tool.

Emotional Models: Generating the emotions extracted or needs to be extracted out of the use of product

Phenomenological models : generated based on understanding the orientation, direction ,relation and destination, physically and materialistically: which gives you Awareness

Socio-cultural Models: in which you redefine your position in society and history, shaping the concepts of culture and generating Consciousness.

It seems that third and fourth model can generate more understandable and applicable results for the users, rather than mere emotional models.

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THEMATIC ANALYSIS OF ONLINE COMMENTS FOR DESIGN RESEARCHERS TO CONTRIBUTE TO AUTONOMOUS TECHNOLOGIES

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ABSTRACT
Although the developments in autonomous devices create new design opportunities for designers, when it comes to the interaction, existing methods remain lacking to deal with the increasing complexity of those devices. It might be because literature for involving designers to the development in devices that are driven by the technology is inadequate. For that reason, the tools embody high technologies that require huge investments result in disappointing experiences for people. The Uber autonomous car accident and people's quick reaction to this incident is a very recent example of this proposition. Thus, we pick on this accident and questioned if it is possible to collect information from people's online comments to create design scenarios for future solutions of autonomous devices. We collected cars, futurology and technology themed comments from a widely used content aggregation platform, Reddit, and employed thematic analysis to gain insights from people's reaction to an emerging technology. We specified actors in the accident, environmental factors that have been effective in the accident and actors that found to be guilty according to the tone of the commenters. As a result, we proposed a way for using that kind of fast analysis to create design scenarios contributing to the direction of emerging technologies.

INTRODUCTION
Since the beginning of the experiments in 1920, the use of the autonomous devices has been questioned a lot. However, setting the ethical and social sides of this issue aside, the technological advancements has taken the experiments to the trials, prototypes and then, the working models. At the end of 30s, an early representation of automated guided car was exhibited in World's Fair by Norman Bel Geddes's Futurama. In 50s, RCA Labs tested a miniature car on the laboratory floor equipped with wires. In 60s a more holistic approach has been taken by Ohio State University and they launched a project to design a driverless car together with electronic devices embedded in the roadway. In 1984, the idea of first truly autonomous car was presented by the collaboration of university and automobile industry. The prototypes and working models were not late to follow. Consequently, accidents of these cars and the resulting discussions have begun with the first driverless car has been tested in the traffic in 2013. (See Figure 1)

According to the report of the State of California Department of Motor Vehicles (2018) there have been 59 accidents that involve an autonomous car until March 2018. The very first crash has been recorded in October 2014, after a very short time the autonomous cars were begun tested. However, until very recently,

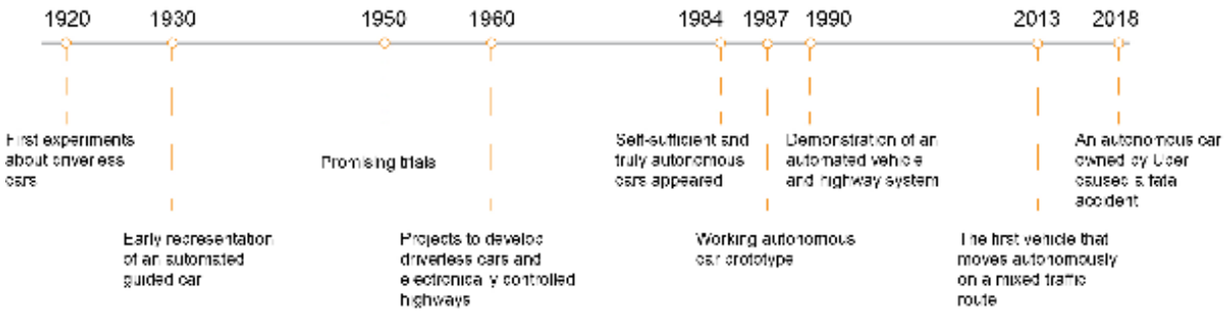

Figure 1: The evolution of driverless cars

March 19, 2018, none of the crashes had a fatal result and in most of the crashes, the other sides were found to be guilty. Consequently, despite there is not an official verdict in the case, people started speculating about the accident on the Internet. Even though, the car has all the necessary capabilities including the radar, cameras, sensors and computer vision technologies, it caused a women die leaving no responsible behind.

The news had started many discussions whether the tests of autonomous cars have to end or the technology is promising and experiments should continue.

LITERATURE AND THEORY

Lindley, Sharma, Potts, and Ventura (2014) think that design ethnography for studying emerging technologies is inadequate because design ethnography puts forward the existing state of things by focusing on the present. The requirements of people change rapidly with the effect of evolving technologies (Rosson & Carroll, 2002). Therefore, design research should focus on how the world could be in the future instead of privileging the status quo (Grand & Wiedmer, 2010). As existing studies for exploration of emerging technologies are largely technology driven, they do not provide any opportunity for designers to gain insight about the everyday needs of people (Bloomberg et. al., 1993). The evolution of driverless car is a considerable example of this situation.

Approaching the accident of Uber autonomous car which caused a person die from the perspective of design research, we believed that, the arguments between the third parties could be a valuable input to the design process. In the literature, there are discourse analysis that inspect the racism, sexism (Hughey & Daniels, 2013) and populism (Sisasket. al., 2012) in user comments on the Internet, yet, as it is the first time that an autonomous car killed a person, we found it interesting to take online comments of people into consideration as the social influence of these comments have found to be important (Althoff et. al., 2017) on online behaviours. Moreover, the studies searching for the effect of online comments on offline behaviours are limited to the subjects of political mobilization (Bond et. al, 2012), physical activity (Consolvo et. al., 2006), health (Christakis & Fowler, 2007) and smoking (Christakis & Fowler, 2008). Therefore, discussing the effect of online comments of people on technology application is going to be new in that respect.

In the previous studies, there is not a common approach to analyse the online discourse on a recent technology. In order to evaluate anonymity, dis-inhibition and quality of the comments, researchers made use of McKee's (2003) post structural approach to textual analysis and Fairclough's (2003) intertextuality theme. Moreover, after the term computer mediated communication (Herring, 2001) was introduced, the studies on the use of language over computerized networks have been increased. These studies adopt a qualitative approach to analyse media text including mainly collecting data, categorizing them under themes and evaluation of the findings. As this is a qualitative method, most outcomes provide an exploratory explanation of cultural and social contexts of the comments (McKee, 2003).

DATA AND METHODS

In this paper, as the previous works, we collected immediate comments of a recent news, categorize them to find common results. Distinctively, we believe that, the analysis can provide an input for designers in the process of scenario building.

We made a quick thematic analysis of the 30 top level comments, in order of karma points from the most up voted threads about the fatal Uber accident, gathered 24 hours after the event. This was done at three separate subreddits in an attempt to overcome community bias. "r/Futurology" was chosen as a technology and progress positive perspective, "r/Cars" was chosen for a more conventional mobility perspective and lastly "r/Technology" was chosen for a perspective from a relatively more mainstream crowd of news followers. Median karma point of all three threads were 1600 and median comment count was 720.

Only the top-level comments were chosen to disregard replies, focusing on initial argumentations. 11 comments out of the chosen 90 was eliminated for being too short (Less than 3 words) but were not substituted to respect the communities' voting choices, leaving 79 comments for the qualitative study.

We collected the related comments in a Google Docs sheet. Four themes were discussed and keywords for each were extracted separately by the two authors and

common ones were used. The themes were:

Blame: What or whom the commenter blamed for the problem, if any.

Actors: What or whom the commenter designated as actors or agents in the situation, if any.

Environment: Environmental factors that the commenter mentioned in relation to the situation, if any.

Stance/Sentiments: Overall tone of the comment regarding autonomous cars.

Keywords on each theme were consolidated until we believed that meaning was getting lost.

RESULTS
Results will be discussed by the four themes.

The pedestrian and the self-driving car (SDC) were dominantly and almost equally blamed for the accident. The monitoring driver was much less mentioned as a culprit, while society was a close third in terms of popularity. These commenters thought the incident was normal (not any more deserving of attention than a non autonomous car in a fatal accident) and they blamed society for "making a big deal out of it":

> "Watch the anti-autonomy folks go nuts and say that this proves that autonomous cars are dangerous."

Another dominant actor that was blamed was Uber, most commenters who mentioned the company singled it out apart from the overall sector of autonomous transportation:

> "Of course, it's Uber. Makes sense they'd be the first ones."

In terms of active agents in the autonomous cars, society and legislation were overwhelmingly dominant in comments. Commenters mentioned that the stance of society and various legislative bodies would be decisive in the future of autonomous cars and that this fatal crash would be vital in how that stance would turnout:

> "Whichever party was at fault here, the fact that was someone was killed will be the only thing that will stick with the general public."

> "People expect it to not just be better than human drivers: They expect it to be perfect, which means it doesn't just have to be better than an average human driver, it has to be better than the best human driver."

Environment was dominated by questioning whether there was a crosswalk or not, and the fact that it was night time when the crash happened. Both were mostly irrelevant for the technology used in autonomous cars for detecting obstacles.

For stance and sentiments, multiple dimensions were generated from blind keywords. First, comments were categorized as optimistic or pessimistic which turned out to be almost equally distributed among the chosen comments. One common sentiment appearing on both of those sides were fearfulness. Optimists stated fear about this accident hampering progress in autonomous car development and pessimists stated that this was proving how vulnerable the tech is and that autonomous cars are being pushed too hard for what they are:

> "These are lessons freely available from the tech in aviation, but instead tech companies are using public highways as test tracks."

> "This may slow down development of self driving cars, due to litigation and liability costs."

Commenters were also showing stances on the speed of progression directly and indirectly. Some stated that the development was way too fast, and some were stating that it was too slow, both as the reason of this fatal crash.

Another dominant sentiment was excitement about how the accountability would be worked out in the legal case following the accident. For them, this was bound to happen and the sooner this is solved, the better for where the autonomous cars would go:

> "This is going to be the test court case we've all known was eventually coming."

> "[...] the reaction to this incident will probably set significant precedent. This is the kind of situation largely theorized and now we get to see it first-hand."

DISCUSSION
We believe that these quick and dirty thematic analysis on the first fatal crash of the autonomous car would provide valuable insights into the impulsive thoughts on people. Our analysis showed that these commenters thought the society and legislative bodies are as important as the autonomous cars and their technologies. This is despite the fact that the car, the pedestrian and Uber was dominantly blamed for the accident. For designers, this creates a world where autonomous cars are blamed and feared by as a technology, yet they are not active actors when it comes to change or redesign the system. A quick outcome of this study indicates that designers would have to design around the autonomy rather than inside of it.

Time and space constraints limited our thematic analysis in this study, but we believe that it would serve designers if these early and impulsive comments are

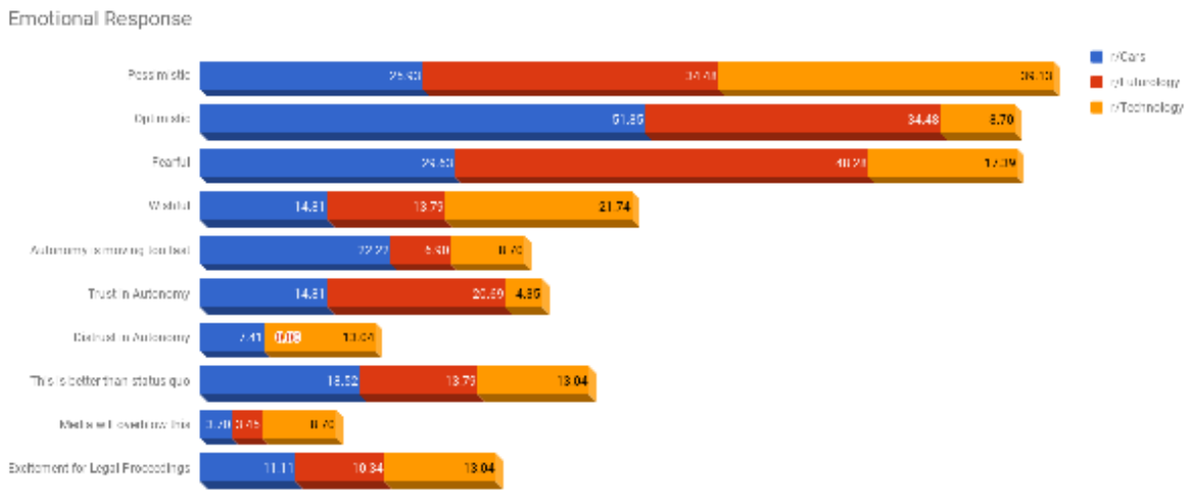

Figure 2: Themes of comments in stance and sentiments. (Numbers indicate number of comments keywords occurred in, corrected for eliminated comments in each subreddit)

more often analyzed as user data.

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EXPLORING 'CITIZEN DESIGN RESEARCH'

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ABSTRACT
The involvement of citizens in science research has increased recently as mobile technology, cheap processors and sensors develop. This allows citizens to be involved in different ways, as data collector or data analysts in various fields, from biology to physics. Engaging citizens to collect data during daily routines and observations becomes an attractive way to engage in the science world and helpful for scientist to get more data rapidly. Being design researchers, who engage diverse people in their research and design process, it becomes of interest to investigate our interplay with citizen science. How is it different from Participatory Design? What may Citizen Science offer design research? In this paper, we will analyse Citizen Science examples and interview experienced scientists so we can discuss opportunities for how design research may benefit from Citizen Science. We will also develop a first case of citizen design research.

WHAT IS CITIZEN SCIENCE?

Lewenstein (2004) defines in three parts Citizen Science. The first is "the participation of non-scientists in the process of gathering data according to specific scientific protocols and in the process of using and interpreting that data;" (Lewenstein, 2004: 1). This is probably the most known side of Citizen Science. However also "the engagement of nonscientists in true decision-making about policy issues that have technical or scientific components" and "the engagement of research scientists in the democratic and policy process"(Lewenstein, 2004: 1) are described as Citizen Science. In 2014 a White Paper on Citizen Science in Europe frames the citizens engagement in science more generally as "the general public engagement in scientific research activities when citizens actively contribute to science either with their intellectual effort or surrounding knowledge or with their tools and resources"(Serrano Sanz et. al., 2014: 8). The first part of Lewenstein's definition and the White Paper on Citizen Science in Europe became the basis for further research in engaging citizens in different projects.

In this white paper, the social aspect, collaboration between people, knowledge, creativity and technology are emphasized. With co-creation, citizens gather knowledge and skills, when scientists and researchers receive data needed for their explorations. This way of involving people, in a process of creating, is well

known in Participatory Design (Ehn, 1993). In this kind of design process, different stakeholders collaborate and take actions to design a solution together. Their knowledge and experiences are important parts of the design process. So, are we able to implement parts of Citizen Science to Participatory Design?

Technology plays a crucial role, both in Citizen Science and Participatory Design. Preece and Bowser (2014) suggest that Human-Computer Interaction can encourage people to take part in Citizen Science projects. The availability of electronic devices and sensors enable participants to gather data, analyse and simply learn in new ways (Guler, 2013; Liu, 2017; Xu et al., 2017).. There is a potential in HCI to support Citizen Science, when the technology itself is accessible, affordable, intuitive and easy to use – but also a risk of discouragement, if it is not.

Mueller et al. (2018) discuss the combination of crowdsourcing and active design tools to design urban spaces with the involvement of citizens and coin the term Citizen Design Science. They distinguish Citizen Design from Participatory Design by emphasizing the fact that it deals with Urban Design rather than a general design process. They combine "harnessing the knowledge of the crowd" of Citizen Science with active co-design of Citizen Design into a new research area namely Citizen Design Science.

Senabre, Ferran-Ferrer and Perelló (2018) discuss a participatory approach to Citizen Science projects, in which they develop a Citizen Science research project through co-creation. Their aim is to explore how Citizen Science projects can develop from using the citizens as data-collectors towards co-creators of the research. One important point from their research is how the research question can emerge in a process driven by the participants rather than forced top-down by the scientists. The co-creation of the research question was found to boost motivation and engagement in the project (Senabre et. al., 2018).

Citizen Science and design has been explored from different angles in earlier research; but so far a design research perspective has not been investigated. In the following, we explore how citizen science could interinteract with design research.

CITIZEN SCIENCE PRACTICES

As a first step of our exploratory journey we collected some 60 cases of existing citizen science projects from around the world were collected. There is a great variety in terms of the sciences involved, purposes, organisations, etc. We used Dimensional Analysis to gain a broader perspective on citizen science

Dimensional Analysis is a method, which helps to generate grounded theory. This analytical process leads to distinguish components of the situation or phenomena, and analyse their attributes from different perspectives (Kools et. al., 1996).

Dimensional Analysis asks one to order all the data points (here: the case studies) along one dimension at a time, until a clearer picture emerges of an overall structure (or theory). We simply used a very long table to discuss where to locate each case, depending on the end-points of each dimension. The first dimension concerned the type of science. We recognised 14 different sciences, from biology to history. This made us ponder, if there is an opportunity for design research too?

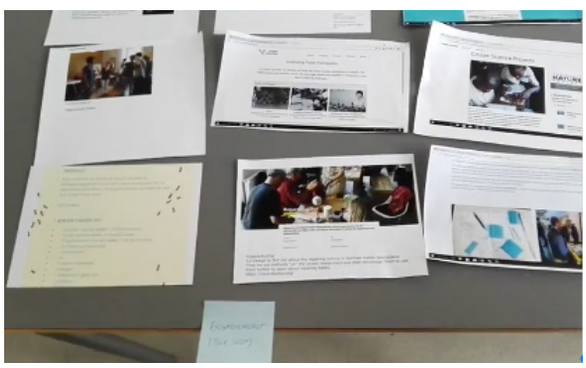

Figure 1: Dimensional Analysis – project examples.

As the second dimension we discussed the roles that citizens take. In some projects, a citizen work as mere data collectors or analysts, in others they act as coresearcher or even researcher, when they develop their own research questions. Similar roles can be found in design research as well, which provided another opportunity to develop an understanding of citizen science and design research.

Figure 2: Dimensional Analysis - role of the citizen.

A dimension that turned quite important was the purpose of citizen science projects (Figure 3). Some of the projects were aimed on building the environmental consciousness, being part of a community, helping researchers or collecting data. One of them was a project from the Natural History Museum (NHM) in Copenhagen, where people were asked to feed ants and send different species to the museum. Data collected by the citizens were precisely analysed by the scientist and PhD student.

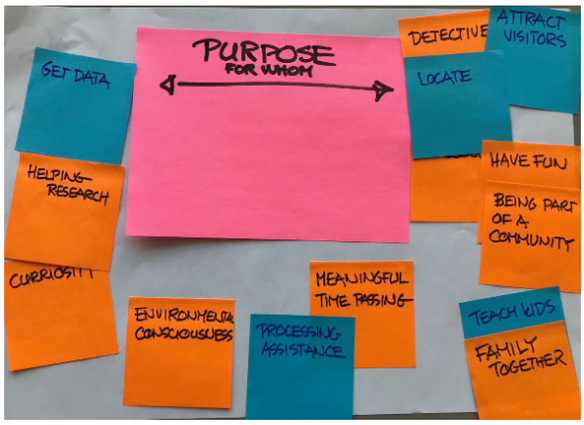

Figure 3: Dimensional Analysis - purpose.

Also, the place where the project is settled plays a crucial role for the design research team. Different places from outside/nature, home, schools, museums and labs were identified. Following this dimension, the team found the other two dimensions that were linked to the place: equipment needed by the citizen scientist and equipment needed by the project. Some of the projects did not require any equipment from citizens but engagement, as some of them expected people to buy some special devices. In the other perspective, equipment was provided by the project, where categories started from 'nothing' and ended up on 'a lab'. For the team this analysis gave a wide spectrum of possibilities in terms of technology involved in the process and the place, and where the research can be made.

We also found that the projects have different scales, from local to worldwide. In our future research, we can involve people and designers from our partner universities and organizations.

The dimensional analysis showed that in citizen science projects, peoples motivation/purpose is tied closely to how expansive roles they take in the scientific process: Are they merely data collectors, do they help create theory, or do they even have an influence on the research question? We also found that there might be an opportunity to employ Citizen Science in design research.

HOW TO MAKE CITIZEN SCIENCE A SUCCESS?

To learn more about the practical side, we conducted two interviews. The first in the Natural History Museum, as they have a long tradition in running citizen science projects. The second with the Experimentarium, a science centre that engages citizens very well.

To challenge the scientist to reflect on how "useful" the projects or exhibits are for the citizens, for the scientists and for the institution (museum/science centre) we developed a tangible conversation tool (Buur 2018). The interviewee would use rubber bands to span a triangle between visitors, museum and scientist for each Citizen Science case and comment on postits (Figure 4).

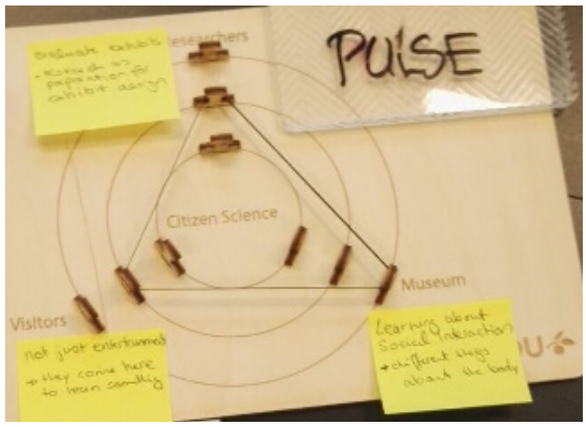

Figure 4: Tangible tool – negotiating the 'usefulness' of the 'PULSE' exhibition in the Science Centre.

ENGAGING CITIZENS IN PHYSICAL ACTIVITY

Experimentarium is a leading science centre in Denmark. While the programme leader and the exhibition developer we talked to are interested in Citizen Science, the centre is not doing citizen science yet – "we communicate science, but we do not do science". However, they are experts at engaging citizens in their exhibitions and at communicating science. For instance, in the 'PULSE'-exhibition visitors team up to do in physical activities, like riding rodeo, in order to collect points. The exhibition was developed in collaboration with the Danish Diabetes Research Centre to promote physical activity among citizens. The message is that activity is not just sports, but can also be many fun things. Our interviewees explained how exhibition design and ongoing scientific research runs at different paces, and that there are different expectations of engaging exhibition vs. scientific publications. 'PULSE' is a social event, rather than part of a scientific process. But it is easy to imagine that the exhibition could collect data for science, not just for fun.

ENGAGING CITIZENS IN RESEARCH ON ANTS

The Danish Natural History Museum (NHM), on the other hand, is actively engaged in a variety of Citizen Science projects. The communications expert we talked to said that NHM is looking to shift from emphasizing public understanding of science to public engagement in science. They heavily involve schools and other institutions in their projects. In the very successful 'ANT'-project, NHM sends out small kits for finding out what foods ants prefer. Participants are encouraged to deep freeze samples of the ants and sending it to NHM for speciation. This project attracts families, as parents do nature experiments together with their kids in their spare time (e.g. during summer holidays). For the scientists, it is a project about locating species and their habits in Denmark. When discussing the Ant project with our tangible tool, we found that this was a most successful citizen science project in terms of the citizens/visitors. It was rated rather useful for the museum as well, because it collected data (which is what a museum usually does). However, they have not yet built an exhibition on this project.

Figure 5: Natural History Museum – using the tangible tool in the interview situation.

A key to the success of this citizen science project was that citizens could relate personally to a scientist. Tn this case her name was Julie. She was presented on all advertisement and the citizens sent their ants directly to her. She would also answer mails and provide feedback on what kind of ants they had found. In a survey, NHM found that people seemed much more motivated by the personal face of science than by a competition to win a price. This is in some conflict with Eveleigh et al (2013) who claim gamification can be used to boost citizen science projects, However, their design considerations also suggest making milestones personal or personalizing the feedback, which aligns with what NHM does in their project.

WAYS OF PARTICIPATING

Eveleigh et al. (2014) explain how a citizen science project has "few committed and productive supervolunteers, a much larger number of 'dabblers' (who contribute only occasionally), and even more 'dropouts' (who tried the work, gave up, but remain interested)" (Eveleigh et al. 2014). While dabbling is described as participating in a small scale on their own agenda, while motivated by curiosity, Eveleigh et al. (2014) suggest that one should support this dabbling behaviour, because it increases the impact of research by making people aware of scientific research problems and bringing forward scientific working methods and values. Based on this they bring forward design considerations for engaging dabblers.

Segal (2015) discuss intervention strategies to make a citizen science project successful by re-engaging the citizens in the project. It consists of four different steps, from a survey to reveal motivations, identifying groups, designing the intervention strategy to analysing the effects of this strategy over time. They emphasize the importance of iterating these.

OPPORTUNITIES FOR "CITIZEN DESIGN RESEARCH"

The basis for exploring citizen design research is a brainstorming session, where design methods (from a design kit) were to be combined with the different roles of the citizens (from our dimensional analysis). After each participant brainstormed on their combination, the papers were exchanged and another member brainstormed on that combination. The team ended up with 10 combinations, which means that each role has been involved at least once.

A discussion emerged around what topics design research deals with and how citizens can be a part of that.

One topic centered around citizen science and things and relates to the idea of wardrobe studies, where participants open up their wardrobe for researchers to learn about peoples' values and their patterns of consumption. These kinds of study have their background in textile design, but are also used in different contexts, e.g. as trunk studies or refrigerator studies. It is interesting to discuss what role citizens have in this kind of science. They are data collector already by definition, but what about involving citizens in analysing these studies about personal objects. Can we actually learn even more about people's values and patterns of consumption if we confront them with other people's realities? Or can we "use" them to make the analysis of bigger amounts of data easier? Can this kind of further involvement in the process stimulate higher engagement in a project over a longer time?

Another discussion centred around the topic of practices. Especially in HCI practices are studied to design for them or future practices. In these studies, researchers are interested in what people are doing, how they interact with things. It is interesting to consider, whether our perspective as researchers is different to the citizens' perspective on a practice?

We further discussed how we can imagine futures through involving citizens in researching their own questions. Is it possible to create Citizen Design Research Kits, that will guide citizen to use Design Research to work on their own research questions? Inspired by using a scenario in a design process, we discussed how scenarios can be used as a tool for citizens to imagine futures. It becomes important then to consider what value these scenarios can have.

THE PROJECT

As the next step in this exploration, we set up a small project, where we study interaction design studios together with other citizens/designers. This project engages students world-wide to contribute with data. They are asked to upload a picture of their design studios, write a story behind it, leave some comments and relevant literature to help us analyse them and then 'build theory' at a workshop at SIDeR 2018.

CONCLUSION

In this paper, we present our exploratory journey from analysing different citizen science examples to

interviews with the scientists that initiate some of these projects. In literature it is discussed that there is different strategies to keep citizens involved (Segal et al. 2015) or to support "dabbling" (Eveleigh et al. 2014). Further citizens are involved in various ways in Citizen Science projects, from data collectors to coresearchers. This offers us the possibility to discuss how design research can interplay with this.

First steps towards Citizen Design Research could be involving citizens in several parts of a design research project, from framing a research question over collecting data to analysing it and building new theory. We aim at conducting a small-scale project, which will do the above with design students to learn about the practices in interaction design studios.

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PLAY //

TANIA CHUMAIRA |
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KILL THE MOSQUITO: GAME FOR COLLABORATIVE TECHNOLOGY IN THE DARK

EXPLORING THE ROLE OF LIGHT AS A TANGIBLE MATERIAL

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ABSTRACT
This paper suggests that the development of technology today in the digital era has enabled light to function as the future tangible interface. In order to justify the hypotheses, we have conducted a research through design. Through literature discussion and prototyping regarding light's ability to be choreographed and manipulated, we would argue that light could be an alternative to bridging the gap between physical and digital realms.

INTRODUCTION
Light is a design material which is on the threshold of tangible and intangible material. Light can be manipulated but not necessarily graspable. Looking at its unique materiality, we have come with potentials in exploring light further as a bridge to connect the gap between virtual space and physical space. This exploration will be oriented through two research questions such as can light take part in connecting physical and digital realms? If so, what is the role of light in the digital era?

LITERATURE AND THEORY
In architectural discourse, light is a significant material as the giver all of the presences (Lobell & Kahn, 2008). Light enables us to acknowledge the dynamic experience from our built environment, whether the ambience is dark, light, or just something in between. While experiencing architecture, light allows us to see some textures yet some casted shadows that bring a different kind of spatial experience.

The development of technology has continuously transformed the way we present or control the light (Lucero et al., 2016). In the primitive age, human beings tried to present the light through applying a friction method. Then today we can turn on the light directly through smartphones or even sensors.
As the light today can be integrated with

microprocessors and pervasive digital devices[1], the purpose of light has also been expanded. Such devices enable light to be choreographed in many different ways. Designers today can apply many of spatial principles to the light. The light can be transformed into different shapes, colours, intensity, scales, and many more.

Lucero argued through his Interference project that light on a larger scale could provoke social interaction in fun ways (Lucero et. al., 2016). The light then is not only fulfilling its original purpose anymore as the source of illumination, but also reaching out extended purpose such as providing embodied experience.

The digital era apparently does not only affect the way we perceive and control the light. As our built environment today has been digitised (Hansen, n.d. all the aspects in which where, why and how we make sense of a place have gradually been reshaped. Besides providing ease to control and arrange the light, such devices could provide a place that is called as cyberspace that extends or even migrates our activities in the physical world. Those devices have transformed our lives in two aspects (Ullmer & Ishii, 2001). The first one is the way we respond actions from our built environment. The second one is the way we make sense of our built environment (Ullmer & Ishii, 2001).

Many of us do not articulate what we want to say in direct communication anymore. In fact, we say things through the cyberspace such as social media. Then, while going to a tourism object, ones will not admire the object through their eyes and share the excitement with their travel partners anymore (Coyne, 2014). Beside, they tend to perceive the beauty of the object through their cameras, capture it, be busy with it, and then plan to share the pictures later through the cyberspace.

Although a cyberspace is not something that is materially constructed (Coyne, 2010), it can be argued that we are now gradually migrating to cyberspace through observing how much it has taken part in our lives. Unfortunately, the presence of such devices and cyberspace isolate many of us from the real life in the physical space. The more we spend time in the cyberspace, the bigger bubble we have that separates us from the physical world. The common devices and cyberspace is still a separated realm from the physical realm. On the contrary human beings have their needs to connect and be connected to the environment directly (Fuchs & Jaegher, 2009). Reflecting on changes caused by digital era, can light take part in connecting physical and digital realms? If so, what is the role of light in the digital era?

[1] A terminology borrowed from The Tuning Place by Richard Coyne. He mentioned that digital pervasive devices represent cell phones, smartphones, portable audiovisual devices, and the convergences

RELATED WORKS

The first work is Between You and I, by Anthony McCall. It was also called as solid light sculpture or film (Mccall et al., 2015) as the projected light could move and change. Apparently, the movement could make difference in both two-dimensional and three-dimensional plane. The user could see the shape on the ground change and affect the movement of the projected conical light.

Figure 1: Between You and I by Anthony McCall

McCall mentioned that he called the work as a film since it provided a wiping movement as if people were watching a cinematic opening (Mccall et. al., 2015). The work was static and dynamic at the same time, provoking one's body to move as the wipe continued. Some people moved their hands as if the conical project light was a curtain. How people interfaced with the light suggested the proposition of light as a tangible material.

Then, to discuss the issue related to physical and virtual realms, which is how to create an enhanced spatial experience without separating both of them, we would like to present the second related work by Keiichi Matsuda. Matsuda tried to answer the discussion through creating a modified optic and light based project, Augmented Reality (AR) entitled Domesticity.

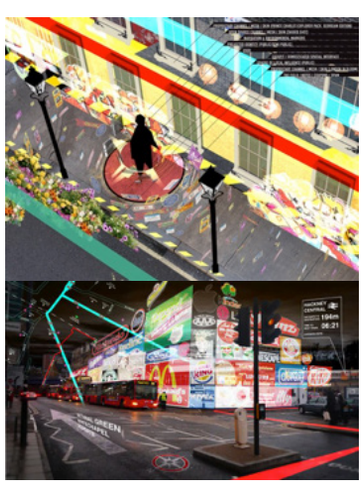

Figure 2: Domesticity by Keiichi Matsuda

In Domesticity project, he provided AR experience of London by augmenting the city with personalised

information. As one walked through the street, one could see some personal notifications, warnings, reminders, or other personal related information.

This project also wanted to illustrate that the dichotomy of space such as private/public has become obsolete through the presence of cyberspace, cloud system, and other pervasive digital devices (Matsuda, 2018). As people shared any kind of information through the cyberspace, nothing is private anymore. Almost all the kind of information is now accessible in the cyberspace. Therefore, he proposed a new way to look at spatial dichotomy: the broadcast and the aggregator, who owns the origin information and who receives the information.

In terms on spatial sense-making, the AR experience also could show several transformations of how we inhabit space in the digital era. The project presented the idea that seeing was not an activity with naked eyes anymore. But we now see our built environment through devices. Furthermore, people do not ask other people questions, but would ask their questions to the device.

Through observing the work which was optic and light based, it can be seen that light has potential as an tangible material that is in between physical and virtual. Therefore, in the preliminary prototyping I would like to observe the sense-making process in a light constructed as well as digitised environment.

DATA AND METHODS

The undertaken research approach is research through design. The process itself is carried out through several phases such as literature study, prototyping, and design observation. The preliminary prototyping has been done by October 2015. However, further development of the prototype will be carried out in the future.

Also, the design evaluation will be analysed through two points of views such as phenomenology and dynamic agentive system. The phenomenology helped us to explore the user's experience in an individual scale. Meanwhile, the dynamic agentive system helped us to observe the sense-making process in a communal (group) experience without disregarding the actual social interaction (Fuchs & Jaegher, 2009).

Preliminary Prototype : The Orbital Threshold[2]

The experimentation was conducted through designing and prototyping a site-specific installation called The Orbital Threshold . We chose the light as the material in which the users interact with since it has characteristic that is between virtual and physical realms. Light itself does not have tangibility, but it could be choreographed in particular way as if it is a tangible material.

The basic concept of the spatial installation is to sense the presence of an inhabitant and project a lase light from above. The laser projection depended on the coordinate of the inhabitant was and how far they were from the centre of the installation. Those different coordinates would create different line lengths and line angles.

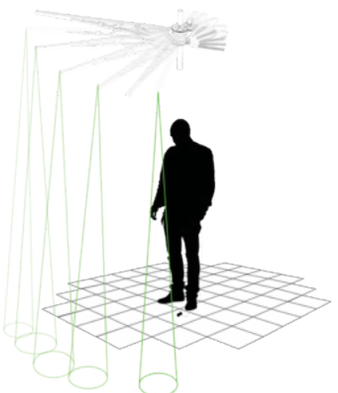

Figure 3: The Basic Mechanism of The Orbital Threshold

In general, the experimentation set up consisted of sensing, motor, and lighting mechanisms. The sensing mechanism worked through configuration of pressured pads. The motor mechanism was supported by a stepper motor which triggered the metal arm movement from above. The laser light was controlled by a device named galvanometer motor, which was attached to the arm.

EVALUATION OF DATA

The observation was conducted by involving five participants who were outside The Bartlett School of Architecture. The observation was recorded by mirrorless and GoPro camera to provide different angles and types of shot. The observation was conducted to understand the lighting experience as an individual or a group of people through orienting to two points of views such as a dynamic agentive system and phenomenology. The individual observation was conducted by being oriented to phenomenology point of view while the communal (group) experience was discussed through the dynamic agentive system point of view.

RESULTS

Individual Experience. This typical experience illustrates in Figure 4 where their hand movement is following the laser light projection as the light cut through space and created a subtle green wall upon the users. The line can be shorter or longer depending on one's position in accordance to the centre of the machine. Then, the moving arm could follow the coordinate and be inclined according to one's angle. The individual experience occurred before the communal (group) experience. It is much alike with our nature to acknowledge the space first with our own modalities, then starting to observe our environment,

[2] The Orbital Threshold, a project created by Tania Chumaira, Wei Zhao, and Renxiang Li. The full version of the video can be accessed on https://vimeo.com/141690418

and finally tried to participate in the social interaction with other agencies (Williams et al., n.d.). The users initially explored their relation to the space by moving their arms and walking in order to understand how the spatial installation works : what kind of input does the installation respond to and how it reacts to such input.

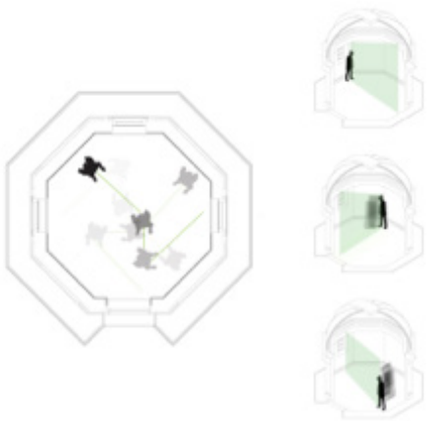

Figure 4: The Possible Scenario of Individual Experience

Communal (group) Experience. After learning about the scenario of the spatial installation on an individual level. They started to observe what others people were doing. If one found different approach in exploring the installation, the other would try to copy the approach and practice it by themselves just like the nature of mutual incorporation (social interaction) where all the actions even on the individual level are affected and being affected by other agencies (Fuchs & Jaegher, 2009). Furthermore, after understanding the behaviour of the installation they started to call and talk to each other then aim for creating geometry shapes through configuring their lines. They coordinated their movement so that they could create cross or triangle shape as drawn on Figures 5.

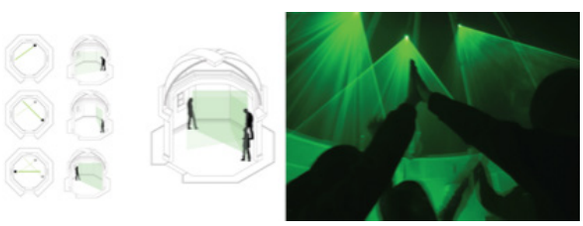

Figure 5: Communal Group Experience

In order to deepen the phenomenological point of view, I conducted short interview with the participants. All of the five participants had not been briefed about the scenario of the installation. They figured out the behaviour through experiencing the installation. All of the participants mentioned that the installation made them think that in the future we may not need light switches at all. They predicted that all switches could be replaced by sensors and integrated system. One participant even mentioned, "If lighting is very easy to control and manipulate, we might not need partitions to divide space, simply good lighting arrangement would do." The results from the interview are summarised through the table below.

Participants	Visual Experience	Haptic Experience	Audio Experience
P-1	The light seems standout and cutting through the space as if it is a real surface	Feeling the urge to play my both hands as if I can touch the light	The machine gives some audio experience that tells me different kind of movement
P-2	Seems like the light covering me. I feel like being inside a curtain	The feeling like being inside of something makes my hands want to touch the light	To me the machine sounds like moving. That's all
P-3	The light keeps on following me. It looks like it's not an inanimate object	As it feels like an animate object, I feel like I can play with the light : push, touch or even tickle	An additional audio experience can be fun
P-4	The light can change its length when I move differently. It feels like communicating	The installation takes place in a dark environment so the light is very visible. This way I feel encouraged to do some pushing or kicking even though the surface is intangible	There is some sound from the machine but I don't know if it affects my experience
P-5	The light can easily move and be manipulated. Perhaps in the future we won't need some partitions anymore	The light feels like forming its own space	There are some different type of sounds for different laser movements I guess

Table 1: Phenomenology Description of Participants Sensory Experience

Those opinions represent how light could act as if it is a tangible material. It could augment the spatial experience without disregarding the importance of physicality. As light is easy to manipulate and multiply, designers also could play with some architectural aspects such as scale and repetition which make the spatial experience of light become larger.

Furthermore, the prototype's testing showed the ability of light to create boundaries in the middle of public space. Light was able to transform a public space into a more private space. Therefore, due to its characteristics, light has potential to be utilised as tangible interface that enable the enhancement of social interaction's experience in our physical space.

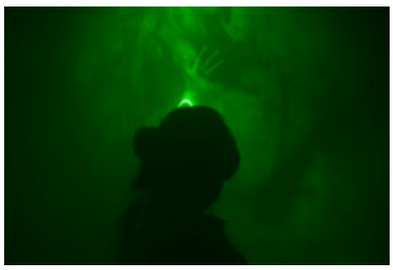

Figure 6: Spatial Exploration in an Individual Scale

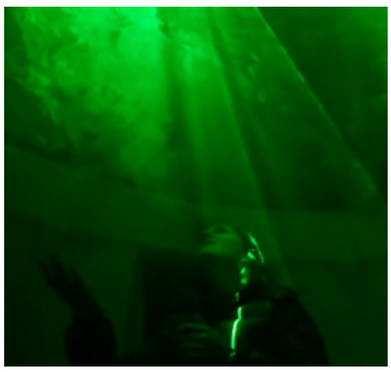

Figure 7: Spatial Exploration in an Individual Scale

DISCUSSION

Through the prototype, we were able to study light as a tangible material. This enables us to look at the light's potential as the future tangible interface which provide embodied and spatial experience. Rather than providing a virtual experience which disconnect us from the physical realm, light could extend or augment something from our physical world and enrich our spatial experience as well as social interaction.

The former prototype could allow us to observe the spatial sense-making process through an optical and light-based installation. The utilised sensing system was still simple. Therefore, employing the real everyday pervasive devices such as our smartphones' usage as an input system of the spatial installation will be interesting to gain deeper understanding about spatial sense-making in the digital era.

It would be interesting to see how the sense-making process has been shifted. From the age of perceiving directly through the eyes to the age while the perception occurred through another medium (e.g smartphones).

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SUBMERGE. LEARNING ABOUT COLLABORATION THROUGH PLAY

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ABSTRACT
SubMerge is a playful experience, which includes elements of collaboration, a narrative, and makebelieve play. SubMerge is a spatial experience designed for young kids, aged 5 -7 years old. The aim is to make children collaborate by pressing two random lit up buttons at the same time. The prototype of SubMerge is designed to explore the ways young children collaborate and help each other. It was tested in three iterations, once with adult players and twice with two 5-year-old nursery school groups. The results have shown a variety of ways which players use to collaborate – some used a vocal "1, 2, 3 now" technique, while others had more tendency to observe each other's actions and act upon these observations. The testing phase of SubMerge has also paved the way for a discussion on how the presence of spectators and/or pedagogues affect children's play and behavior in general.

INTRODUCTION
According to Benford et al. (2000), young children might have difficulties collaborating. The article claims, that enforcing collaboration, in other words, making children synchronize their actions, might have positive gains, although it is not optional for developing collaborative skills. SubMerge is designed to be a tool to challenge this statement and used to explore the ways young children collaborate and help each other.

The facilitators instruct the players on how to play, as well as tell them the surrounding story. In this case, the facilitators are captains of a submarine which has just been attacked by a sea monster. The vessel is severely damaged, and it requires fixing. The captains instruct the mechanics, who are the players, to rush into the engine room and take care of the motor. The motor indicates the damage by lighting up the random pair of lights which need to be 'neutralized' by being pushed down simultaneously by the players. After doing so, another two random buttons light up, and the play continues.

LITERATURE AND THEORY
The design of SubMerge implicitly invites the players to work together, even without being given instructions on how to play. The two lit up buttons provide no feedback unless being pressed down in sync, therefore the lack of response indicates to the player, that

something else is missing. Early explorations with the design have shown, that people tend to ask for help or offer it to others when it comes to playing with SubMerge. Each of the players can see only a part of the box which is identified in relationship to a known whole (Heape, 2013); therefore the design calls for collaboration with the other participant, and together, the two players acquire shared knowledge. The phenomenological perception of a cube, in this case, is divided between the two players who need to collaborate to reach the common goal.

Figure 1: The prototype of SubMerge used for user testing.

SubMerge has a surrounding narrative (Figure 2), which is used to make the players engage more in the play. According to Riedl and Bulitko, "we communicate through stories, but also use stories to entertain and educate." The nautical theme suggests that the two players are captains of a ship, striving to save the submarine by repairing the engine. According to Roth et al. (2009), the added narrative can help increase the level of suspense and curiosity about the game, which was mainly oriented towards the older kids of the target audience.

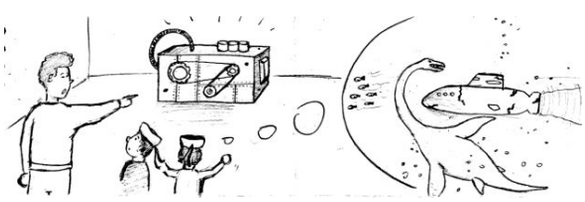

Figure 2: A sketch of the nautical narrative.

DATA AND METHODS

Different iterations during the ideation phase provided valuable information for the designers about the playful experience; hence it became the base for the creation of SubMerge. The key features were derived from these – the collaboration should happen via tangible means (buttons) and the playful experience should require the use of the whole body and synchronization between the participants. In the early prototyping phase, the team of designers created quick and dirty mock-ups of the possible design of SubMerge, which served the team of designers as "things-to-think-with" (Brandt, 2007) where an immersive bodily experience evoked and facilitated their communication. The mock-up testing in an interactive room was 'inverted' into the shape of a large box, which could accommodate the wiring and the battery. The affordance of such box would allow the prototype to be portable, yet provide the right settings for the players to collaborate, as one person could not reach all ports at once.

The prototype of SubMerge was tested on 19 five-year olds from Maria Mikkelsen's nursery school (Figure 3), as well as 13 children at Nicolai for Kids, both in Kolding. Lastly, the prototype was also tested on four adults between the two iterations of the target group. Children met the experience enthusiastically and were fully immersed in the experience. Since the narrative was not fully developed by the time of testing, the children were merely instructed to press the buttons simultaneously with their co-player to activate the next set of buttons. The initial setup of the testing did not isolate the players from the spectators. The nineteen nursery school pupils played and watched the others play in the same room.

Figure 3: A sketch of the nautical narrative.

The designers mainly observed as the primary source for data. This is primarily due to the fact, that the children had to follow the schedule of the pedagogues. The observations were both video recorded and photographed, which was the main source of data acquired from the test sessions.

EVALUATION OF DATA

The testing has provided designers with a significant amount of food for thought. The setup of testing in large groups of children gave exciting results when it comes to observing the influence of the spectators for the play. Although, it eliminated the opportunity to look more into how children would interact with the prototype and each other without the presence of their peers or pedagogues. In separate cases, the latter suggested or gave children instructions on how to play – they did so by telling the children whose turn it is to play and shushing the spectators, as well as imposing the rules of interaction according to their understanding. Such quick and quantitative interactions deprived the team of designers of more substantial qualitative data and valuable verbal feedback from the players.

DISCUSSION

The first test has shown, that the kids did not necessarily need a story or a concept behind the prototype to have fun and allow themselves to be taken up by the activity. The second iteration showed the designers that the 5-year-olds are as able to collaborate as the adult

players – they chose techniques of collaboration and pace of the play according to their preference. One of the most commonly used techniques was "1, 2, 3, now", which was apparent both among the adults and the children. The other way of communicating was non- verbal – the players observed each other's body movements and, according to the cues, assuming the timing of pressing down the button (Figure 4). However, the spectators were present both times when testing on the 5-year-olds, and they played a role in collaboration by helping the players to navigate around the box and, in this way, were involved in the play.

During the first two tests, the designers noticed, that the adult players were more engaged and captivated by the experience when given a set time lapse. The children were presumably considerably contributing to the intensity of the game, as the spectators were speeding up their pace by giving them directions to the activated buttons. On the other hand, the adult players admitted, that both the predetermined duration of the play through, as well as the added surrounding narrative to the play helped them to feel more invested in the experience.

Both the adults and the children were using similar techniques for navigating around the box, to find the lit up buttons. The visual cues were critical, although the children were more likely to use the affordances of the large wooden box to support their body, to keep the balance, and improve their speed while moving around (Figure 5). The tests with different positioning of the prototype revealed that the large box resulted in a more full-bodied experience while laying on the ground, rather than standing on workbenches. Testing with children at the age of five showed a great variety of emotions that appear when playing. Along the process, the children got more accommodated to the concept and understood the principles of SubMerge better, which resulted in a higher engagement. They were especially active when able to contribute by pointing at lit up buttons on the side visible to them, and participated in the play by directing others.

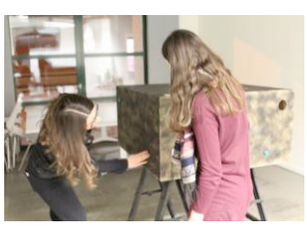

Figure 4: Non-verbal communication.

Figure 5: Full-bodied experience.

The initial design of SubMerge intended to give a delay whenever participants pressed the buttons out of sync. The delay gave no other feedback than the lights turned off for three seconds. The delay disrupted the flow and caused confusion among the players; therefore it was eliminated in further testing sessions. The altered setup gave the players more probability of creating flow (Sweetser & Wyeth, 2005) and enjoy the experience uninterrupted.

FUTURE WORK

The current prototype of SubMerge has one type of inbuilt input – buttons. It provides instant feedback on the two buttons, pushed down simultaneously. However, it is not able to respond to any other kind of interactions. Although the user testing has shown, that the experience provided by SubMerge is not necessarily dull with one type of input, it could, however, be enhanced and tested with more components. Early tests have shown, that sound input could give a personal touch to the experience, reduce repetitiveness, and thus make every iteration different.

If possibly improved, SubMerge would be able to provide audio feedback to the players, as requested multiple times, both positive and negative. This type of feedback could contribute to the narrative by incorporating sounds similar to the ones known in submarines and create an even more playful exper ence.

ACKNOWLEDGMENTS

The group consisted of three members, so the authors would like to thank Joseph Yang for the contributions of his work throughout the project. Among other things, he provided the illustrations for the surrounding narrative (see Figure 2.) and participated in the creation of SubMerge.

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KILL THE MOSQUITO: GAME FOR COLLABORATIVE TECHNOLOGY IN THE DARK

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ABSTRACT
In a world increasingly driven by wearable technologies, actual physical human interactions have decreased. On top of that, long-distance interaction between people has become a conventional normality. Kill the Mosquito is a game explicitly focused on creating a collaborative playful experience focused to enhance the interaction between co present bodies by taking advantage people's accustomedness to be guided by technology. This game was developed to explore how can a wearable controller enhance a full body experience of social connectedness thanks to socially- and bodily- unconventional movements. The following paper focuses on describing the technical parts of the full body wearable interface (Cassinelli et. al., 2012).

INTRODUCTION

Motivated by a design brief that required to explore interactive lightning to provoke interpersonal collaboration between people, the focus of the project was fuelled by evoking sensorial emotions linked to social unconventionality.

As a matter of fact, Kill the Mosquito is a game that thanks to technology and a dark environment creates an emotion of distress for the players, and thus leads them to behave in a socially unconventional way while promoting collaboration in a humours and captivating way, just like resembling a collective imagination of a mosquito and the general distress behaviour linked to it.

The choice of name Kill the Mosquito guides the player's behaviour to follow the actual behaviour specifications that the game affordances were designed for; creating a game played by intuitive rules so to let the players naturally break social conventions and not force them to do so by imposing strict rules.

TECHNICAL DESCRIPTION

The physical product of Kill the Mosquito consists of "patches", pressure-sensitive conductive material covered by flexible fabric material so to cover the LEDs and wires inside (See Figure 1). This ensures to turn them into a soft technology that contributes to

Figure 1: User wearing one of the patches in a recommended position

Figure 2: One patch of the soft technology prototype

the tactile feeling of embodying the game, therefore reducing the perceived distance between the body and the awareness of the technological artefact (See Figure 2).

Specifically, the prototyped hardwear consists of:

- Arduino 101
- Pressure-sensitive conductive sheet (Velostat)
- 6 RGB LEDs
- 6 10k Ohm resistors
- Circuit boards
- Wires (Solid & Stranded)

The main Arduino-based system connects with wires to all the patches with LEDs. When a patch is hit, the Arduino program detects the pressure and how much force was applied to the patch and randomly transmits the data to the next LED. One of the influences during the development process was the Ubiquitous Drums Project (Smus& Gross, 2010). The following circuit diagram explains the systematic wire connections (See Figure 3)

Currently the technology runs in a serial connection and the two players are connected through wires. To have control of the amount of wires we are using, we made sure that they are all running together as one long wire. In the future, the game would be optimized to become wireless using BLE to have two Arduino's communicating.

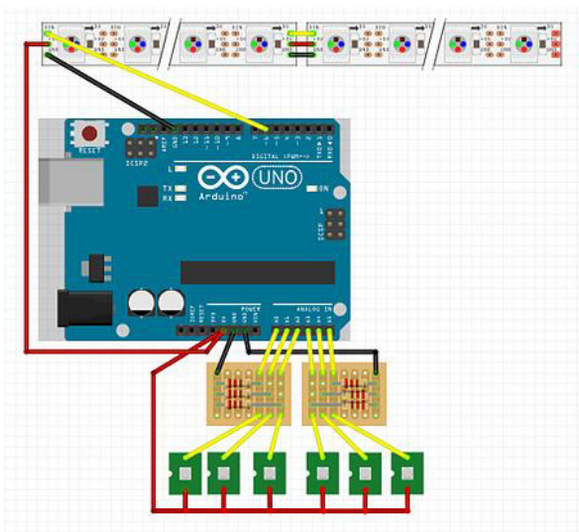

Figure 3: Circuit diagram

Currently the technology runs in a serial connection and the two players are connected through wires. To have control of the amount of wires we are using, we made sure that they are all running together as one long wire. In the future, the game would be optimized to become wireless using BLE to have two Arduino's communicating.

When creating the game, we explored different kind of materials (See Figure 4) so to test different types of flexibility of the movements and free play that the game should support (Wilde, Cassinelli, and Zerroug, 2012). As a result, we created patches that are made of cardboard and dense, yet soft material to cover the pressure-sensitive conductive material and wires. Cardboard is used for the base, to avoid bending the conductive material and sending false signals. A dense material was used to protect the LED and the conductive material. This protective fabric shell is sewed onto adjustable elastic straps with clips.

Figure 4: Exploration of materials

RESULTS

Engaging Kill The Mosquito in ice-breaking activities requires people to break comfort-zones of socially acceptable distances and body touch. It requires people to join in a collaborative game which they can find embarrassing (Sharp & Rogers, 2007). Following several prototyping tests challenging social norms, ranging from post-its to laser beams, we considered

various interesting body-positions of the patches. Thanks to numerous responses from user testing and re-iteration processes, the final product consists of patches to be placed on the forehead, on the backside of the arm and on the lowest part of the leg (See Figure 1). These positions make sure that people do unusual movements while creating an atmosphere of fun and humour for the players as they move closer in relation to each other (See Figure 5) as well as a lively and entertaining spectacle to the viewers.

Figure 5: Users playing Kill the Mosquito

This simple technological game interaction of sending lights between bodies created a complex shared attention among players while evoking thrilling and captivating experiences for the players.

According to the measurements of the emotional arousal, positive valence level and social connectedness level (Isbister, Schwekendiek, and Frye, 2011), we could assess that the players were mutually captivating each other in dynamic moves, and unconsciously creating a fast-paced and competitive atmosphere.

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DESIGNING FOR FUTURE: SPECULATIVE DESIGN RESEARCH FOR A DATA OBSESSED SOCIETY

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ABSTRACT
This paper explores the role speculative design can play as a research tool while designing for the future. Through a sample project about the future of a data obsessed society, the paper highlights ways of creating and presenting the design work to help with imagining future possibilities. The project uses a mix of prototype, scenarios and story telling to highlight some possible negative outcomes even from a good intentioned evolution of Human Data Interaction.

INTRODUCTION
Thinking about the future has occupied many a great minds over centuries. From science fiction writers mostly trying to create wonder, presenting in a sense, a utopian dream or a dystopian disaster to business futurists with their largely "pedestrian predictions" (Bell et. al., 2013), the domain of futures research has also become a "scientific discipline" (Bell et. al., 2013). Over a century ago, H.G. Wells', *The Time Machine* (Wells, 1895) popularised our yet unattained quest for time travel, but also inspiring a lot of scientific writing in futures, science, science fiction, culture and other related domains (Haden 2017). Popular science fiction in the past inspired technological advances like hover boards and self lacing shoes as seen in the film *Back to the Future II* (Zemeckis, 1989), they have only yet appeared as self balancing boards (Hoverboard Technologies) and limited edition expensive 'adaptive lacing' shoes (Nike Hyper Adapt 1.0). While attaining a predicted future was largely a quest for technology, over the past decade or so design and futures thinking have also "grown into a more intimate and collaborative relationship" (Candy & Dunagun, 2016).

This is also highlighted by the emergence of various terms that are associated with a 'futures thinking' mindset like, "design fiction" (Sterling, 2005), "critical design" (Dunne & Raby, 2001), "speculative design" (Dunne & Raby, 2013), "experiential futures"

(Candy, 2010) among others.

This paper describes a speculative design project, titled *8 bytes of body* that explores a possible future of our data obsessed society. We question how society itself might adapt to the kind of future we propose. We imagine a future where your face has no value and only your behaviour and data authenticates you (Anjomshoa & Erol-Kantraci, 2017). A society where exchanging lives was as easy as exchanging data.

DATA OBSESSED SOCIETY

The increasing pervasiveness of technology and our use of personal computing devices has enabled and thus led to a sharp increase in tracking and logging of information about individuals (Smith, 2016). A lot of this information is about geolocation and our behaviours of interaction through digital devices and with digital services. This information about individuals and their behaviour is the "data" referred to in this paper and hence society as becoming "data-driven" (Pentland, 2013). Large quantities of such data are called "big data". Gartner defines big data as "…high-volume, high-velocity and high-variety information assets that demand cost effective, innovative forms of information processing that enable enhanced insight, decision making, and process automation" (Gartner).

While there is still no consensus about the size at which data becomes big data, we are more concerned with its "capacity to search, aggregate, and cross-reference large data sets" (boyd & Crawford, 2012). So, while on the one hand big data promises solutions to difficult sociological problems through insight and greater knowledge, on the other it is a troubling manifestation of a 'Big Brother' sort of surveillance mechanism (boyd & Crawford, 2012).

A lot of data collected on individuals is done without explicit knowledge of the person the data concerns (Smith, 2016), but an equally large amount of data is also willingly collected by individuals about themselves to quantify their own quality of life. We are increasingly measuring everything about ourselves and sharing for consumption by the world. This is highlighted by The Quantified Self movement (Nafus & Sherman, 2014) where even though the participants ask questions about by whom, why, and what the data is used for, they are still obsessively recording various aspects of their lives, quantifying and analysing it. While this movement may be some sort of resistance to the automatic collection of data and its use by corporations for advertising, it still is a great belief in the power of quantification and hence contributing to a future data-obsessed society.

EXPERIENTIAL FUTURES: AN EXERCISE IN SPECULATIVE DESIGN

Candy (2010: p. 3) in his thesis, *The Futures of Everyday Life*, proposes the concept of "experiential futures", which he defines as — "a *term* denoting a practice that deliberately attempts to explore the places where language alone cannot". He describes it as a form and at the intersection of "foresight practice, design work and political action", wherein one creates a version of the future in any medium or form, be it images, artefact or performance.

In *Speculative Everything*, Dunne and Raby (2013) situate speculative design in the unreal, about experimenting with possibilities about how things could be. They talk about understanding critical design as "embodying ideals and values intentionally at odds" (p. 17) with those of the time.

The project *8 bytes of body* is situated in the realm of experiential futures and is an exercise of thinking speculatively about the future as an extrapolation of our present. It is "critical thought translated into materiality" (Dunne & Raby, 2013: p. 35). The project imagines a future questioning the responsibility of design itself, the evolution of the technology industry and its limitations while implicitly embodying elements of general social theory, politics and ideology, which are discussed later.

EMBODIMENT OF DATA

Understanding flows of data is essential in understanding it's embodiment and on the contrary, its disembodiment. Data is created by and then acted upon persons, hence embodied at these points. But between these two points is when data gets disembodied. Both data and human bodies are dynamic in nature, flowing, transforming as they go through their lifecycle. The data that is acted upon a person then also has a role to play in changing the person (Smith, 2016).

One can say that in a data driven environment the role of the body is to act as a host for data, to be a point of collection and then as a point of action. The actual identity of the body eventually is meaningless as long as it acts in accordance with the data. Smith (2016) refers to two notions to help explain the "body - data dialectics" — "disembodied exhaust" and "embodied exhaustion". Where the first one is related to the process of datafication, that is collection and storage of data and the later to the process of that data acting upon the person and its ramifications thereafter. He goes on to talk about the creation of "data-proxy", which in a sense is the disembodied virtual avatar of the embodied self.

8 bytes of body imagines a future of such data - body dialectics, where the body has lost meaning to the machine and only serves the purpose of being a host. This future is set in a capitalistic world where the data collected on you has gone on to control and direct your life. It imagines scenarios where people can exchange their data-proxies, and in a sense wear a 'data mask' and live another life.

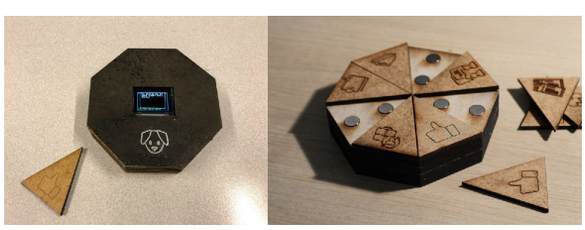
8 BYTES OF BODY

In the project *8 bytes of body* we imagine a future world where 'data masks' are a reality, but as a form of "resistance" (Galloway, 2004) against the system. Wherein persons take on another identity just by mimicking behaviour patterns in some one else's data.

The project is based in the "scenario" and "evolutionary futures research" paradigms outlined by Mannermaa (1991). Using a prototype of a device that encompasses the essence of the world and various scenarios depicting narratives, an idea of the world and its society is created. The project is based in a future world where every type of data can be collected, thereby removing any need for human input and where artificial intelligence algorithms are quick, efficient and personalisable. The main characteristic of this world is that people have autonomy over their own data. This is achieved through:

The Central Console [Fig. 1a] - that works like an assistant and also a mode of implicit control. It is a docking station for data modules.

Data Modules [Fig. 1b] - these actually store one's data. The prototype has 8 data modules each for various aspects of one's life. These are meant to be physical embodiments of one's data.



(Left to right) Figure 1a: The central console
Figure 1b: Data modules on and off the console

These data modules store the persons behaviour patterns for specific spaces and/or activities like a data module for Home would store data about your behaviour with devices that are a part of your smart home, the data module for Communication will store your contacts and communication services you are signed up with, the Work data module will store work related information and control your access, appointments and responsibilities. Other modules could be Health, Lifestyle and Entertainment etc. These are just indicative for depicting segregation of data and hence allowing for greater control. The central console enables communication between the data modules and other external services.

The materiality of the prototype and the knowledge of your data in your hands makes you realise its value. This helped in further imagining scenarios by playing around with these physical data modules and understanding how the device becomes central to one's life. One of the extreme scenarios of exchanging work lives between two persons is depicted in the film that forms a part of the project (Rohilla, Maes, Ostendorf & Asveld, 2018).

Mortier et. al.'s (2014) concept of Human Data Interaction to put the human at the center of the flows of data and for providing mechanisms for persons to interact with these systems and data explicitly, helped with understanding about the kind of autonomy that is desired from a future data system. The three themes mentioned below are incorporated while imaging this future society.

1. Legibility - to make the data and mechanisms used to interpret the data more accessible and transparent to the people the data concerns.

2. Agency - allowing people to choose to opt-in or opt-out, to inform and correct any inferences made from the data about them.

3. Negotiability - concerning with the more dynamic nature surrounding data and data processing, about how society forms its attitude and norms around data and its use.

This is a version of society born out of the current capitalistic needs of user data. People exchange their data in return for services, much like now but with choice and knowledge. They receive a monthly statement of their data and services. They choose when to get tracked and share their data by physically connecting or disconnecting their data modules. However the catch is that without sharing one's data, one can barely live a normal functioning life in such a society where data is the currency so to say. So while there is an illusion of choice, there is coercion built into the system (Galloway, 2004).

DISCUSSION

The project succeeds in raising questions about the control structures that emerge in such a society and how they came to be. While designing we extrapolated our current ways of living and presented one of the possible directions for the future, which is driven by data. The various data modules are based on the apps in most of our phones that track and analyse aspects of our lives for us. The idea of work as a leisure activity is hinted upon, but left open ended for the audience to decide how that makes them feel. While the general trend for technology is to be invisible, the project questions the idea of ubiquitous technology through conscious engagement with a large physical prototype.

8 bytes of body, in some ways, is itself an embodiment of Deleuze's Post Script on Societies of Control (Deleuze, 1992). If the types of machines are matched with types of societies and machines themselves are an evolution of capitalism, a completely data driven society is a dream in the conquest for power and therefore control. In this society the power rests in the ones who control these devices, the service providers.

In his book Protocol, Galloway (2004) talks about the deceptiveness of the Internet and the control structures that inhabit its very architecture. He cautions and calls to "be wary of the obvious". *8 bytes of body* starts at the obvious of giving people autonomy over their data and then goes on to build a narrative of control within this.

The society described is neither utopian nor dystopian, for the people living within that, it is their reality. But as designers, while designing for the future we should be mindful of the quality of life we are designing for, not just the convenience of it. There is hence a need to be critical in the design of such systems that collect and offer services based on the collected data (Khovanskaya et. al., 2013). Big Data can offer the kind of insights that are needed for new kinds of thinking and problem solving that plague the world of today. But before that can happen there is a need to allow individuals to have more control over their own information in this data driven society (Pentland, 2013).

CONCLUSION

The paper talks about speculative design's role in futures research and specifically it's importance in a data driven society. It discussed some of the implications of big data on the human body. It describes a project that imagines a future society and presented it using a prototype device, scenarios and narrative through a film. The paper wishes to highlight the importance for designers to go beyond their desire to just make human life convenient and to examine the deeper repercussions of design choices.

It is important to understand the unintended implications of architecture, in this case code and speculative design based on prototypes and narratives is a great tool for doing that.

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THE CAT-CHER: DESIGNING SMART OBJECT FOR TEMPORARY COMMUNITY WITHIN A SPATIAL CONTEXT

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ABSTRACT
Isola Felina is a temporary community based in largo di Torre Argentina, Rome. It is the sanctuary of Roman stray cats, a shelter where volunteers take care of the them and find a family willing to adopt them. The senior visitors spend their time here during the day to contemplate, while the young visitors find this place less attractive to visit. Although colony of cats is one of the attractions of the site, the cats are always inside the boundary of Largo di Torre Argentina which is separated by fences and makes it difficult for visitors to make interaction with them. By combining rapid ethnography and behavioural archaeology as the research methods, this project aims to generate a flux of looping back interactions in order to enable the space, visitors and cats as a whole integrated community. A new morphology of smart toy is created to engage both kids and adults, encouraging mutual interactivity between them and transforming the society to be more vivacious.

INTRODUCTION

This paper presents a product design project for a specific temporary community; from design thinking to design solution, in order to improve their performance to reach the community's goal. The project was done by an interdisciplinary team coming from different countries and cultural backgrounds which results to a lot of ideas and negotiations.

Generally, our work aims to unfold an alternative design solution to enable the temporary community by injecting new experience. In conjunction with that purpose, the specific aim of the research is to introduce alternative spatial solution in the form of small product.

The above aims will be accomplished by fulfilling the following research objectives:

- To define the relationship, figure out the missing link, and recreate the new hub between cat, space, and visitor as a whole community
- To create a new morphology of object to generate the new interaction within a spatial context.

The structure of this paper is organized as follows. Section 1 describes the site context and community based on the research methodology. Section 2 unfolds

the issue, problems, opportunities found based on data. Section 3 demonstrates the new scenario and design concept. Section 4 illustrates the user-object interactions, object morphology, and applied technology. Section 5 draws our conclusions.

BETWEEN ISOLA FELINA AND LARGO DI TORRE ARGENTINA

Located in archaeological area of Largo di Torre Argentina is the Torre Argentina Cat Sanctuary, known as Isola Felina, a no-kill shelter for cats because in Italy there is a no-kill law for stray cats (of which Rome has many). It is a shelter for cats run by volunteers, whose main purpose is to reduce the stray cats. The shelter will house stray cats, giving priority to those most in need of care and sick, trying to restore their health, and looking for a distant adoption or a new family who are willing to adopt them.

We conducted on-site data collection while doing secondary research on literature simultaneously. The on-site data collection involved 2 research methodologies: rapid ethnography and behavioural archaeology. We believe that the chosen methodologies will be useful to analyse the activity pattern of a temporary community whose user and interaction space keeps changing dynamically.

RAPID ETHNOGRAPHY ON TEMPORARY USERS

Fundamentally, rapid ethnography seeks to discover a more complete context of activity, an objective perspective with rich descriptions of people, environments and interactions, beyond what informants say or what they think they do (Millen 2000). Thus, in our research, in order to gain more objective data on the visitor and cat sitter, we conducted field activities such as shadowing and interviewing.

Last but not least, we conducted an interactive observation method introduced by Millen called participant observation. Participant observation is considered as one of our most interesting observation technique in optimizing the observation result. We joined in the activity of interest, which in this case is experiencing the role of visitor, to unfold a richer understanding from personal experience. This method is the best way to understand some of the affective issues surrounding various field activities (Millen 2000).

EXPERIMENTAL ARCHAEOLOGY

'What we perceive must be a direct function of how we act' (Ingold 2000). Hence, it is also important to understand the relationship between the space and inhabitants (all components of temporary community). We practiced the second and the fourth class of experimental archaeology as our research strategy which consist of behavioural reproduction and ethnoarchaeology (Busuttil 2012). This strategy will be useful to observe the relationship between human behaviour, material culture and the physical environment in a functioning observable setting (Ingersall 1977). This method results in space occupancy mapping diagram (Figure 1) of both visitors and cats. We consider the cats as part of the temporary community because most visitors consider them more interesting attraction rather than the archaeological itself.

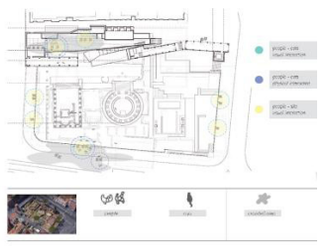

Figure 1: Space Occupancy Diagram

COLLABORATIVE DATA PROCESSING

The results of our research are unstructured mixedmedia. The unstructured data can result to a lot of ideas, and it can be considered as a good starting point of design process. We processed the data by first doing the brainstorming, specifically visual brainstorming. We added visuals in order to boost the process, because images express better what goes beyond words. This process could be wild, fun, and mind-blowing, but that's how we have fun on the game.

According to Brown, it is necessary to combine designer's structural competence to think divergently (creating problem) and convergently (finding solution). Afterwards, in order to understand a complex problem on the research and experimentation in design thinking, a design thinker should be able to find out the pattern (analysis) and to extract the meaning from the pattern (synthesis) (Brown 2009). This process will give senses to the raw data we have collected.

We need to visualize those ideas, and it is what Brown suggests as "to start thinking with our hand" (Brown 2009). It is the stage of prototyping. This stage will be fairly quick and rough (Figure 2). But the benefit of prototyping is that we can see whether the idea may work or not work as planned, which will drive us forward and urge us to make a decision between plausible options. Prototyping is not merely visualizing the physical things, it goes even beyond the intangible part, which in our case would be the scenario; the user journey.

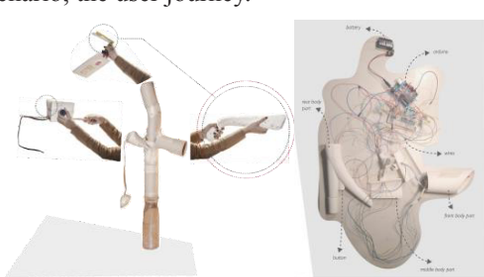

Figure 2: Dirty Prototyping to Final Prototyping

ISSUE, PROBLEM, OPPORTUNITY

Largo di Torre Argentina as one of tourist attractions in Rome is less visited by the young generation. Based on the observation that we did, most visitors are adults whose age are ranging from 40 to 70 years old (Figure 3). It is difficult to reach and make physical interaction with the cats since most of the time they stay inside the 'boundary' of Largo di Torre Argentina which is barricaded by fences. Therefore, the activities that can be done by the visitors are taking photos and seeing around (Figure 4).

Figure 3: Visitor Classification Diagram

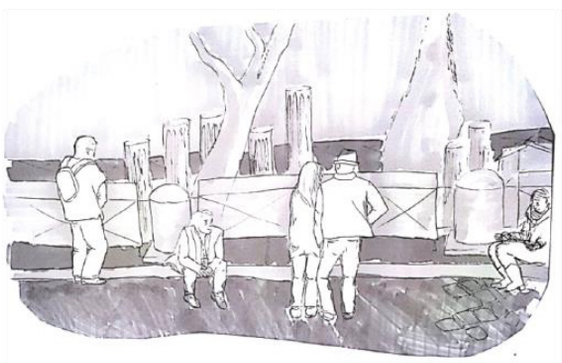

Figure 4: Current Situation Illustration

During the interview and shadowing activities, we found out that people that already practice a distant adoption often make an interaction using a tool like a laser pointer, a ribbon, a rod with a rope. It makes possible to go beyond the boundaries creating a relationship with a specific cat. Those people are more tempted to come frequently to take pictures with their cameras and smartphone following a specific cat which they often found around the same spot. Most of the cats have the tendency to move around their specific area. This makes them spread evenly inside the boundary. We notice that the seniors also enjoy spending time watching kids running around, playing counting cats or petting the cats. We discover that the cat sanctuary has a big opportunity, not only as a therapy for adults who often spend their time here to contemplate, but also as an edutainment attraction for children. Hence, we consider this as a field of opportunity.

NEW SCENARIO: MANIPULATING THE BOUNDARY

After we have been through several explorations of ideas, we see that 2 most critical issues are to deal with the spatial boundary and the need of enhancing the entertainment. Hence, we ended up with the idea of injecting a game experience that focuses on manipulating the environment and develops an entertainment through a mutualism interaction (Figure 5). We try to transform the visitor experience from a passive involvement to an active involvement by creating a smart toy as an alternative solution as well for the spatial issue. The smart toy will engage the kids and the adults, encourage interactivity between them and transforming the whole community to be more playful and vivacious (Figure 6).

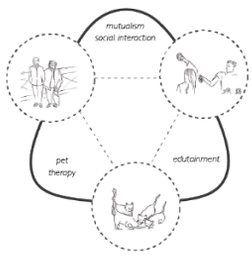

Figure 5: Mutualism Interaction

Figure 6: Illustration of the New Experience

FUNCTIONALITY: THE NEW BOOMERANG

We name the project 'The Cat-cher'. 'Cat-cher' implies a new concept of boomerang (Figure 7). Boomerang known as a weapon-recreational tool has 2 functions: to hunt and to play. The difference lays in the practical way of using the object. Instead of being thrown and returned to the thrower physically, the catcher implies the conceptual flux of looping back interactions, but the object itself stays in place.

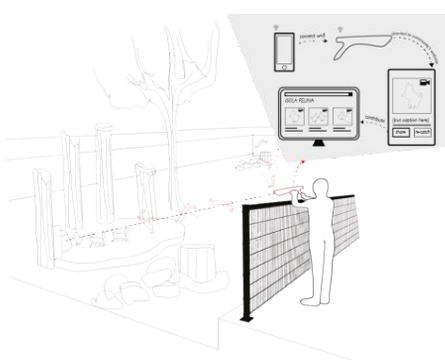

Figure 7: The 'Boomerang' Concept

In parallel, 3 of the main functions of 'Cat-cher' is to play with the cats by attracting them in the distance, to observe things closer, and to give something back to the community. These functions will be achieved by implementing some technology on the smart toy such as the light to attract users, the vibration for the feedback, the telescope for the cat-watching, the laser to attract the cats and the camera to film the cats.

SMART TOY MORPHOLOGY TO USER EXPERIENCE

The form evolution of the object is divided into 3 phases. In the first phase (Figure 8), 3 different functions were combined into one basic form. The form came up from the need to put different functions on different sides in order to allow it to be used together by different users concurrently. In the second phase (Figure 9), one function was merged within the other two. This lead to the simplification of the form. We ended up with 2 branches to work on that resulted in the boomerang look-a-like shape. In the third phase, we went into details of the ergonomic and user experience aspects.

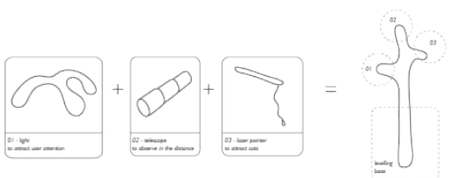

Figure 8: 1st Phase of Shape Evolution

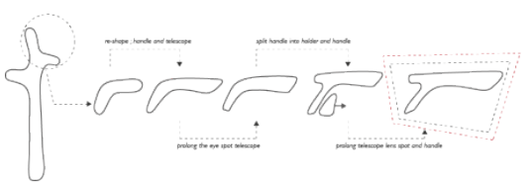

Figure 9: 2nd Phase of Shape Evolution

We start by transforming the object form from a gun look-alike to a less violent look. The development of child's play into games devotes to the learning and acquirement of a non-violent ritual (Erikson 1977). The activation button was changed from a gun-like trigger to a thumb button without losing the user-friendly interface. The white plastic and aluminium together with a biomorphic rounded shape give a contemporary high-tech appearance. Plowman and Luckin assert that the children enjoyed the tactile nature of the toys more than the toy's interactivity (Plowman and Luckin 2004).

On the sides, there are diffusing pulse RGB LEDs to attract user's attention. A touch sensor will activate a small vibrator so when the handle is being touched a short vibration will be activated as the feedback, and all the lights will be turned on. A telescope with a manual focus (3mt to ∞) gives the opportunity to find and follow distant cats, while a laser allows the user to interact and play with them (Figure 10). A little wide camera allows to film cats playing in a short or middle range. Additionally, it is possible to share these short videos (GIF) to the community's social media. All these features are implemented to create the whole game experience (Figure 11).

The last evolution was to create some limitations according to the issues of the site context. The movements of the toy in the two hinges were limited to the archaeological closed area to avoid disturbing people and especially drivers around the site.

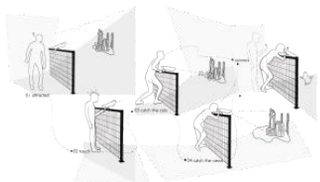

Figure 10: Game Diagram (Attracted–Touch–Catch–Connect)

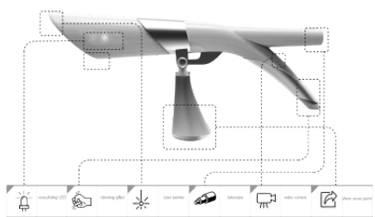

Figure 11: Object Features

CONCLUSION

Although there are some digital and technical aspects that need further development, the final prototype can demonstrate the tangible user interface as corresponding solution to the current spatial issue. For the future work, we expect to know the impact of Catcher to the community, both direct impact to the object user and the indirect impact to the cat community. Smart object can be an interesting alternative solution for spatial issue, as product works in smaller scale, has closer interaction with human, and provides a more affordable solution. Architects and designers have to take into consideration the overlapping discussion of spatial issue and product design in order to be able to create an adequate design for today's society.

ACKNOWLEDGMENTS

We would like to express our sincere gratitude to Professor Lorenzo Imbesi for guiding us during the design process. We also want to thank Fabio Patrizi who rendered his help in programming the smart features of our product and Michele Calvano for helping us on the 3D modelling. Last but not least, we would like to thank our colleague, Lieke Lenaerts, for contributing during the research development.

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EMOTIONAL VARIABLES OF INTERACTIONS INSIDE OF COMMUNITY

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ABSTRACT
Emotion is one of the topics of interest for experts and thinkers from different areas of knowledge. This paper explores different visions of the meaning of emotions and how they depend on the previous experiences of each person. It also incorporates the concept of community as an extension of people because in their interactions with others generate unique moments of expression and reconfiguration of emotions, thoughts and behaviours. The results suggest that the observation of the different interactions of people, such as acts or communication products, contain valuable information to create and implement a system of interactions within a service tuned to the needs and possibilities of relationship within a community.

INTRODUCTION
This paper exposes how emotions are part of the variables that influence the interactions of a community observed from the perspective of service design.

Services account for 70% of the EU economy, therefore Services are a key part in society (Meeting of the OECD Council at Ministerial Level, 2016). Also, according to Miettinen S. (2013) "User participation can change society, and service design can contribute with this change". This paper focuses on how the contribution that service design can make to society is focused on the community. Considering that the design of services is "The Ability to create empathy and make stories" (Miettinen, 2018), identifying and understanding emotions is a key element.

Interactions are a key point of relationship of people with their environment, objects, situations or other people. From a more practical view "Services are a series of interactions between customers and the service system through many different touchpoints during the customer journey" (Stickdorn & Schneider, 2011). Therefore they are a fundamental part to understand the dynamics within a community.

The communities can be constituted by two or more people, from the moment that a relationship or link

exists, a community can be established (Tolosa, 1999). The emphasis in the community is related to the current challenges of society, where the spread of experiences through social media can influence, in a positive or negative way, the perception of services. Emotions are present in all stages of an interaction and a service. Sensitivity to some issues and the possibilities of dissemination is increasingly massive, therefore, worry and take care to create services with interactions focused on the emotionality of people can be considered one of the current priorities for creators and designers.

LITERATURE AND THEORY

Emotions are a field of research of interest for different disciplines. Experts from different areas of knowledge have studied the manifestation of emotions in various situations, have identified variables that intensify or weaken them, have classified emotions from perspectives as diverse as their possibilities of application and of course generate the various crossings of theories to understand them.

For the development of this paper emotions are defined as the different states, mental and physical with specific characteristics that affect in different planes of our lives. (Van Gorp & Adams 2012) Emotions are generated both by the genetic configuration of people and their social interactions, including the ability to modify and adapt to different environments and new experiences. The complexity of the study of emotions is due to their dependence on the situations that people face on a daily basis. The same emotion can be observed and materialized in different ways in each person, even for the same person the emotion will be different depending on the space-time that is living. (Izard, 1977)

From a more concrete perspective, the basic emotions according to Bloch (2008) are six -rabia, love, joy, fear, eroticism, sadness- and the combination of these six in different intensities creates new emotions called complementary emotions. The basic emotions are defined as those that have allowed the survival of the human being throughout history. With this base of understanding of emotions it is possible to observe and identify the different states through which the human being transits in the different interactions and relationships that it establishes.

Emotions involve people and their communities. People interact with others and create a shared world. Every organization, institution, project is a community in which, through the interactions or actions between people, a space is defined for a particular relationship that belongs to the members of the community (Tolosa, 2009).

These interactions between people within a community can be established initially to be incorporated as new dynamics or they could be modified according to the utility and the internal relationship of the community. The interactions have the particularity of establishing the rhythms within an experience, and their design as a system allows them to flow and make sense to the users. These characteristics are what Csikszentmihalyi (1979) defines under the concept of flow experience “Flow denotes the wholistic sensation present when we act with total involvement. It is the kind of feeling after which one nostalgically says: “That was fun”, or “That was enjoyable”.... We experience it as a unified flowing from one moment to the next, in which there is little distinction between self and environment: between stimulus and response; or between past, present, and future”.

One way to understand a person or user inside of community is observe and identify the people´s interactions. Tolosa (2009) developed the tool of the 3C’s (by the initials in Spanish of the words head, heart and body) that allows to observe and distinguish features of people through three main dimensions: representations are the mainly cognitive characteristics; emotions are feelings that defining the person´s personality; and behaviours are the actions that people developed.

Historically, human beings have established spaces of relationship and interaction to achieve common goals. Tolosa (2013) specifies that the word Komein, of Indo-European origin refers to ‘Ko’ as living together developing activities that collectively allow the survival of the human being; ‘Mei’ is the word that describes the exchange of the ancient peoples and tribes. Therefore, Komein is the relationship that is established within a community to exchange experiences and knowledge, defining it in a phrase such as “Being together exchanging”.

RESEARCH DATA AND METHODS

This paper is part of the process of a doctoral research which is focused on identifying the factors that influence the emotionality of users to create services based on the well-being of the community. Therefore, this text is the reflection of a selection within the literature review process which mainly seeks to understand the concept of emotions from the perspectives of different authors.

The process behind this paper is the selection of books and articles by the most recognized authors on emotions that from different perspectives explain their origin and influence in the lives of people. After the reading, the selection of phrases and key words facilitated the understanding of emotions.

The focus of the selection was to seek a clear and obvious approach with the design of services, without delving into the biological and neurological process of emotions. This definition allows the results to be closer to the discipline but at the same time it is a

way to expand the knowledge of the emotions and the potential benefits of their understanding for service design.

THE EMOTIONS IN ACTION

Emotions communicate through actions and behaviors, each one of them is evidence of how the personal world of each individual is configured (Harré and Parrot, 1996). This constant communication from our body to the environment allows people to generate spaces for interaction with others. Emotions are the fundamental element for decision making (Van Gorp & Adams, 2012).

By looking at emotions as a dynamic and flexible construction, not only as the expression or consequence of a stimulus, the system of interactions that surrounds people becomes more complex. Therefore, previous historical and immediate experiences are also relevant to the design and expectations of the interactions. With this background, it is interesting to understand that the present interactions can be influencing the present of the people and building the previous experiences of the future.

Through the observation of people, elements and situations it is possible to obtain information to conclude which are the mental models of people, those models that were fed by previous experiences and that are translated as internal representations (Van Gorp & Adams, 2012).

The way in which emotions materialize in certain situations are the reflection of the experiences stored in our memory by reacting our body and cognition in function of the known, if it does not have the expected response this reconfigures the emotion and adapts it to the new experience.

INTERACTIONS WITHIN A COMMUNITY

The interactions depend on a person who interacts with their environment, they flow according to the emotions, experiences and prior knowledge of each person. Izard (2010) stated that "emotion will have substantial and measurable effects on cognition and action when the stimulus or situation is a personally or socially significant one". In this sense, it is relevant to consider that the interactions incorporate that flow that defines Csikszentmihalyi for the experiences that provoke a state of consciousness that is obtained by the attention focused on only one activity and that maintains the balance between the emotion that provokes a challenge, and the possibility of using personal skills to overcome the challenge.

One of the purposes of the interactions within a community is to communicate, establish a space of understanding and make an exchange. Tolosa (1999) defined that people communicate through products and communication acts and that these also define the identity of the community. These acts and communication products viewed from the perspective of the design of services, is the definition of all interactions involving a service, which will define the experience of the service and which will identify the community that interacts with the service.

The services understood as a community interacting with a system of interactions, establishes a specific scope of action in which the user's understanding is more linked to the actions he deploys with others, people and elements. Observing people, elements and situations can get a sense of the world behind each person, how he/she has configured his/her mental models: emotional responses of internal representations about the internal and external world (Van Gorp & Adams, 2012). This observation organized in Tolosa's acts and products of communication allows us to visualize the invisible plot around how interactions are constituted and how these can become relationships within a community.

CONCLUSION

Emotions are present in every interaction. It is an opportunity to observe the invisible plot that shapes the world of each person. By specifying the interactions within a service, these can be understood as a set of actions that allow the exchange between people that defines and delimits the space of relationship of a community, and therefore of a service.

The understanding of a community from the Komein concept, can identify the interactions as a system built by a set of emotions, experiences and knowledge that are specific to the relationship of a community. The observation of the interactions of a community with an emotional emphasis can provide the creation of services with valuable information to specify the system of interactions. This contributes to the creation of experiences closer to the expectations of people but more importantly tuned to the dynamics of a community.

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EXPERIENCE //

YUVIN HA, TILDA JYRÄSALO & JIYOUNG SON |
DESIGNING FOR EXPERIENCES OF CUSTOMER SERVICE AGENTS

PAUL NYLUND |
ENABLING REWARDING INTERACTION WITH ANTICIPATORY BEHAVIOR IN DESIGNED ENVIRONMENTS

HEMANT GUPTA |
UNDERSTANDING THE USER EXPERIENCE OF WATCHING ONLINE VIDEOS

DESIGNING FOR EXPERIENCES OF CUSTOMER SERVICE AGENTS

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ABSTRACT
In this paper, the process and the result of designing for experiences with an experience design tool, Xgoals, is proposed. Conducted as a collaboration with a leading company in the elevator and escalator industry, the project aimed at providing meaningful experiences for customer service agents as well as diminishing their pain points. Based on key findings from our user research, three experience goals, Self-actualization, Everyday Fulfillment, and Challenging were identified. For those prioritized key findings, we generated 54 initial ideas, developing 3 concepts to achieve experience goals. As the outcome of the project, two services for customer service agents to develop themselves and enjoy the work more were proposed.

INTRODUCTION

PROJECT OVERVIEW

This is a project done in Aalto University School of Arts, Design and Architecture, on Experience Driven Design course lasting for seven weeks in spring 2018. The project was done by three master level students studying Collaborative and Industrial Design. The project client, one of the leading multinational companies in elevator and escalator industry, has announced its strategy to become more customercentric.

This project is part of the global project, already conducted in other 7 countries, aiming at delivering better customer service through thorough understanding of customer service (CS) agents' pain points. All in all, the project aims at answering to the following question:

How might we provide great meaningful experiences for customer service agents as well as diminish their pain points?

EXPERIENCE DRIVEN DESIGN APPROACH

In this project, we used Double Diamond design process (Council, 2005). We approached the project from the perspective of Experience Driven Design placing pleasurable and meaningful moments at the centre of all design efforts (Hassenzahl et al., 2013). As one of our main tool, we used experience goals

(Xgoals) that is a tool for achieving the right experience (Roto et. al., 2017). Xgoals were used in each phase throughout the process, as Roto et al. address they can be utilised in different ways such as for investigation, evaluation and design activities (Roto et. al., 2017). In first two phases, discover and define, Xgoals were used to define the right experience (see Figure 1). Xgoal hypothesis was set, validated with end users and refined. In last two phases of Double Diamond, ideation and implementation, Xgoals were used to design for the right experience by prioritizing ideas with them and evaluating how concepts meet them (See Figure 1).

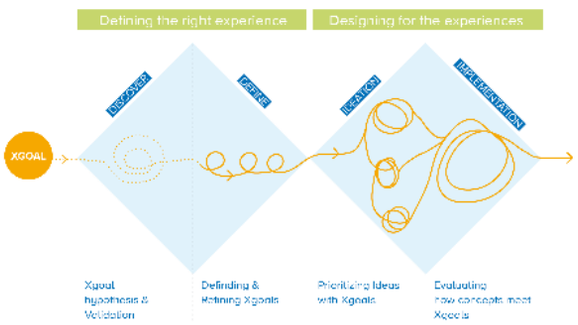

Figure 1: Using Xgoals in Double Diamond design process.

USER RESEARCH & ANALYSIS

METHODS

Based on the knowledge from the desk research, one-on- one interviews and observations were conducted with employees in their workplace. Six people were interviewed, including five CS agents and the head of customer care centre. All of them are women, as there are only female agents working in the office. The agents have a variety of work experience from three months to 8 years, and the head of customer care centre has experience over 20 years.

The interviews were conducted in a structured way around 40 minutes each with questions regarding their role and responsibilities, systems and tools, relationships etc. After each interview, a short five minute activity was facilitated related to Xgoals. Lastly, two agents were observed for an hour in order to gain understanding of the context they work in.

After the interviews, the data was analysed. First, insights and pain points were individually highlighted by three researchers on each interview script. Second, the scripts were cut and re-arranged question by question. Third, the comparison and discussion of the individual highlights was followed by writing gathered insights and pain points on post-its. The analysis was done by affinity diagramming (Lucero, 2015).

RESULTS

While affinity diagramming, eight clusters were created, all emphasising different aspects of customer service agents' work (see Figure 2). The eight clusters include *1) Communication & Collaboration, 2) Selfactualization, 3) Development & Learning, 4) Everyday Fulfilment, 5) Customer Value & Service Quality, 6) Information Accessibility & System, 7) (In) flexibility and 8) Workload Management.* Furthermore, due to the large size of some clusters, some sub-clusters were created. After clustering, 15 key findings were created to cover each cluster and sub-cluster.

Figure 2: Affinity diagram and eight clusters.

EXPERIENCE GOALS

METHODS

Experience goals (Xgoals) is a tool used in Experience Driven Design for transforming knowledge from research into practice and design (Roto et. al., 2017). In our project, Xgoals were utilised in validating the decisions we made and taking us closer to the experiences we aimed at designing for.

We first set Xgoals hypothesis that we evaluated with a Xgoal activity we conducted when interviewing the agents. Each participant was asked to choose three emotions out of 50 that they ultimately want to experience through their work. An exception being the head of customer care centre, who we asked to choose three emotions she would like her employees to experience through their work. Xgoals were written in cards based on Xgoal example list created by Roto. Based on the results we got from the Xgoal activity, we refined our hypothesized Xgoals.

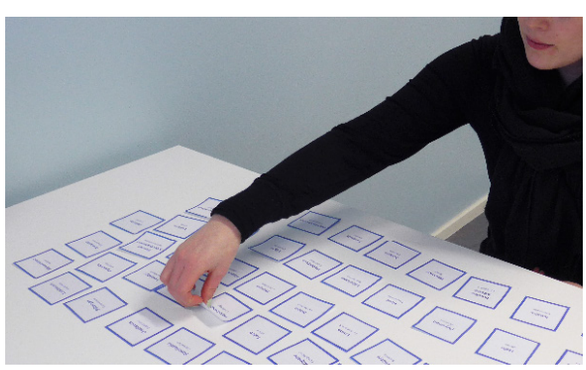

Figure 3: A customer service agent choosing three Xgoals out of 50.

RESULTS

There were some clear tendencies in results we got, the most significant being that 4/5 agents chose *Challenge* as one of their Xgoals. Also Joy was well

represented as it was chosen by 3/5. Two agents chose *Self-actualization* and one *Competence*. The head of customer care centre wanted her employees to experience *Exploration, Sympathy* and *Submission.*

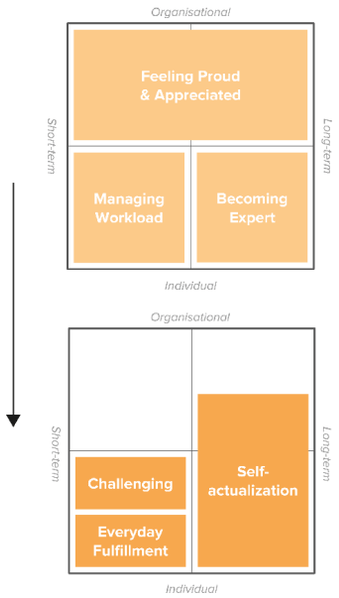

Figure 4: Validated Xgoals (Challenging, Self-actualization, Everyday Fulfilment) were more individual level than hypothesized ones(Becoming Expert, Managing Workload, Feeling Proud & Appreciated).

We saw similarities in the validated Xgoal *Self-actualization* and our hypothesized Xgoal *Becoming Expert* (a merge of *Self-actualization, Competence, Confidence* and *Completion*). For the other Xgoals, hypothesized and validated ones did not meet. None of the participants mentioned about *Workload Management* and only one mentioned Respect (related to hypothesis of *Feeling Proud & Appreciated*) (see Figure 4).

We mapped Xgoals based on whether they are short-term/ long-term and individual/organizational, based on a matrix created by Roto and Lu (Roto, 2016). Also the mapping changed pretty drastically from hypotheses to validation as it seemed that the experiences the agents are seeking for are more individual than organizational.

If the Xgoal activity was conducted in a larger scale, it would be interesting to see if there were any patterns related to how long an agent has worked in the organization.

CONCEPTS & PROTOTYPING

IDEATION & CONCEPT DEVELOPMENT

There was a need to narrow down our scope before moving to ideation. We did this by prioritizing our eight clusters based on three criteria (i.e., Xgoals match, novelty, Finland-specific). Clusters that entail the most potential were *Self-actualization, Everyday Fulfillment, Development & Learning* and *Workload Management.* After narrowing down, we had 4 clusters instead of 8 and 4 key findings instead of original 15. Having those 4 clusters and 4 findings in mind, we generated 54 ideas and ranked them by value-effort matrix and their match with Xgoals.

Finding 1- Self-actualization
Currently the work doesn't provide enough stimulation and opportunities to influence for customer service agents who like challenging themselves.

Finding2 - Development & Learning
Agents want to develop themselves and become experts in the organization.

Finding 3 – Development & Learning
Agents want to provide the best customer service and that can be reached through internal learning and global best practices.

Finding 4 – Workload Management
Agents enjoy variability of the work but ultimately want to keep the work-life balance.

CONCEPTS

We created three concepts. First, Concept A aims at achieving our Xgoal *Self-actualization*, through developing and specializing oneself as a CS agent. Second, Concept B is a tool for having some time away from the front line, enhancing the Xgoal *Everyday Fulfilment*. Third, Concept C meets Xgoal *Challenging* by adding some gamification elements for the monotonous tasks.

PROTOTYPING

Before prototyping, we created user scenarios and service flows to communicate the context of use within the team and for client and to ideate about the key functions. We prototyped the three concepts first with paper prototypes and then with digital prototypes. Paper prototypes allowed us to think about the UI while simultaneously working with detailed functions. Digital prototypes shifted our focus to UI, UX and visuals. We aimed at displaying the content in a smooth way.

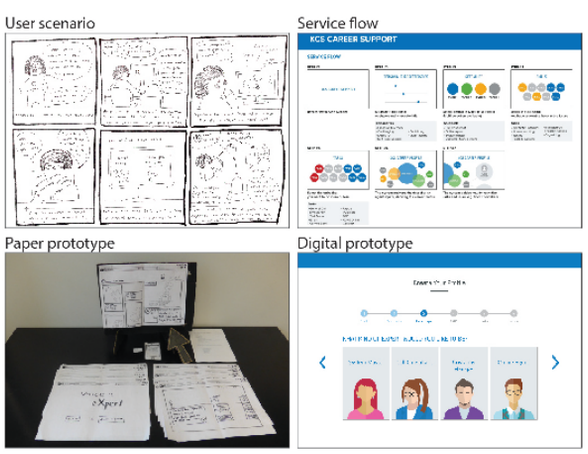

Figure 5: The three concepts developed through user scenarios, service flows, paper prototypes and digital prototypes.

EVALUATION

METHODS

For two concepts among three we made in the previous phase, we conducted the evaluation test with CS agents to validate the value of concepts for the actual users as well as how the concepts meet Xgoals. We excluded one concept after the pilot test since it seemed not as concrete as the other two to be validated. In the evaluation test, we invited two CS agents and the head of customer care centre. The tests were taken place in the controlled setting. Each session was taken between 40 to 50 minutes, and a video was recorded for the purpose of analysis. For each concept, we first introduced the overview of the concept and let them experience the service based on the predetermined scenario by using the interactive prototype. After that, the participants were asked to fill the evaluation sheet and discuss with the facilitator about the details of the concept. We used the modified version of Hassenzhal's AttrakDiff (Hassenzahl 2003), a tool to measure both hedonic quality and pragmatic quality, with 21 items, extracting some less relevant items from the original list while adding a couple of Xgoal related adjectives.

RESULTS

Since the results come from the only three participants, we interpreted the quantitative data together with the comments, rather than relying on the scores that each concept received. In overall, both concepts received positive feedback from the participants, and all items were marked over 4 in a seven-point scale (See Figure 6). In case of Concept A, all participants took the transparency of information as the most valuable factor in the concept while it had the highest score in terms of practicality. The other concept, Concept B, got the highest score in terms of novelty of the concept. Comparing to the Concept A, it was a more inspiring idea for the participants in that they already started coming up with their own way of using and developing the service concept. Meanwhile, as described on the chart, Xgoal related items were well received from the participants as well.

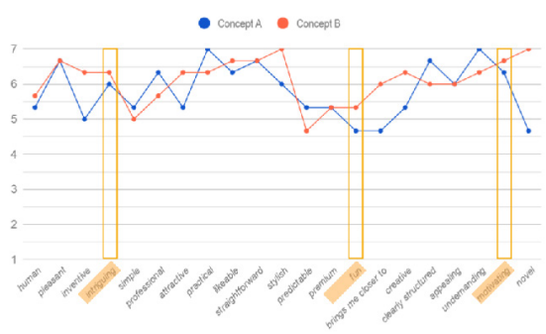

Figure 6: The results of the evaluation sheets.

Especially, the items related to Challenging and Selfactualization were marked over 6 in the seven-point scale, which indicated that both concepts were able to meet Xgoals although it still had the limitation due to a shortage of participants.

FINAL DESIGN PROPOSAL

Based on the results of evaluation, we refined our concepts to make final design proposals, creating a high-fi prototype and the video of the proposed service.

DESIGN PROPOSAL 1 - CONCEPT A

Concept A is a tool to support CS agents to develop and specialize themselves. CS agents are expected to fulfill one of three Xgoals, *Self-actualization*, with this service, making their own career profile and development path visible as well as integrating their skills to the shift list. Also, the system guides how to learn the skills from other colleagues and through outsourced services.

Figure 7: The screen of a career profile in Concept A.

DESIGN PROPOSAL 2 - CONCEPT B

Concept B is a tool to encourage CS agents to have some time away from the frontline. The service allows them to use two hours per two weeks to do something meaningful for their work, team or the company. It would prevent CS agents from feeling of overload as well as add more variability and enjoyment in their work, aiming at meeting another Xgoal, *Everyday Fulfilment.*

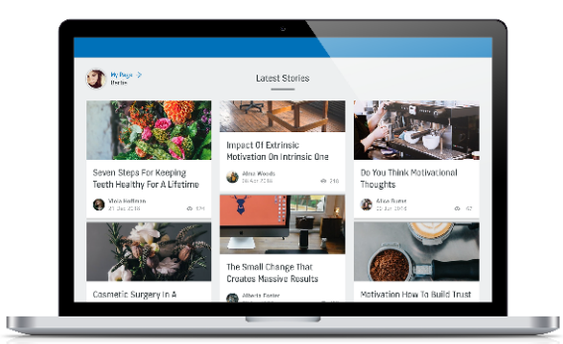

Figure 8: The main screen in Concept B where all posts are listed.

CONCLUSION

In this project, we clarified the current pain points that customer service agents have and opportunities for better customer service based on the understanding of customers' requests and the tools and information the customer agents need. In addition to the outcomes from the research, we also proposed two service concepts as final deliverables, which were well received from the end users, showing the potential to be implemented in

the future. During the entire process, we applied the experience design tool, Xgoals, from the investigation to design and to evaluation activities. Xgoals led us to more focus on the experiences of the end users, rather than just trying to solve problems. Also, Xgoals acted as the criteria of selecting the opportunity areas and ideas as well as in the evaluation. However, since Xgoals were more related to the emotional value, some practical issues should still be considered.

ACKNOWLEDGEMENT
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ENABLING REWARDING INTERACTION WITH ANTICIPATORY BEHAVIOR IN DESIGNED ENVIRONMENTS

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ABSTRACT
The discussion surrounding adaptability of user experiences remains frozen on the time domain, focusing on present contexts rather than preparing for continuous changes in future outcomes. Anticipation in smart products could reframe the discussion to that of constant future-context prediction, in turn leading to the formation of more valuable engagements with users via machine learning. The findings are based on a cross analysis of survey responses as well as several papers spanning anticipatory design, machine learning, calm technology, and more. It is important to consider how anticipatory behavior on the part of computers should interact with human actors, especially regarding empathetic conclusions. The aforementioned topics are charged by the rising ubiquity of technology and its serving as more practical components of our daily lives.

INTRODUCTION
What questions might be generated as a result of flipping the expectation of humans to anticipate functionality from the objects they use to the objects themselves possessing the ability to anticipate human interactions? The benefit of applying anticipatory behavior in designed environments can extend to a reduction of decision fatigue, redistribution of user activities, and less conscious interference on part of technological solutions. While there is a significant amount of published literature on anticipatory behavior as it applies directly to humans, anticipatory behavior as exhibited by the environments which we inhabit has received relatively little attention. Anticipatory environments could enable more meaningful interactions with people in terms of extending the limits of distributed cognition.

While anticipation is a potentially useful tool in daily interactions with the technology around us, consideration of the topic as relevant to increasingly ubiquitous computing remains beyond the limits of the public imagination.

METHOD
The process of gathering information for this project involved an exploration about what anticipation meant in the context of human users and the concept of anticipatory design. Furthermore, machine learning surfaces as a particularly important factor in realizing

anticipatory behavior in designed environments, in that it supports the process of anticipation as an alternative to traditional prediction models. Calm technology emerges as a means to actualize the behavior of integrated machine learning solutions as well as a viable approach to human-centered problems.

RESULTS

Anticipation is more dynamic than prediction in that the behavior responds dynamically to changing inputs, generating more possible outcomes as new data is provided. Traditional computational methods mimic the calculation of specific outcomes in response to certain static data inputs, aligning this process more closely with prediction which is a quantifiable and definitive term (Howard 2007).

CALM TECHNOLOGY

Calm technology can act as a patent extension of self; It is a seamless construction of distributed cognition, given that an object can become "invisible when it is most genuinely appropriated" (Suchman, 1987) Essentially, if an object is integrated well enough into one's contextual perception, the user may distribute their attention to targets of their now extended ability. In this respect, a mug, for example, can recede to one's periphery, allowing the user's full attention to be dedicated towards their perception of the contents of the mug.

Calm technology revolves around users' relationship to technologies exist in their periphery, or lying outside of one's active focus. One such example is a window, in that it offers the passing of light from one room to another, yet its subjects do not constantly engage with it. When discussing the role of anticipatory behavior in designed environments, it is important to consider calm technology, because it allows us to consider such behavior as transitioning between users' periphery and active engagement. It is in this transition that anticipation or prediction becomes manifested as action, rendering itself through a respective medium.

Offenhuber (Offenhuber, 2013) asserts the contextuality of calm technology, as it "inherently" enters the actors' space given special circumstances. As anticipation attempts to act in response to future contexts, the behavioral enactment of anticipation in itself could be considered to be possessing a calmness. The concept of locatedness describes the contribution of peripheral elements to a person's sense of context (Weiser, 1996). This is what allows actors to process their whereabouts through the observational presence of representational queues.

MACHINE LEARNING AND FUZZY LOGIC

Traditional call-and-response models fail to serve the ever-changing, constantly evolving reasoning on the part of human actors in response to their environments. Supervised learning, with respect to machine learning, enables users to continuously train the systems that the interact with. Machine learning algorithms can adapt as they receive new data, while we infer the consequences of their output. This relative degree of flexibility makes machine learning an ideal back-end platform for exhibiting anticipatory behavior in that it gives artificial intelligence its ability to process complex data structures. The ability of programs to constantly adapt to new data inputs had been dubbed by Choi as teleoreactivity (Choi, 2017). The resulting web of predictions is described by the system's range (Howard, 2007). Processing complex data earns an important role in achieving the prediction of values in a fashion that parallels the ebb and flow of anticipation that human beings so often exhibit.

CONTROL AND AGENCY

Pieters (Pieters, 2011) discusses variable perceptions of security with observation and degrees of explanation. The amount of agency possessed by a user in a certain context is integral in ensuring a sense of control, or security. Control, or security, can be addressed by anticipatory systems through "organization-based" (Pieters, 2011) explanations. Pieters also touches on the role of organized explanations in supporting users' trust and/or confidence in a system. (Pieters, 2011) In short, a user's feeling of security amidst an interaction with an intelligent system can be affected by the amount of detail in an explanation for an action. Providing either too little or too much information in an explanation may cause users to lose trust and/or confidence in a system's behavior.

ANALYSIS

Here, I will address the balance of agency in multidirectional interactions, ethical concerns with respect to user trust and confidence, and give a brief overview of a project I have worked on which intends to illustrate the main themes of this paper through the construction of an installation.

A lot of research in anticipatory design discusses anticipatory behavior as it pertains to users themselves. Given the term 'interaction' implies mutual influence of one or more environmental actors, the value of a designed behavior can be measured by its subjective quality of reciprocity, or 'reward'. The subjective quality of such reciprocations is determined by human actors and the qualitative benefits the former possess.

While contextual systems are intended for current situations, anticipatory systems could predict future context states and enact functionality before a state is reached.

User intention should be measured in some respect to generate affect. Affect can be derived from the

actualization of data pertaining to human activity as a means to better understand the reasoning behind certain behavior. A better understanding of user patterns could assist in anticipating user intention more effectively. Additionally, an anticipatory environment should aim to anticipate the consequences of the intention.

DISCUSSION

The process of gathering information for this project involved an exploration about what anticipation meant in the context of human users and the concept of anticipatory design. Furthermore, machine learning surfaces as a particularly important factor in realizing anticipatory behavior in designed environments, in that it supports the process of anticipation as an alternative to traditional prediction models. Calm technology emerges as a means to actualize the behavior of integrated machine learning solutions as well as a viable approach to human-centered problems.

ETHICAL CONCERNS

There are ethical dilemmas concerning agency and control, especially. Information should be communicated in a way that gives users enough leeway to make "unbiased" (Pieters 2011) decisions, thereby preserving the agency a user possesses prior to their entering an environment. This requires a level of justification for decisions made by intelligent systems. In this case, a justification can be given through the explanation of a system's behavior.

An explanation can still be effective even while the amount of informative detail is low; An intelligent system can instill confidence in human actors through explaining why it chooses to make a certain decision. On the contrary, providing more information can instill a greater sense of "transparency" and user trust.

There is the cost of convenience; Can convenience, in fact, be desired to the detriment of one's personal agency? Does improving the convenience of a set of functions, to an extent, limit one's agency to a degree more than is actually desired?

Another important consideration is the testing of users – something I exhibit in my project. Given the nature of machine learning, new data is needed to improve decisions. However, it is understandably difficult to collect new data if a user is not engaged. The solution might be to make certain considerations in the design of products to accommodate for unknown behaviors. We should consider how to separate ourselves from the consistent nudging by today's popular smart products and look for new ways of responsibly collecting and using data.

MUTUALITY: ANTICIPATORY BEHAVIOR IN ACTION

To illustrate the effects of the interactions between anticipatory environments and human actors, an illustrative anticipatory environment was constructed to represent the effects of residual solutions -as pictured in Figure 1. The illustration consists of a "lamp" suspended by three strings in a fashion that mimics a delta robot. The lamp is then repositioned via stepper motors to enter the personal space of a human actor performing a certain activity. The actor can either choose to accept the lamp's company or push it away. Regarding the latter, the lamp then returns to its initial resting position in the actor's periphery. While the lamp may periodically return to the actor a number of times, it eventually learns to avoid doing so while the actor performs the aforementioned activity.

Figure 1: The installation in effect

This type of evolving anticipatory behavior could also be applied to digital user interface elements in any dimension. By augmenting interfaces elements over time in response to users' continuous behavior, software developers and user interface designers could be freed from focusing on trivial tasks such as making minor aesthetic adjustments to buttons, forms, and the like. Evolving elements could improve the click-through rate throughout various interfaces by anticipating the behavior of unique users. This would in turn allow the same developers and designers to focus their efforts on addressing more abstract hurdles such as finding better ways to usher in more humanity and subsequent emotional connection to their services.

DISCUSSION

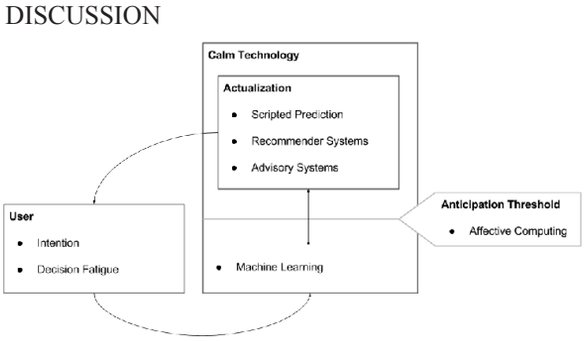

Figure 2: The anticipatory environment

Figure 2 describes the collaborative interaction between an anticipatory environment, designed

with respect to calm technology and the utilization of machine learning processes. A machine learning algorithm responds to training data generated by the user and their environment. When the output of the algorithm matches a predetermined set of requirements, or the anticipation threshold, features previously hidden or delegated to the user's periphery are actualized into the user's scope of attention. This actualization can be manifested in the form of scripted prediction, recommender systems, advisory systems, or direct action. The way a user responds to this stimulus can be recycled to affect the behavior of the anticipatory environment.

As machine learning models become better at predicting outcomes, taking into account "fuzzy" data, our intention alone may be enough to have tasks completed before we are able to actively engage in them.

If a peripheral state is meant to blend in with an environmental context, an active state should purposefully attract a user's attention. This can be achieved through multitudes of techniques, one of which is improving a user's sense of locatedness. One can alleviate the amount of cognitive load experienced through decision fatigue as it may pertain to making sense of unfamiliar environments. Hence, in designing solutions that intend to minimize decision fatigue, it is important to consider how these solutions 'blend' into a user's peripheral sensory scope.

The anticipation threshold describes a point in time when an anticipatory environment decides to actualize features that were previously either limited to a user's periphery or hidden entirely. This threshold is closely related to user affective computing, in that an anticipatory system would have to understand in some capacity when it should actively engage in a user's environment.

It might be useful to consider solutions a integrations, complementing experiences through anticipatory behavior as sensory augmentation. While popular physical and digital products alike are, to an extent, self contained and quantifiable, integrated solutions may be derived from the environment itself. Existing environments can thus be subservient to the changes brought on by such integrations. An integration is subject to change following its implementation in an environment.

They can be contextual, reacting to depth and light. Implementing anticipatory behavior could enable solutions to become part of the environment, blending in and evolving along with it. Ensuring that the user feels either trust or confidence in a system is vastly important in allowing users to determine situation outcomes. (Pieters 2011) Anticipatory systems need to be constantly formulating future contexts based on current user activity, so it is necessary that these human actors are given the agency to make decisions in response to their sense of locatedness until those future contexts take place. This can aid in diverting the center of attention away from a system's actionable components unless summoned, allowing anticipatory systems to become one with a human actor's periphery, allowing the latter to carry out actions typically associated with analogous environments.

LIMITATIONS

There is the danger that anticipatory behavior relies too heavily on advanced prediction models, thereby requesting large amounts of data that could be exploited by corporations. It is vitally important that we design products that engage responsibly, considering user agency in an empathetic manner.

WHAT'S NEXT?

An increasingly ubiquitous amount of personal connected devices build in-depth qualitative data profiles of who we are, constantly improving contextual predictions about what we would like to see in present contexts. Seeing as smartphones in 2017 are packing a large number of advanced sensors, the resulting data is diverse, and the information the latter might lead to could pave the way for anticipation at scale. Smartphones in 2017 are beacons of predictive environments, serving as a limited lens through which users engage with the environment they are existing within. Improving the dynamism of present contextual predictions through the implementation of constant future-context anticipation could lead to a more empathetic mutuality between humans and machines.

RECOMMENDATIONS FOR FUTURE RESEARCH

Evolutionary design could be an interesting avenue through which to build on the findings in this paper (ex. How to scale repeatable design practices). Can one use the themes in this paper as tools to analyze environments surrounding users? Specifically, do designed environments have boundaries, and who makes them? How can we use these terms to reverse the polarization of hardware and software in order to design richer, more holistic experiences?

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UNDERSTANDING THE USER EXPERIENCE OF WATCHING ONLINE VIDEOS

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ABSTRACT
The consumption of online content especially in the video format has increased many folds over a decade, which highlights the merit of online video as a great potential of sharing knowledge across wider audiences. This research study was conducted to understand existing user interactions with online videos, and it is discovered that the user interactions and use-cases of an online video are still very rudimentary by being limited to pause, play, next, closed caption, full screen , speed of player etc., there is a lot of scope of work in interaction flow of how users consume online video content. This paper describes the research process for understanding the underlying user goals in terms of their interactions and experiences with the online videos. It also illustrates how the discovered insights can improve the future interactions and use-cases of online video interfaces and eventually a better user experience of watching online videos.

INTRODUCTION
Since 2005 onwards, with the surge in online video sharing websites like myspace, YouTube, Vimeo and others, the consumption of videos has increased manyfold. As a result, online videos has now become an open access to information, a powerful force for education, building understanding, and documenting the world events. On the basis of this research study, it was discovered that there are new use-cases of interacting with videos as such and especially the online videos, which is open to everyone to share and access knowledge using any of the online platforms.

The research study incorporated most of the primary research methods like interviews, surveys, contextual inquiry, task analysis etc. along with some secondary research method like literature review and trend analysis to support the findings of the primary research.

The objective for this research study is to primarily understand how different user-types interact with online video content and further discover insights which could help in designing better user experiences for the identified future use cases.

LITERATURE AND THEORY
To gain a better understanding of the domain of this research study, one needs to learn from the existing resources. Therefore a model consisting of 4 areas were devised which helped in making informed

decisions while conducting this research:

1. Technology
2. Devices
3. Businesses (Services)
4. UX Research

On the technological front, there have been interesting breakthroughs in the past, in terms of recognition technology developed at Microsoft Research, MAVIS (Anon, 2008; MAVIS) , to enable searching of audio and video files with speech ; Real time language translation by Skype Translator (Anon, 2014; Skype), which was the result of decades of research in speech recognition, automated translation , and general machine learning technologies.

When we talk about hardwares/devices; there has been a drastic change in the modalities of interactions with these types of devices which varies from being static to mobile, large screens to handheld scale factors. As per YouTube "more than half of YouTube views come from mobile devices", which shows as trend shifting from big static screens to mobile handheld devices.

In the grand scheme of things, the internet's accessibility has changed very fast in a very short amount of time, causing a surge in the consumption of online video content (McCarthy, 2017; Zenith's Online Video Forecasts 2017 report) (Statista, 2017) thanks to services such as YouTube, Netflix, Vimeo, TED, Amazon Prime Video, Facebook, Instagram and Whatsapp to name a few; with their easy accessibility on mobile devices. (Wroblewski, 2016)

To formulate the research process for this study, the 3-dimensional framework of "When to Use Which User-Experience Research Methods" by NN/g (Rohrer, 2014) is used. It is helpful to view which research method to use along a 3-dimensional framework with the following axes:

1. Attitudinal vs. Behavioral
2. Qualitative vs. Quantitative
3. Context of Use.

These literatures and theories on technology, hardware devices and services available, as studied in this research study, highlights the trends in how these factors are aiding the use case of consuming variety of video contents from different services available to the users which are easily accessible to them, at the same time enhancing the voice enabled searching of audio and video file formats.

Proceeding ahead with the basic understanding on the possibilities in the area of technology, devices and services available, this research study is primarily going to focus on the experience of users while watching online video content.

DATA AND METHODS

In order to find answers to the first objective i.e. to understand how users interact with online video content, quite a few primary research methods were used to get the first hand idea of user expectations and their goals.

For the primary research study, a short survey was conducted which primarily targeted working professionals and college going students. This target group is chosen because of their frequent interactions with online video content.

Following which, personal interviews were conducted by taking cues from the survey data. A draft version of questionnaire was created and a sample of 4 users were interviewed.

Followed up by the contextual inquiries where mix of task based exercise and open-ended work items were provided to the participants. The participants here being post-grad college students. They were not invited in any specially arranged settings, all the activities were conducted in their natural context of usage. The findings from the survey and interview methods were taken into account to formulate the action plan for the following contextual inquiry.

For the secondary research study, the literature review method was used which involved referencing a lot of reading materials and videos as listed in reference section of this paper.

To gain a better understanding of existing features and solutions available to users by taking learnings from the literature review, a comparative analysis of existing online video hosting and sharing websites (YouTube, DailyMotion, Vimeo and TED) was conducted.

The overall outcome of these research methods was that it helped in coming up with the user task flow of how they go about watching an online video and understanding the opportunity areas to enhance the user experience in their natural flow of task.

EVALUATION OF DATA AND RESULTS

The data resulted from the user survey, which was taken up by 29 participants (office going professionals and college students). The data showed three crucial data points:

1. 87% of the respondents manually seek the progress bar of the video player to reach at relevant content
2. 62.5% of the respondents (office goers) do go through the recorded meeting videos (if available), if they have not attended the meeting in first place
3. 17% of the respondents plays the video at a faster speed (1.2x, 1.5x or 2x) to finish

the video quickly, but do not want to miss out something important

This research study started of by conversing with people around about how they go about watching videos online. Key observations that emerged from these personal interviews are:

1. Annoying to locate content inside the video (which does not have a structure to their content) which user has already seen before.
2. Users like to skip content in between while watching videos e.g. music pieces in a movie.
3. Users find it helpful to scrub over the progress bar to see the thumbnails while revisiting a video to remember contents inside the video.

To understand the context of how people actually interact with online videos and to get a clearer picture of "what people say" versus "what people do" (Rohrer, 2014), few instruction based task activities and few open-ended tasks were given to the participants. This was done while conducting a contextual inquiry to better understand their behaviour while watching online video content. Key observations from this method are as follows:

1. User's (going through the video for the first time) doesn't know what content to expect and when
2. Users wanted quick lookup in comments section while watching, a few of them used CMD+F (mac) or CTRL+F (windows) to search
3. Users played the video at 1.5x or 2x speed to go through the video quickly while looking for something important
4. Hassle of toggling between the video tutorial on the web browser and the software application
5. User's wants to save the URL if they found it useful and might use it for future reference
6. Title doesn't justify the content in the video
7. Users were not sure whether the content of a video would be worth the time to go through the full length, judging by the number of likes or dislikes on the video

The literature review study on the timeline of the online videos pointed out that since 1995-2004 some websites, like newgrounds.com, heavily rely on the container formats to display online video After 2005 till 2010, mass-streaming services like YouTube and Netflix became massively popular for streaming online video content. From 2011 to 2016, live-streaming becomes increasingly popular because of the services like Vine and Keek which are in-turn being integrated into services like Facebook and Instagram.

As per YouTube press statistics (YouTube Press website), 1 billion hours of online video is watched on daily basis by the users; the watch time has increased by 60% over past 2 years; and 40 minutes is the average mobile session by YouTube users.

According to the pewinternet.org study on the audience for online video, overall 19% of video viewers say they have either rated a video or posted comments after watching it online. Unsurprisingly, those who engage with online video by rating and commenting tend to be young; video viewers ages 18-29 are twice as likely as those ages 30-49 to do so (Madden, 2007) .

Another interesting fact came across the secondary research that is 96% of internet users in US aged 18 to 24 years accessed the video platform (Statista, 2018) .

A comparative study was done to analyse how various other online video sites currently functions, and understand the nuances of their interfaces which helped in discovering the features set that is currently available for the users to interact with.

DISCUSSION

In this research study, it is observed that users do have underlying needs whenever they interact with the online videos while watching it.

From the interviews, contextual study and task analysis, it is discovered that the existing user interactions are incapable of addressing the problems identified in these primary research methods. Most of the approaches user have to take to achieve these are makeshift in nature and that too individualistic for each user, there is no standardized interaction patterns to accomplish the tasks.

Based on these observations made in the process, this study identified that there is an intrinsic need for the online video users:

1. to find,
2. to remember, and
3. to revisit the specific content later.

And for these needs to be met, the key insights discovered from this research study for designing better user experiences are:

1. to enable searching specific content inside an online video, which could make use of recognition of audio and video file formats using speech, text or image based searches, auto-transcription and index based searching on transcripts

2. to discover quality content based on experts' recommendation system on websites like YouTube, Facebook etc. as these platforms has a profiling of the users based on their viewing history or their engagements with the content on social media
3. to save , revisit and share the content inside the video, for e.g. taking notes or by bookmarking just the interesting video snippets instead of the complete URL of the video
4. to enable tagging by viewers on top of the tags which are provided by the video content uploader, which could be a better method of rating the quality of a video content in a crowd sourced manner, rather than just depending on the number of likes or dislikes by viewers

At the time of this research study, no digital solutions were found that takes care of the user needs identified in this study. The findings of this research study works as foundation for requirement specifications of the features for power users of online video content.
Few areas in which this research findings could be utilised for are:

1. Designing new user interfaces for the online video players like YouTube, Amazon Prime, Video, Netflix, etc. which allows users to search contents inside an already being watched video.
2. Building note taking or bookmarking applications that could be standalone or embedded with user's account e.g. how Google Drive is with Gmail account etc., which enables users to save and revisit specific content at later time.

Consider a grad student who has to write a movie critic based on the movies shown in her class. She log into her NETFLIX account to re-watch those movies and in the process of that she takes notes of scenes that interested her to mention in her critic. With a new UI, she can take in-line note describing a scene in her own words, put tag to categorise, annotate the context and can bookmark a specific scene clip or image to review it later while writing her critic.

Consider an office goer, a team leader in a MNC, he has come back to office after 2 weeks vacation. He discovers that there were many meetings / discussions had happened which he could not attend, but were video recorded. To save time of going through all the recorded meeting sessions, with a new UI / tool, he is now able to do smart searches on topics inside the video content which he finds relevant for his work items.

Mentioned above are few use-cases which are easily achievable and probably can become a reality in near future and just to back this proposal, here is a fact, this study was completed (independently) by the end of April 2017 and on May 19, 2017 at Google I/O event Video Intelligence API was launched which is a new machine learning API for automatically recognizing objects in videos and making them searchable; the API also allows developers to tag scene changes in a video (Lardinois, F., 2017).

With advances in technology like Video Intelligence API from market leader such as Google, this research study actually shows a lot of potential in designing solutions for better user experiences.

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SELF //

RUNE MØBERG JACOBSEN, PATRICK SKOV JOHANSEN & LUKAS B. L. BYSTED |
DESIGNING A PERSONAL ASSISTANT FOR A MEDICAL SECRETARY

ARMAND THIERRY DJAPPI, ALBIN TCHOPBA YOUOMO, ANDRÉ ROMIAL KENMOGNE & WILLY KONGUEM MBOUGUEN |
MOBILE MONEY BECOMING A MAJOR MEANS OF DISTANT PAYMENT IN DEVELOPING COUNTRIES. CASE STUDIES OF SUB SAHARAN AFRICAN COUNTRIES

BERNICE D'ANJOU |
DIGITAL REFLECTION TOOL TO SUPPORT TRANSFORMATIVE REFLECTION FOR TEACHERS

DENNIS CHRISTENSEN, GINTARĖ ADOMAVIČIŪTĖ & MARTIN PEDERSEN |
DESIGNING TRACKERS FOR UNIQUE INDIVIDUALS WITH FOCUS ON PERSONALIZATION

DESIGNING A PERSONAL ASSISTANT FOR A MEDICAL SECRETARY

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ABSTRACT
Development of AI is opening opportunities to automate parts of human labour. In this case study, we worked with a medical secretary to design a personal assistant, supporting medical secretaries in handling hospital referrals. We conducted design activities with the medical secretary, which gave insights into the medical domain and how medical secretaries may utilize personal assistant. We contribute with an example of how a personal assistant for a medical secretary, that conveys reasoning and results for a suggestion, can be developed. Finally, a discussion is conducted regarding our design solution and the changing role of interaction designers.

INTRODUCTION

The interest in Artificial Intelligence(AI) has since the middle of last century been steadily rising. In computer science, AI is the concept of machines being able to carry out tasks in a way that we would consider "smart". Machine Learning (ML) is a branch AI based on the idea that we give machines access to data and let them train themselves.

As we move from scientific experiments and laboratory studies to real-world applications, we see a trend towards automating cognitive routine tasks in many human jobs. The trend suggests that we should not expect to see the full portfolio of a given job being automated, but rather a subset of activities that could be considered as "heavy-lifting". The automatable activities would typically be within areas such as optimization, planning and recognizing known patterns, while natural language understanding and human social interaction is not expected to be automated. (Schröder et al., 2017)

How should the human worker interact with the machine worker? One suggestion is the introduction of a manifestation of an Intelligent Agents (IA) – an interface layer between the machine backend and the human worker. This manifestation could be in the form of a personal assistant. The assistant may be implemented with different degrees of autonomy – from a system that delivers decision making-support,

where the user has the control, to full autonomy where the personal assistant can commit actions in a system without human oversight.

In a world where decisions are supported or even made by IA, how can a user expect to understand the process that leads up to the decision? Discussing Intelligent Agents, Don Norman wrote, *"People will be more accepting of intelligent agents if their expectations are consistent with reality. This is achieved by presenting an appropriate conceptual model - a system image - that accurately depicts the capabilities and actions"* (Norman, 1994).

This poses a problem for researchers and developers on explaining exactly how the AI systems reach conclusions and thereby base their suggestions and actions (Knight, 2017).

In order to communicate the complexity of the decisions that underlie Intelligent Agents, it is paramount to ensure that information is presented out in a meaningful way for the users. This could also be the designers challenge: to convey the right information at the right time, while still maintaining the feel of control and authority for the user.

BACKGROUND

This study was conducted in collaboration with a company (anonymised) that works towards increasing task automation within the medical sector. Denmark has a tradition of storing medical data and information from patients, and the company intends to process the relevant data and deliver intelligent assistants to medical staff. In this study, we supported work on a conceptual product which had the goal of aiding a medical secretary in a decision-making process.

THE MEDICAL SECRETARY

A medical secretary (MS) performs the clerical duties in a medical office at a hospital. The work consists of communicating with patients, making appointments, planning treatments and various administrative tasks. This study focused on the way referrals are handled within a hospital department. A referral is created by a general practitioner and is sent to the appropriate hospital department. The referral is assessed by doctors, filled out with a provisional diagnosis and recommended treatment. The information is logged by the MS and s/he will allocate a treatment time assigned to a doctor. The process of going from a referral to a scheduled patient appointment is called a visitation process.

Based on historical data of visitation processes, the company had developed an AI system that could perform the assessment part of the doctor, producing a suggestion for how a given referral should be handled. But given the sensitivity and importance of the actions, there was a need for human oversight – in this case, this task was given to the medical secretary role, who traditionally has the expertise assessing visitations. The company's initial design idea was simple: present the user with a list of processed visitations and provide the user with a number that shows the percentage score of confidence compared to historical data.

USER-CENTRED DESIGN ACTIVITY

As interaction design students, we did not accept the idea that a percentage score is enough for a user to critically examine a suggestion from a personal assistant. Is 95% good? Is 87% good enough? While the confidence score may be meaningful to an AI engineer, we doubted it would support an MS in her work. Our hypothesis was that a system designed in alignment with the users' conceptual model would enable the user to more critically understand the suggestions proposed by an ML system.

To explore this, we planned a user-centred design process with an MS. This later allowed us to include ideas in our design that matches the current users' conceptual model for a visitation process. The main objectives of the activity were to:

- Explore how the workflow and visitation process for the MS/Hospital
- Understand what information the MS would require in order to understand the suggestions the ML is proposing.
- Explore complications and concerns of an MS when using an automated system

ACTIVITY DESIGN

The activity was designed as an open interview with design artefacts. The artefacts were used as a facilitating tool for the participating MS to describe experiences, understandings and needs.

The activity was conducted with one female MS, with 25 years of experience. Two students had the role of facilitating the interview as well as engaging in an open conversation. The data was collected through sound recording and was analysed through interpretation of the collected data from the recording and the artefacts.

ACTIVITY ARTEFACTS

We created two different artefacts, each supporting a user activity.

RICH PICTURE

The first artefact was a Rich Picture (Nielsen et al., 2000) that depicted our understanding based on initial research (see Figure 1), and the purpose was to test out our understanding of the current processes and enable a conversation about these. The rich picture is developed by sketching people and objects connected with arrows describing how the current system is used. The precision of the Rich Picture is of less importance, as errors or misunderstandings will be detected and corrected by the participant and lead to a more correct understanding.

INFORMATION PRIORITY PAPERS

The second artefact consisted of 20 different pieces of paper, each containing one type of information regarding the visitation based on information provided by the collaborating company and a basic referral document, as well as some suggestions for visitation considerations (see appendix A). If a type of information was not available on the prepared papers, the MS could write down and produce a new type of information on a blank piece of paper.

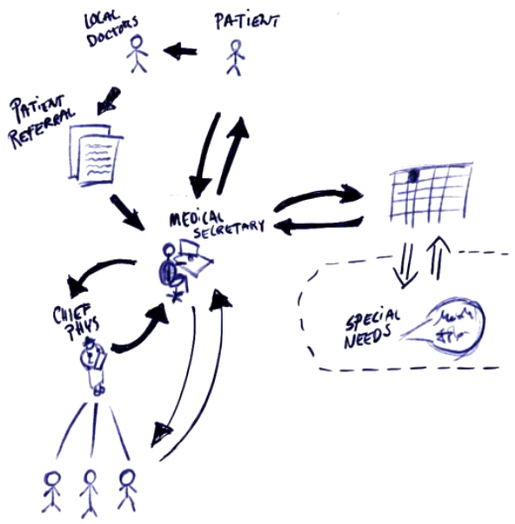

Figure 1: Rich Picture describing the current referral process, starting with the patient and the local doctor, generating a patient referral document. The referral document is sent to a hospital ward, where it is handled by the medical secretary, who communicates with ward staff and the patient to devise a treatment plan and consults with the booking calendar to find a date.

PROCEDURE

1) The MS was introduced to the Rich Picture and encouraged to critique the dynamics, validity and correctness of the information in the artefact. 2 The MS was asked to arrange the papers, in the order of importance for the visitation process, while simultaneously describing her thoughts and actions. If two or more were equally important they would be placed adjacent to each other. At the end, the MS was asked to group the pieces of paper into 3 groups: significant, neutral and insignificant (see Figure 2).

Figure 2: The medical secretary performing the information priority sorting activity.

RESULTS

This section describes insights derived from the user activities – the Rich Picture and the information priority sorting activity.

INSIGHTS FROM RICH PICTURE:

The first part of the activity showed that the rich picture encompassed the process adequately, however it was not sufficient in covering the MS' work. The MS is making several decisions while handling the visitation that was not apparent to us from the start. This includes when the patient:

- Needs a translator
- Is a child (planning with parents)
- Is handicapped
- Needs assistive transport
- Comes from remote islands (ferry)
- Comes from far away (transport time)
- Has secondary diseases e.g. social anxiety
- Must quickly return to the workforce

These decisions are largely human considerations and are integral parts of the work that the MS already does. Therefore, it was important for the participating MS that the assistant would be able to also support these considerations.

INSIGHTS FROM THE ARRANGEMENT ACTIVITY:

In the information prioritisation activity, the MS categorised information into three categories; significant, neutral and insignificant. The MS preferred to identify the patients by their social security number, but was indifferent towards data such as name, age and gender. She also placed high value towards information about diagnosis, acuteness and treatment guarantee.

This activity helped us decide what information is necessary to provide an MS when she handles visitation suggestions, allowing us to attempt a design that reduces complexity in alignment with the MS conceptual model.

DESIGN IMPACT FROM RESULTS

An important insight that we came about was that the MS considers several factors in order to schedule the best time for the patients. Some of these tasks are out of the scope of the assistant, e.g. booking a translator or contacting parents of a child. The ML behind the assistant must make decisions based on the same considerations, and it is equally important for the MS to know when to take appropriate action.

When analysing the data, a pattern emerged concerning the information that was necessary for the MS (see Table 1). This pattern involved three categories of information. To handle a visitation, the MS needs to know a) information of the patient and illness b) an overview of what the assistant suggests and the reasoning behind it and c) the outcome of accepting the suggestion. We found it important to ensure the design

can propagate this information.

Identification	Social Security Number
Information of the patient	Diagnosis Acuteness Treatment Guarantee
Agent suggestion	Treatment Treatment date and time Patient considerations
The outcome of the suggestion	Assigned doctor Assigned room Information letters

Table 1: The pattern of information gathered from the user activity.

A PERSONAL ASSISTANT FOR A MS

This section shows one part of our implementation of an assistant for a medical secretary that attempts to realise the obtained insights from the MS in a meaningful way. The design consists of two main sections, the overview section holding a view of all visitations (see appendix B), and the action section that shows one visitation suggestion at a time.
At the conceptual level, the action section contains a 3-part view of information, where (1) is the referral information, (2) is the suggestion from the assistant, and (3) is actions of outcome for the hospital ward (see figure 3). This gives the MS a way to follow the logic of the decision-making process according to the user's model discovered in the user-centred design activity.

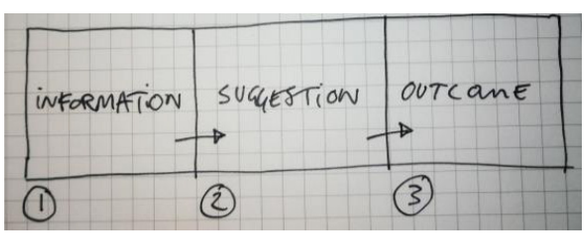

Figure 3: A conceptual implementation of the design

To accommodate the MS' needs to know various details of the visitation suggestion, a row of icons was introduced (see figure 4). Each icon signifies an information the MS can act upon (4). In this example, the medical secretary is told that the visitation is acute, that the patient is a minor and that the parents must be contacted. When the information is actionable (i.e. "it would be wise to call the parents"), relevant extra information is relayed via a dialogue box.

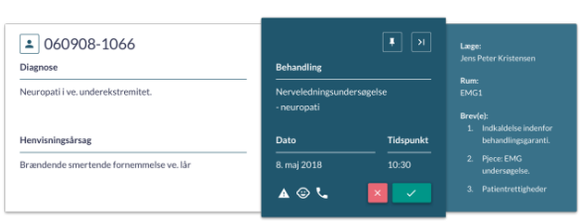

Figure 4: The implemented "Action-card" design.

DISCUSSION

In this study, we worked with a single medical secretary. Hospital work may be differently structured across different medical specialties, and even more across regional or national borders. This suggests that the actual design results may not have a high reliability and replicability. As a preliminary exploration, the study still suggests that the understanding of the user is much different than the engineers building ML applications. Ideally, we would include a larger number of users in our studies to develop a general description of the current users' models.

IS THE PERSONAL ASSISTANT SOLVING THE ISSUE?

In our design suggestion, the ML is still very hidden. When the IA is not making good suggestions, you really do not know why it is not working. There are multiple ways a patient booking could go wrong – and in the current paper-based visitation system, there is always a paper trail back to a doctor responsible for the visitation. Using the suggestion system, we will not be able to explain a flawed decision, and we will not be able to place the responsibility, discovering the weakness in the system. So, on an ethical level, you really want the system to be able to explain itself to a higher degree - without that, we could fear that medical secretaries, doctors and patients would simply not accept such a system being used. The personal assistant could also be making suggestions that are biased without being able to explain itself – meaning that the historical data it is basing the suggestions on, could be biased in a suboptimal way. That is another situation where the explanation is very important for the individual assessments.

This suggests that a meaningful design must be followed up by a trustworthy backend, one that is able to explain the reasoning that lies behind the ML decision-making process.

THE ROLE OF INTERACTION DESIGNERS WITHIN ML

As more ML is integrated into systems, it might become the role of the interaction designer to bridge the gap of understanding between the end users and the logic of the ML. Also, in order to avoid ML being a goal in itself, the interaction designer can uncover and support the future needs of the end user – what user contexts and work tasks must also be supported in the applications of ML? This work is needed to create meaningful interactions between humans and artificial intelligent systems.

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MOBILE MONEY BECOMING A MAJOR MEANS OF DISTANT PAYMENT IN DEVELOPING COUNTRIES

Case Studies of Sub Saharan African Countries

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ABSTRACT
Online payment solutions allow people to pay for goods or services without moving from one place to another. Therefore, time is saved when this payment method is adopted. It can also help to reduce poverty by increasing the productivity of citizens in a country. A report from The World Bank shows that:" 2 billion people don't use formal financial services and more than 50% of adults in the poorest households are unbanked" (Worldbank, 2018). Thus, could not make a distant payment. Magnetic cards, Online banking, Cryptocurrency are the main online payment platforms. However, the difference between Mobile money and others is that it requires only an active SIM card to be an account holder. In Sub Saharan Africa, Mobile money is becoming a major payment mean. The studies conducted by Walkap services in 2016 involving 40 participants living in Africa, Europe, North America proving that mobile money is becoming a major payment method in Africa and shows it impact on people life in rural communities.

INTRODUCTION
In 2007, M-Pesa was launched in Kenya as the first mobile money (Redac Chef, 2013). It was the most optimal solution at that time for people in Kenya to transfer money to their friends and relatives living in the rural areas. In fact, banks and traditional money transfer companies were closed as it was not safe to travel due to the difficult political situation at that time. Using a mobile phone to transfer money in the same manner as airtime communication was unpredicted but in the same time an interesting way to send money, thereby solving the problems.

Mobile money solutions are mostly developed by mobile network operators, banks and others financial institutions. The most popular in sub Saharan Africa countries are M-Pesa, MTN mobile money, Orange money, and Airtel money.

A significant number of people in sub Saharan Africa is adopting this form of payment in their daily life (Jumia white paper, 2016). The main reasons are low cost of transfer, cultural facilities and proximity of cashiers to the population even in the most remote area where it is almost impossible to find any bank office. This study focuses on the people living in Africa as well as those who truly understand why they have chosen this form of payment over others. The study started in Autumn 2016 and ended in December of the same year. The participants spanned across different parts of

the African continent, namely Central, South, East and West Africa.

MOBILE MONEY IN AFRICA

Many studies have been conducted on the topic of mobile money in Africa, Asia. However, they focus mainly on the economic impact of the trends on the population. There are 960 million mobile phone subscriptions across Africa and it represents 80% penetration rate among the continent's population (Mobile Money Programme, 2018). It makes Africa an important market for any activities centralized on mobile devices.

2.1. EAST AFRICA

Mobile money is very popular in Africa it is centralized exclusively on mobile devices. M-Pesa developed in Kenya, was the first mobile money solution. Its market covers countries such as India, Kenya, Lesotho, Mozambique, Romania, Tanzania, Albania, Democratic republic of Congo, Egypt, Ghana (Di Castri, 2014) i.e.: The Figure 1, below shows the first mobile money transaction made by M-Pesa.

Figure 1: First mobile money transaction in 2007

Across sub-Saharan Africa, mobile money is constantly rising. Mobile money revenue rose by 27% between September 2015 and June 2016 (Thomasine, 2007). In Kenya, M-Pesa recorded revenues of around 530 million US dollar in 2016-2017.

2.2. WEST AFRICA

Mobile money is widely present in the western part of the continent. In Ivory Coast, there are over 5 million mobile money accounts, 35% of which are active. MTN mobile money, Orange money, Airtel money as well as M-Pesa, which is also present in Ghana are the main solutions. However, in Nigeria, the most popular country in the continent, mobile money has been categorized as a potential threat to the traditional financial system. Therefore, it did not have the same growth as in other countries (Jones, 2016).

2.3. CENTRAL AFRICA

Cameroon, a main economic force in this region has been a central country for this research. Mobile economy has generated about 1 billion US dollar in 2017 and has accounted for about 3,5% of the country's GDP (Gross domestic product) (Jumia, 2017). Mobile transactions are made via Orange money and MTN mobile money.

During the international forum on numerical economy hosted in Cameroon from 15-17 May 2017, Ms. Elisabeth Medou, the former CEO of Orange Cameroon stated that about 80% of the Cameroonian population are covered with 2G, 3G, 4G (Badang, 2017). Since internet is mainly accessed via mobile data in Cameroon, it thus also makes them potential users of mobile money. In Cameroun, the law n°868/ PJL/AN" (Loi régissant le commerce électronique au Cameroun, 2010) defined in 2010 by the National Assembly, regulates online transactions in the country (this includes magnetic cards and mobile money transactions). The Figure 2 amplifies the statement of the former CEO of Orange Cameroon.

In Gabon, a country of about 2 million population (2016, estimation), mobile money transaction generated about 6.085.800 US dollar in the first quarter of 2014. African population has adopted mobile money even though there are still restrictions and limitations in comparison to magnetic cards. However, the core of our research is centred on the population using the technology, their age group and preferred situation.

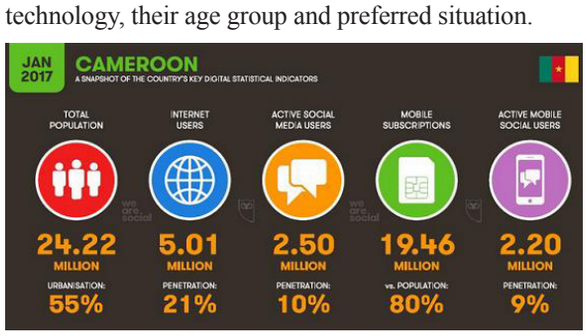

Figure 2: Cameroon's keys digital indicators (Jumia white paper, 2016)

WALKAP USER'S STUDY

Walkap services conducted a study on many individuals residing or have been living in any African countries for at 4 weeks within the last 6 years. The study was done during fall 2016. The goal was to know the aptitude of the target population with mobile devices; their habits regarding buying goods and services online, their interest regarding online payment solution mainly mobile money. The paper will focus on the last goal of the study.

3.1. DESCRIPTION OF THE STUDY

We conducted a study on a population of 40 participants via a combination of online survey and face to face interviews. The study last over 3 months. We had multiple choice questions, closed-ended questions and open-ended questions. We have scale from 1 to 5 and we evaluate the answers based on the percentage.

The youngest participant was 16 years old and the

older over 45 years old. Participants were somehow connected with Central, West, East or Southern part of Africa. The participant had different occupation in the society such as: student; entrepreneur; employee. Their education level goes from high school till college/university degrees.

3.2. DATA COLLECTED

In this section we present data collected during the studies in the table 1, 2, 3 below. You will find in this paper acronym such as:

AG Age Group; F: Frequency;
IA In Africa.
ID In the Diaspora (Europe; North America);

In the Table 1 below, we range data based on the knowledge/usage of mobile money by participant. The number of occurrence for a specified age group and their residence.

R1 I used Mobile money regularly;
R2 I used it from time to time;
R3 I heard about it but never used.
R4 Never used and head about it.
R5 I had a negative experience with mobile money.

F / AG	R1	R2	R3	R4	R5
[16~24]	4IA	1IA 1ID	2ID	1IA	0
[25~35]	14IA	3IA 1ID	5IA 2ID	1ID	1ID
[36~45]	1IA 1ID	0	0	0	0
45+	0	0	1ID	1ID	0

Table 1: Mobile money usage/knowledge by age group and residence.

In the Table 2, we range data based on the reasons why mobile money is used or the situation where it could be suitable for by participant. In the same table, we group the situation in which Mobile money could be suitable for and the number of occurrence is grouped by age in a same box.

S1 for money transfer at a low cost.
S2 Purchasing goods or service on web/mobile apps.
S3 Paying or receiving salaries.
S4 Never

S / AG	S1	S2	S3	S4
[16~24]	5IA 1ID	2IA	1IA	0
[25~35]	12IA 6ID	5IA	2IA	2IA
[36~45]	1IA	1ID	0	0
[45[	2ID	0	0	0

Table 2: Preferred situation of Mobile money's usage based on age group and residence.

At the end of our studies, we wanted to know, if the usage of mobile money to pay for goods or services, could improve life of people in rural area in Africa.

In the Table 3 below, we collect participants' points of view regarding mobile money as a mean to improve people life in rural areas in Africa.

Will mobile money transactions will improve people's life in rural area in Sub Saharan Africa?	Occurrence
It usages will save people's life.	1
It usages will improve people life.	28
Maybe	2
It usages will be limited by the quality of technical infrastructure.	4
It is limited by the level of education .	4
Cultural barriers block them to use such a technology.	1

Table 3: Suggestions regarding mobile money transactions as way to improve people 's life in rural area I sub Saharan Africa continent.

3.3. EVALUATION OF DATA

The Table1, gathers data regarding the level of knowledge and/or usage of mobile money by our participants and we have the following:

- In the range between [16~45] years old, ~77% use it and about 89% of the users live in the continent
- 50% of people who have never used momo lives in the diaspora and 75% of those who have never used and heard about it live out of the continent.
- In the age group of 45+ no one has ever used it.

In the Table2, we inserted data regarding suitable situation of using Mobile money.

- About 68% of the participant thinks that it is suitable for low cost transaction.
- About 88% of people thinking that it is a good online payment mean for website/ mobile application such as e-commerce, lives in Africa and have already experienced it.
- 100% of people saying that it is suitable to pay or receive salaries lives in Africa.

Finally, the Table 3, we collect the suggestions of participants regarding Mobile money transactions as way to improve people's life in the rural area of the continent.

- About 73% of the participants think that

momo transaction will improve people life.

- 20 % of the participants think that it will take longer so that it could widely be adopted by people living in rural area since they technical infrastructure are not good enough and the education level of people in rural areas could not be sufficient to fully use the innovation.

RESULTS

Mobile money has been adopted as major way of doing financial transactions by most of the participants of our research. The percentage of people using this method of distant payment is high. Knowing that in a county such as Cameroon, the technology has been launched in 2011, it has had a very fast growth. The age group between 16 and 45 years old are the first in it adoption. However, people over 45 years are more reluctant regarding its usage.

The low transaction cost of Mobile money in comparison to other form of payment present in the countries, the fact that it can be used on e-commerce platform as mean of payment and its rapid subscription process offered to the customer has contributed to his fast growth. Mobile money once adopted by people living in the rural area, will contribute towards improving their lives in the short and long term. In fact, by purchasing goods or services online, movement of people between cities will be reduced. Therefore, the risk of road accident and environmental pollution will decrease too.

Meanwhile, amelioration of technical infrastructures in rural areas as well as better education level of the population are factors that will further increase the adoption of the innovation.

CONCLUSION

Online payment platforms such as magnetic cards, online banking, payment gateway (PayPal), cryptocurrency (Bitcoin, and other) are widely present in western countries. Innovative solutions are developed to make online transactions faster, cheaper, more secured and reliable. However, there are over 2 billion people (Worldbank, 2018) in the world who do not have access to most of these online platforms since they are unbanked. In certain areas of the globe, administrative rules, limited funds, cultural barriers restraint people from owning bank accounts. Mobile money offers a solution to their problem. In fact, within couple of hours, a citizen with his ID card and a registered SIM card can become a mobile money account owner then start doing online transactions and even purchase goods or services online. It is quite fast and the process is culturally adopted by people living in sub Saharan African countries. This study has shown that people living in the Africa continent and mostly the youth have adopted mobile money in their daily lives and words such as “Orange money” are acronym meaning “transactions” via mobile devices. However, Mobile money transactions are limited in the national territory, therefore another financial vendor is needed to validate transactions from one country to another. In fact, there is not yet an international regulation such as PCI-DSS (Personal Card Industry Data Security Standard) which applies for magnetic card transaction, for mobile money transaction. In rural areas, mobile money could be used as way to reduce poverty. However, a thorough study must be made so that the product can be more centralized and adapted to the needs of people living in those areas, particularly as they often face challenges such as electricity failures, poor internet quality, cost of smartphone which cannot be afforded by the average person living in those areas.

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DIGITAL REFLECTION TOOL TO SUPPORT TRANSFORMATIVE REFLECTION FOR TEACHERS

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ABSTRACT
Primary education in the Netherlands is struggling with a number of challenges, most importantly that the teachers are dealing with a feeling of powerlessness in their daily working life, due to high work pressure and top-down governmental regulations. There is an opportunity to give teachers the feeling of empowerment and control in their work environment. The focus of this paper is on the requirements of a digital reflection tool to support primary school teachers in learning to reflect transformatively on their professional development. This stand-alone design research study investigates this by means of a design probe, a digital reflection tool, as a starting point for discussion. This tool was tested qualitatively with participants from a primary school in the Netherlands. A selection of the results of this study are described in this paper and design guidelines are formulated for future tools to support reflective practice of primary school teachers.

INTRODUCTION
Primary education in the Netherlands is struggling with a number of challenges, mostly importantly low wages, high work pressure, top-down governmental regulations and a shortage of teachers. These teachers are dealing with a feeling of powerlessness in their daily working life, leading to two strikes in 2017. There is an opportunity to give teachers a feeling of empowerment through reflective practice, to support them in the constant state of change their profession resides in. Previous research has shown that when practicing the act of reflection, teachers can become more empowered decision makers (Dewey, 1997; Farrell, 2003; Schön, 1983). This does imply, however, that other factors (such as high work pressure, salary deprivation and other external regulations) need to be regulated more fairly by government alongside this reflective practice.

In the paper, the combination of reflective practice and interaction design is explored, as technology offers many benefits for supporting practitioners. Implications for design for reflective practice have been of interest to the community of Human-Computer Interaction for a while now (e.g. Boud et al., 2013), however designing for reflection is still in its infancy. The research question that this paper discusses is *"In what way does a digital reflection tool for individual reflection support primary school teachers in learning to reflect transformatively on their professional development?"*.

To reflect transformatively is a term defined by Fleck and Fitzpatrick (2010) to describe a level of depth reached while reflecting, which will be further explained in the following section. The abovementioned digital reflection tool consists of a reflective journaling system based on a personal website per participant, making use of Google Docs.

LITERATURE AND THEORY

Reflective practice of teachers is mostly seen as a personal responsibility and is not always properly stimulated within schools. Teachers are often focused on finding quick solutions to practical issues, without reflecting on the underlying problems. Reflective practice can be seen as the *"conscious re-evaluation of past experiences with the goal to learn from them in order to guide future behaviour"* (Fessl et al. 2017, p. 3). One of the methods that facilitate effective reflective practice is journaling (Farrell 2003), however research on the integration of this type of reflective practice in HCI is still scarce.

Code	Reflective Level	Description	Week of user study
R0	**Description**: revisiting	Description or statement about events without further elaboration or explanation	Week 1
R1	**Reflective Description**: revisiting with explanation	Description including justification or reasons for action or interpretation, but in a reportive or descriptive way (no change of perspective).	Week 1
R2	**Dialogic Reflection**: exploring relationships	A different level of thinking. Looking for relationships between pieces of experience or knowledge, evidence of cycles of interpreting and questioning. Considering different explanations	Week 2, 3
R3	**Transformative Reflection**: fundamental change	Revisiting an event or knowledge with intent to re-organise and/or do something differently. Asking of fundamental questions and challenging personal assumptions leading to a change in practice or understanding	Week 3, 4

Figure 1: An abbreviated version of the reflection matrix

To understand the complexity of reflective practice and its respective degrees of depth, Fleck and Fitzpatrick have described five different levels of reflection from various literature sources (Fleck & Fitzpatrick, 2010). In this study, these levels were combined with additional definitions (Prilla et. al., 2015) in a matrix to classify the levels of depth of reflective practice. A visualisation of an abbreviated version of this matrix is shown in Figure 1. This matrix forms the basis of the design probe used in this study. The level of depth that is gradually stimulated in this project is R3 Transformative reflection, which occurs when the practitioner asks fundamental questions that challenge their personal assumptions leading to a change in practice. The following level R4 Critical Reflection is defined as the relations between your actions and assumptions to social and historical trends. This level is not included in this research as it is reported to occur rarely.

DATA AND METHODS

The digital reflection tool was designed to function as a design probe to incite the discussion on the integration of reflective practice in this field and was used by the participants for four weeks. Through mixed methods, the research question was investigated, with a focus on qualitative methods complemented with a quantitative questionnaire on perceived self-efficacy (Bandura, 2006).

The qualitative data sources consisted of semistructured interviews within their daily context (in week 2 and week 4) that were collected through audio recordings and transcribed afterwards. The collected qualitative data was divided into different topics, in an inductive affinity diagram. The quantitative data source was a questionnaire on the perceived self-efficacy questionnaire (before week 1 and after week 4) and were analysed through the use of descriptive statistics. The questionnaire consisted of 16 statements on the perceived self-efficacy on reflective skills of the participants and 5 statements on their confidence in the support the digital reflection tool would offer them in their reflective practice. These statements were scored on a scale of 0 to 100.

PARTICIPANTS

The participants were all experienced teachers at a primary school in the Netherlands. They were all simultaneously following a professional development course at their school, which was complementary to their participation to this research. The total number of participants was N=6 (see Table 1), all being female teachers of different grades within the same school.

Teachers	**Gender**	**Part-/Full-time**
P1	Female	Full-time
P2	Female	Full-time
P3	Female	Part-time
P4	Female	Full-time
P5	Female	Part-time
P6	Female	Part-time

Table 1: Overview of the teachers participating in this study

DESIGN PROBE

This design research and its design probe, the digital reflection tool, were based on design assumptions leading to the following capabilities:

i. The tool is able to adjust the level of depth of the reflection questions to the abilities of the participants and gradually built-up in more depth each week, which will have

a positive effect on their level of depth of the teachers' reflections. The levels of depth and content of questions were based on the matrix (Figure 1).

ii. The reflection exercises adapt to the content of the written reflections of the teachers of the previous week, which will have a positive effect on the users' experience.

iii. The medium and timing of the tool are integrated well into the daily work life of the participants.

The digital reflection tool consists of a personalized website for every participant, that contained an introduction, an exercise schedule, and links to the exercises. These links redirected the participants to the exercises in Google Docs (see Figure 2). Google Docs is an online platform of Google that enables the user to work in a text document that is stored online. It also enables the immediate usage by multiple users, in this case by the participant and the researcher. This was needed to enable the researcher to read the reflections by the participant and adapt the reflective question for the upcoming week, as mentioned in the design probes capabilities.

Figure 2: Screenshot of the website and its reflection exercises (in Dutch)

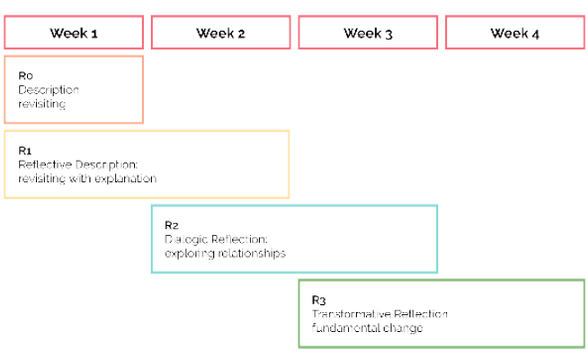

Figure 3: Overview of the reflection levels of the exercises per week.

In the first week of the study, the questions were based on the R0 level of reflection on relevant moments focused on feedback or interpersonal connections with their students that occurred that week. In the second week, the reflection questions were focused on both the R0 and R1 levels of reflection. Also, the level of depth was personalised to the answers of the participants of week 1. In the third week, the reflection questions were focused on both the R2 and R3 levels of reflection in which the participants had to look for patterns in the situations and uncover personal assumptions that influence their thinking and actions in the classroom. In the last week of using the tool, the reflection questions were focused on the R0 level of reflection, in which the participants had to describe any changes done or planned. In Figure 3, a visualisation of this process is shown.

RESULTS

In this section I discuss the results of deploying the design probe for enabling reflective practice in the daily lives of primary school teachers. A selection of results from the whole study is mentioned in this paper, to highlight the most interesting insights.

IN-DEPTH REFLECTIVE QUESTIONS

The gradual built-up of depth in the reflective questions guided the learning process of the teachers to reflect more critically, as it created *"awareness of your own actions and professional growth"* [P2, P3, P4, P5, P6]. This confirms aforementioned assumption i. Furthermore, the personalization of the questions had a positive effect on the non-repetitive perception of the teachers. P6: *"When there was a piece of text from my previous reflection, the questions felt less repetitive and that gave the feeling of analyzing the situation deeper."* This shows an additional surprising effect next to assumption ii.

The reflective exercises contributed to the critical attitude of the teachers, towards their own way of working, by creating awareness on their professional identity and their actions as a teacher. *"I felt I was able to reflect more critically, because of the practice of answering more critical questions each week"* [P2, P5]. The teachers felt that the tool provided guidance in developing that critical attitude and were afraid that attitude might fade when they stopped using the tool.

TIME-INVESTMENT FOR REFLECTIVE PRACTICE

The biggest paradox that emerged from this study was that the appreciation and the way the teachers valued the reflective exercises were in contrast with the lack of willingness to invest time in these reflective practices. P5: *"When I think about all the work I still have to do while I'm doing the exercises I feel very stressed and frustrated."* This was a surprising contradiction to assumption iii. As teachers have a high work pressure, the reflective practices are the smallest priority compared to the lesson preparations etc. that they need to finish for the next day. Less time-intensive reflective practice is preferred, e.g. P4: *"I would prefer a tool that gives reflective questions that you can think about, but that does not require writing. That would also be more time-efficient."*

PERCEIVED SELF-EFFICACY

The teachers' perceived self-efficacy on their abilities

in self-reflection increased after participating in this study (see Figure 4). In the interviews, the teachers said that *"the tool gave me guidance in learning to think more critically about my own way of working and reflecting"* [P3].

The visualization of the scores of the participants on their self-efficacy on their abilities of the different levels of reflection (see Figure 5) showed that for most of the reflection levels an increase occurs after the test-period. It is also interesting to see that for some participants, the perceived self-efficacy on their abilities in descriptive writing is decreased. Another unexpected observation was that all participants showed a fairly large increase in perceived self efficacy on their abilities to reflect critically. As critical reflection did not appear in the digital reflection tool and it is reported to happen rarely it is not likely that their actual abilities in this level of reflecting increased, only their perception of this level.

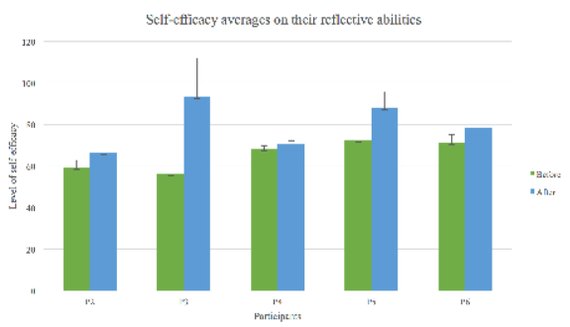

Figure 4: Graph of self-efficacy on reflective abilities per participant

Figure 5: The scores of perceived self-efficacy of the participants, before and after the test-period, divided into the different levels of reflection *(Descriptions of the reflection levels can be found in Fig. 1).*

DESIGN GUIDELINES

The aforementioned results enable reflection on the predefined assumptions and give the opportunity to define practical design guidelines for future designers or researchers in this field.

a. Create a tool that is both supportive of what the teachers are already comfortable with doing in terms of reflective practice and that stimulates them to take their knowledge/attitude a step further. This creates a positive experience that stimulates learning and professional growth. The matrix on levels of reflection can be beneficial when creating and structuring exercises to stimulate deeper forms of reflection.
b. Personalization of the content of reflective exercises has a lot of positive benefits for the perception on the reflective exercises.
c. The integration into systems/products that are already used in the daily practice of teachers is important, the addition of new external systems is not preferred by teachers.
d. The extensive version of the reflection matrix used in this study, links key words to each level of depth. When a system is designed for this context, an algorithm can be made that focuses on these key words within the written reflections by the teachers and adjust the successive exercises accordingly.

DISCUSSION

This study gave insight into the implementation of reflective practice of primary school teachers through a digital reflection tool. Through qualitative research methods several design assumptions were tested, which after analysis led to practical design guidelines. These guidelines can be used as a basis for further research in this field or as a starting point for creating new reflection tools for primary school teachers. These guidelines include: the importance of both supporting and pushing teachers to learn how to reflect more indepth; the benefits of personalization within the content of reflective exercises; the importance of integration of reflective exercises within systems and products that are already used by teachers in their daily practice and a matrix that can be used as a basis such a system.

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DESIGNING TRACKERS FOR UNIQUE INDIVIDUALS WITH FOCUS ON PERSONALIZATION

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ABSTRACT
Not all mass produced products have universal value for individuals; for some people these products have no value at all. Therefore, we are exploring the concept of personalization as a design tool to create and design unique objects for unique people. Personalized products add value to the lives of specific individuals, (without needing to add value to other people's lives), whereas a mass produced product would not do the same. We explore how to personalise an object (tracker) based on pre-gathered and analysed information and how the developed ideas/objects can enable the participants to track contribution and reflect upon themselves.

INTRODUCTION

Surely from business standpoint there is value in creating products for mass production. But the risk with creating for mass production is taking the user into account by overgeneralizing, or creating idealised scenarios of the product use (Churchill, 2014). However, is it the same looking from the user perspective? We think that user-centered approach is more preferable. People are unique, so why shouldn't the products created for them, reflect on their uniqueness in some way. We suggest that a design process should get to know our intended users and create for them, with their unique qualities, behavioral tendencies and values, in mind.

PERSONALIZATION

Personalization refers widely to customization of content to a specific user. It is used widely in various fields, such as marketing where ("marketers increasingly tailor their online and messages based on the profiles of the individuals they are reaching" (Turrow, 2017), music streaming services (such as Spotify, which generates suggested playlists and songs based on one's listening habits (Turrow, 2017), web design for example Amazon.com can recommend products to their customers based on their profiles and purchase histories (Tseng, Jiao & Wang 2010), service design and other fields. But what does it mean, and how does it look like in terms of design.

It means considering users as individuals, taking into account their characteristics, like their personal taste and preferences, traits, innate needs and experiences (Tseng, Jiao & Wang 2010). When we think of design, one should never forget who we are doing this for, as "design is always about meeting particular people's' needs in particular contexts" (Churchill, 2014). Putting it simply, the more relevant for the user a product or a service is, the more effective it is. According to Berry, Wang & Hu (2013) the main challenge of personalization in product design is a successful incorporation of the customer. ["From concept to ideation to prototype and evaluation, the design of interactive technologies and systems that are intended for people should start with some understanding of who the users will be, what tasks and experiences they are aiming for and what the circumstances, conditions or context(s) are at play"] (Churchill, 2014). So how did we personalize for the participants?

DATA AND METHODS

Aiming to design for the participants (H & S), we used pre-gathered data which is part of a ongoing project by two PhD. candidates. Interviews both in video format and transcriptions were provided. We also had a chance to learn interesting insights directly while working together in studio with one of the PhD. candidates.

The data we worked with is specific for the participants. It can be considered personal data (EU Commision, 2002) as it is able to identify the participants and that it gives details about their behaviours and lives. All data was given to the project voluntarily by the participants through interviews and correspondences with the PhD. Candidates.

The design process applied was the D-school Process developed at the *Institute of Design at Stanford University* . Using this the process can be divided into five themes; *Empathize, Define, Ideate, Prototype and Testing* . We used an iterative approach, meaning that we went through the process in different stages at multiple times. Through multiple ideation sessions we created prototypes in a circular process, working back and forth and thereby obtaining a better understanding of our project.

TAKING A PERSPECTIVE

["To create meaningful innovations, you need to know your users and care about their lives."] (d.school Stanford (2011). The perception, documentation and interpretation of user experiences gives implicit knowledge about the individual (Koppen & Meinel, 2015).

Therefore, in order to *empathize* with and learn about our participants we started by watching interviews and reading transcripts. We then analysed the participants, noting what kind of data we had discovered and thought we should focus on. We went on making a roleplay interview with us in the roles as participants H and S and from that created profiles of them as seen in Figure 1. This exercise gave us unexpected insights into the minds of the participants and a deeper understanding of their behaviour. In fact, having to take on a role of one of the participants and having to give answers on his behalf was an interesting sensation. It gave a strong sense of responsibility of representing this person in a fair manner and not to add anything that wouldn't be true of him. This process was very useful in building empathy and connection with the participants.

Figure 1: Profiles of participants created during defining stage

OBJECT METAPHOR

Analysing and discussing the participants, H and S, gave the group a common understanding of their values, interests and in general who they are .Then we made profiles with this understanding relating to the personal data; which included personal values and material values. It also included what objects they had a special connection to, what where they're tracking and the perceived reason to why are they're tracking. With these values defined we had a session of *object and material association* . This is a method where each of us had to pick an object, which in our opinion would represent some values of our participants, be it in their behaviour or tracking. This led to a discussion of how it fits with their values and how to further build on this in order to identify possible overarching themes for each person. For H and S who are engineers, roommates and slightly daring, as they are into sports experiences such as snowboarding and surfing, we were able to move on in design process to the ideation stage with the knowledge of who they are and tailor our ideas uniquely for them.

EXPLORING OBJECTS

"It's not about coming up with the 'right' idea, it's about generating the broadest range of possibilities." (d.school Stanford, 2011) In the ideation we used Brainstorming in small sessions to create a wide array of ideas. Some of these ideas were taken into *Object theatre* (Buur & Friis, 2015) to see how random collection of items could be used to make a form of tracker. Furthermore, we went to a thrift store with the intention to take the exploration further. As we walked through the store with our users in mind, collecting things that reminded us of them, or things we thought could be used in prototyping specifically for a particular user H or user S. Through *object exploration,* a subsidiary of Object Theatre, we used

the same objects (Figure 2) in our workspace as well as some new objects bought in a thrift shop with our users in mind to explore how these different objects could interact and through that led to creating prototypes of trackers.

Figure 2: Objects to explore and ideate with

PROTOTYPING

["The imagination has the capacity to see things that aren't there; it fills the gaps to create an impression"] (d.school Stanford, 2011) Throughout the different stages of the project we had prototyped in different ways from very abstract ideas, using what was at hand to laser cut versions. Through analysing the data, we created the design challenge: "How to enable tracking for shared goal setting", from which we ideated and created these"prototypes" which aims to allow the participants to track themselves in some shape or form, reflect upon themselves and encourage them to share their progress.. The most notable prototypes are:

THE MAP

Since both H and S are tracking their running in different ways, we wanted to create a way for them to share their progress with each other. They would set a goal - kilometers to run and in that way would "travel the world" and in the process could share their achievements with each other. This idea originates from H who has a map from one of his snowboard trips hanging on his wall, where he has drawn the routes he took on the map. The development of the idea is still ongoing.

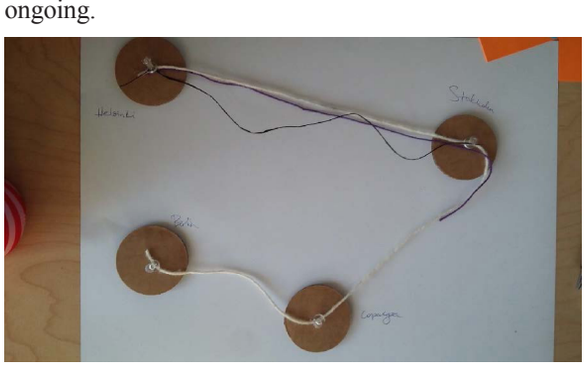

Figure 3: First prototype of the map, after first rapid prototyping session

THE SCALE

The scale is designed so the tips are the goal(s) of the user(s). The user adds weight to the end of the horizontal beam, while also being able to move the weight further out on the beam in order to have 2 variables that can be changed and varied. When the weight is resting on a surface and therefore no longer hanging, ones goal has been achieved. It is thought that the two participants could use it as a conversation and encouragement tool in context of their exercise and goals within that activity. Further inspiration also stems from H and S's respective ways of setting up their own systems both in tracking and in general.

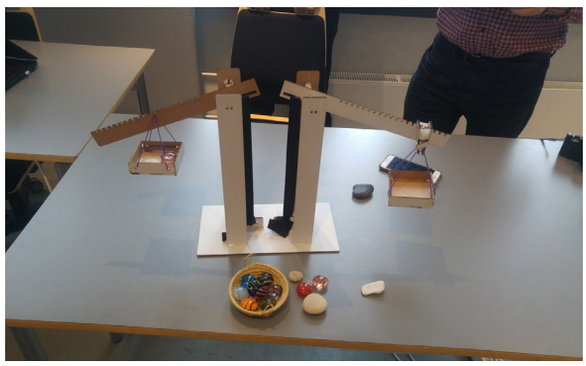

Figure 4: Scale

We had a rapid prototyping session in the very beginning, when we just "met" our users, and interestingly enough, the ideas that we got from that session are the ones we are pursuing right now, further into the project.

EXPLORATION THROUGH ROLEPLAY

We used a roleplay session as an opportunity to learn about our prototypes and our participants. In a session using improvised scenario acting (Figure 4) we had a chance to take on the roles of both users and observers. We observed two actors roleplaying as user H and user S as they tried out the prototype of the scale. As the improvisation went on, and the actors developed a situation, which we knew wouldn't actually happen due to our insights into behaviour of user H and user S, we understood the difference between having first hand knowledge of the user and his unique qualities and not. Then we took over the roleplaying and tried to go into the role of H and S just receiving the prototype and being curious as to how the scale would work and how we could interact with it (being more analytical due to the fact that both H and S are engineers).

Figure 5: Roleplay session

In this session we learned about how our prototypes can be used and how a possible user actually interacts with it. “ Role play the raw acting out of an activity or problem - as this can provide an effective opportunity to identify fundamental issues that might otherwise be overlooked“ (Bramston & YeLi, 2009) The session revealed more functions and suggested improvements for further development, role playing provided “a framework for the imagination to relate to.” (d.school Stanford, 2011)

DISCUSSION

A person should be at the heart of design. That is where personalization is a great tool. Personalization aims to design for the uniqueness of (an) individual(s). This can be achieved through “private information” (In this projects also referred to as “personal data”) where information about a person and their behaviour are analysed in order to understand them and then develop an item (be it physical or immaterial) that are customised to their behaviour/life/person.

This goes against normal consumer products as they are designed and sold to a multitude of people in varying demographics. But *why design for an individual*? Why spend time and resources when it can be more profitable to design for more people?

Designing for the unique can give ideas and objects which are exactly that; *unique* . Personalization allows us to design for a specific individual, and to create something that (for starters) only benefits one person, a benefit that can not be achieved through conventional design since they are outside the “normal” target groups. We as designers are able to provide a response to a specific situation in people lives by focusing on *them* instead of looking towards markets, shareholders and demographics. What is created is *personal* for them, though that doesn’t eliminate the possibility of turning into something, that could be useful for others at a later point, but even so it would all start at the personalization. The final discovery from working with personalization is, that when one is designing for an individual, looking at their behaviour (hobbies, sports, what they like to do and how they do certain things) gives more to work with than focusing on personal data such as age/sex/location.

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INTELLIGENCE //

ADRIEN FONNET, FLORIAN MELKI, YANNICK PRIÉ, FABIEN PICAROUGNE & GREGOIRE CLIQUET |
IMMERSIVE DATA EXPLORATION AND ANALYSIS

SOM SUNDER, CHANCHAL PRAJAPATI & NEHAL GULATI |
EVALUATING EASE OF INTERACTION WITH VOICE ASSISTANTS

PATRICK SKOV JOHANSEN, RUNE MØBERG JACOBSEN & LUKAS BJØRN LEER BYSTED |
CONSIDERATIONS FOR CREATING MEANINGFUL INTERACTIONS BETWEEN USERS AND INTELLIGENT AGENTS

SHIBASHANKAR SAHOO |
AUGMENTED SOCIAL NETWORK ARCHITECTURE

IMMERSIVE DATA EXPLORATION AND ANALYSIS

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ABSTRACT
This paper belongs to the emerging immersive analytics research field. It presents a system for exploratory analysis of multi-dimensional data focusing on providing freedom of locomotion while remaining comfortable for long user session. The solution allows to investigate temporal traces through a 3D scatterplot using a cylindrical coordinate system. Users are free to move inside the tracked area either standing up or seated in a mobile chair. A limited user study (n=6) has been conducted to investigate if the designed solution was deemed appropriate for mobility and user comfort.

INTRODUCTION

Understanding and exploring multi-dimensional datasets is a critical process for any decision maker. Immersive analytics is an emerging research field aiming at providing supportive tool for data analysis and decision making through the use of immersive environment (Chandler, 2015). Building upon the initial reflexion proposed in (Cliquet, 2017) for HMD based immersive analytics, this work describes an exploratory system focusing on navigation, i.e. keeping the freedom of room-scale movement while accounting for long-session.

RELATED WORK

Even though immersive analytics terminology has only been defined in 2015, using immersive environment for multi-dimensional data analysis and exploration has been investigated since 1996 (Symanzik, 1996). Symanzik et al. used a CAVE to display 3D scatterplot, encoding additional attributes through color and shape, followed by (Ammoura, 2001; Nagel, 2001; Nagel, 2003; Nagel, 2008). Other hardwares have also been exploited, such as augmented reality through fiducial marker (Meiguins, 2006) or 3D stereo with hand-tracking (Azzag, 2006).

Our system focuses on the use of virtual reality head mounted display (HMD) to visualize multidimensional data like the Wizard solution (Datey, 2002), or the works of Donalek et al. (Donalek, 2014) and Filho

et al. (Filho, 2017). However, those solutions are either stand-up or desk only while we combine in our system both modalities. We use a tracked mobile chair, to allow users get both the comfort of being seated for long session and the freedom of free standing movement in the tracked space. Moreover, we use the chair's tablet as a support for menu selection to give haptic feedback through a tangible surface. Tangible surfaces have been used in immersive analytics serving other purposes such as a reference map for augmented reality visualization (Franz, 2017), or as touch table hardware (Butscher, 2018).

IDEA IMMERSIVE ANALYTICS SYSTEM

Our immersive analytics solution has been developed with Unity3D for HTC Vive HMD rendering display and HTC controllers as the main input for interaction.

SYSTEM PURPOSES

Our target activity is exploratory data analysis, where users are looking for insights within trace data without any precise hypothesis to test. The trace format we use in our system is composed of event. An event has generic attributes such as event type, date, actor (e.g. who does the action depicted in the event), as well as several type specific attributes.

VISUAL MAPPING

Each tuple of the dataset is represented by a sphere. This shape's choice limits occlusion at the cost of more computer processing (Ammoura, 2001). A cylindrical coordinate system is used to place data points based on their generic attributes, see fig.1. Vertical axis represents users, horizontal curved axis time, and depth event types. Since additional data points specific attributes depend on the event type, using another general visual mapping would not be relevant, so readability has been improved by color coding event type information. User sessions appear quite naturally in this representation as alignments of sphere.

Aggregation is also used to limit occlusion, by grouping data points of the same user and same event type which are temporally close to each other. The resulting object, is a semi-transparent sphere that contains the data points spheres scaled down. This solution seems adequate to aggregate up to 10 data points.

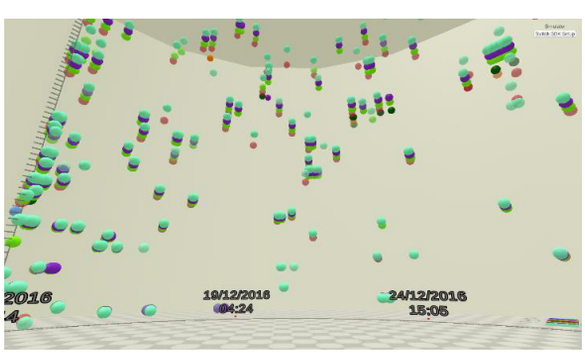

Figure 1: Overview of the virtual representation, each sphere representing a data point

INTERACTIONS MODALITIES

All elements for interaction have been put in the user vicinity and represents its workstation (see fig. 2). A virtual disk represents the limit of the tracked physical space. A mobile chair, equipped with a tablet, tracked via Vive tracker (see fig. 3) is modelized and positioned on top of the disk. Both Vive controllers are used, one dedicated for movement while the second is for data and menu interaction. A virtual trashcan and plank, positioned on both side of the chair, complete the setup.

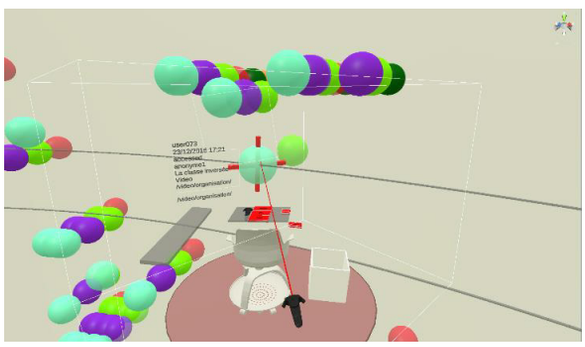

Figure 2: The workstation inside the virtual environment. The mobile chair and the tablet are modelized and tracked via Vive tracker. The virtual plank on the left is used to gather selection cube, while the trashcan on the right is used to discard cloned data point or selection cube. The disk represents the available physical area where the user can move while in the chair or standing up. "Flying" movement and teleportation move the whole workstation.

Figure 3: The mobile chair setup with a user exploring the dataset in seated position.

Up to 4 movements modalities are available for navigation. The first is physical displacement while standing up using the HTC Vive head-tracking. Second is the ability to physically move on the platform while seated, rolling the mobile chair over the disk. Third, the user can "fly" the workstation in the direction of the left controller combined with the trackpad input. Fourth, the user can teleport the workstation, by selecting direction and distance of teleportation, the point of arrival being visualized by a semi-transparent duplication of the disk + chair. Switching from flying to teleport is done via the left trigger. And last, pushing left grip button teleports the workstation back to

a central position for the user to have the full data visualization in its field of view.
The user can point at a data point with a raycast from his right controller to access its full details. A window with all information appears next to the data if the sphere is closed to the user and close to the user otherwise to optimize readability of the text. The same window can be triggered by putting the right controller in contact with a data point. Upon trigger press, a selected data point can also be duplicated and kept next to the workstation.

A menu is displayed on top of the chair's tablet to choose parameters for a data selection based on event type or user ID, multi-selection is available. Upon confirmation a virtual cube is generated in front of the user at arm's length, with the selection information written on it. This "selection cube" materializes the selection. Grabbing the cube with the right controller applies a highlight, i.e. a glowing effect on the selected data points. The cube can also be released on the top of the virtual plank to filter out all the data points that are not selected. Multiple selection cubes can be chained on the plank keeping visible only the data points at the intersection of the selection cubes. To undo a filter, the user can simply remove a cube from the virtual plank. A temporal zoom on the time axis is also available: the user can select two markers on the curved horizontal axis using the raycast. These markers are then used to change the visualization according to the new time interval.

Last, the virtual trashcan is used to destroy any unwanted object after use by placing them in contact with it, whether it is cloned data point or a selection cube.

USER STUDY

This section describes a limited user study conducted to draw some early conclusions. The focus was on qualitative aspects of the design, aiming to get user insights on visualization, interaction and comfort of use.

DATASET DESCRIPTION

The dataset explored contains traces extracted from the coconotes platform (https://coconotes.comin-ocw.org/) which is a e-learning video platform allowing user to annotate video at specific timestamp. Traces have been monitored over 5 months, from September 2016 to January 2017, and results of over 200 000 actions from 200 users. Only 17 users were used for the visualization resulting in only 5000 data points to render ensuring acceptable framerate in our preliminary prototype. Each tuple contains a user ID, a timestamp and an event type. Additional attributes depend on the event type, e.g. play or pause events will have specific attributes such as the name of the video.

EXPERIMENT

A participant's session lasted one hour. The following procedure was used: first a demographic questionnaire, then the presentation of the dataset and the visualization, and some training on interactions. Once we had the confirmation that the participant was comfortable with the system the main study started with a set of tasks. A post questionnaire and an interview wrapped-up the session.
The study had two phases. In the first phase participants had to perform basic search tasks, e.g. find a video name knowing the time it was played and a user ID or determine a trend by answering questions such as "what behaviour may you observe after the completion of video reading?". In the second phase they could explore the system as they pleased, discovering new information about the dataset.

The post-questionnaire contained 4 affirmations on movement modalities, data visualization and interactions, comfort of use, and overall experience, the user had to evaluate with 7 points Likert scales.
Six male subjects from the computer science section of the University of Nantes participated to the study (mean age 20.8 ranging from 20 to 23). They had good experience in video game but few in virtual reality and data analysis. The experiment was run on a computer equipped with a CPU Intel Xeon ES-1630 v4 (3.70GHz), 16 Gb of RAM and a Nvidia GTX 1060 graphics card.

RESULTS

Movement modalities scored an average of 5 [0.58], main complaint was the slow velocity of the flying movement. However, scaling the speed up could result in increased cyber-syckness so complementary solution such as tunnelling effect should be added. The linear movement could also be replaced by dashing step. Regarding data visualization and interactions, with a mean of 5 [1.15], the feedbacks was positive towards the cube selection object and trash can metaphor, improving the level of engagement. The details on demand feature was however unanimously disregarded due to the necessity of keeping the raycast over the point of interest, both tiring and frustrating gesture if the data is far away. Using the duplication of data point alleviated the problem during the study though this was not the intended goal of this feature.

Comfort of use was rated with a 5.33 [0.47] average and no cyber sickness was mentioned by users. Moreover, they appreciated the possibility to remain seated for analysis while having the freedom of moving when required. A full session only lasted around 30 minutes in the virtual world, so further study will be required to see if the system remains comfortable for longer period of time. It nevertheless shows encouraging results.

Last, the overall experience was rated with a mean of 5.66 [0.47], even though this can mostly be accounted for the "wow effect" of the first virtual reality and visual analytics experience based on the discussion

with the subject.

CONCLUSION

This paper presented an immersive analytics system for multi-dimensional data analysis. The main contribution is the navigation solution that provides the user with the comfort of using a seated position in front of a desk while retaining the freedom of using full physical movement while being immersed. The user feedback we obtained from a limited user study confirmed the benefits of our mobile chair solution. Future work will improve the data analysis component.

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EVALUATING EASE OF INTERACTION WITH VOICE ASSISTANTS

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ABSTRACT
With the popularity of voice assistants, Google is focusing on making Google Assistant (GA) more personalised and ubiquitous. Due to GA's role in changing the way users access information and accomplish tasks, and their increasing engagement with intelligent voice assistants, it only deems necessary to understand the user experience as Voice-First Interfaces. This paper describes a user study designed to understand the users' ease of interaction with Google Assistant, using a range of non-query task varying in terms of complexities. Further research analysed how the complexity of tasks, usage frequency of the assistant, visual feedbacks, affect the interaction experience.

INTRODUCTION
Voice assistants see their future in IOT ecosystem as personal assistants which necessitates studying them from a usability and interaction point of view. Themes such as dialog systems, user satisfaction, user interaction, character and personality of AI have become centric to research studies. Due to the change in the way users access information through verbal communication, voice assistant is expected to understand the intent, maintain a conversational flow and a context. The level of interaction engagement with the assistant, the complexity of tasks and queries also differ from scenario to scenario and user to user. Despite limitations, adaptability of GA in everyday life, will depend on the ease of interaction the voice assistant would provide to the users, for which we try to answer a few questions:

How to define ease of use in context of voice interactions?

How we can evaluate the ease of interaction with intelligent voice assistants like Google Assistant, Siri Cortana etc.?

This paper analyses, primarily the ease of interaction with voice assistants, Google Assistant in particular, due to its popularity among other competitors in India, and tries to understand what makes the interactions easy on part of the users.

RELATED WORK

Research studies have already been done in the field of voice interfaces, dialog systems and conversation agents (Jurafsky et. al., (2017); Bangalore et. al., 2006; Porcheron et. al., 2018). However, these studies focus majorly on improving efficiency of voice assistants, character development, modelling spoken dialog systems and Natural Language Processing (NLP). Studies need to be done to understanding the ease with which users maintain a conversation, their expectation from the assistant and the parameters that limit the user's interactive experience of voice interfaces. We look into various aspects of research on speech enabled interfaces which define our context for ease of interaction in voice control interfaces and categories under which we evaluate the same. This is to emphasize the fact that there is scope to incorporate the intended settings that can enable voice assistants to facilitate and improve human machine dialogue.

2.1. EVALUATING EASE OF INTERACTION

Research on spoken dialog systems have placed a focus on modelling CUIs using Conversational analysis (CAs). Making the assistant understand and reply in natural language makes the conversation more interactive. According to IBM's research on Watson (Console.bluemix.net, 2018), along with NLP, understanding the intent and context behind the user's words help intelligent assistants maintain a continuous dialog flow with the users. Based on these literature review we select the below mentioned parameters for evaluating ease of interaction.

2.1.1 CONTINUITY IN DIALOG FLOW

Features like understanding halts in conversations, leaving scope for delay between 2 way dialogs help to reinforce continuity in dialog flows (Jurafsky et. al., 2017). Having continuity regardless of halts and error dialogues, keeps the user engaged for a longer time.

2.1.2 NATURAL LANGUAGE

NLP-NLU algorithms, even in their early stages, are currently driving the interaction with chatbots. They are successful in identifying the entities and intent behind the sentences in a conversation, thereby facilitating a dialog flow. (Console.bluemix.net, 2018).

2.1.3 PRESERVING CONTEXT

Preserving the context helps the voice assistant maintain a conversational flow and give relevant replies which are less prone to error and misunderstanding (Chatbots Magazine, 2018).

2.1.4 MULTI SENSORY FEEDBACK

Users registers significant amount of information using sight (Smashing Magazine, 2018) . Therefore, aiding voice interaction with GUI even if for the purpose of feedbacks, significantly improves user experience, because in certain scenarios relying on just verbal communication is not enough (Hecht & Ambady, 1999).

METHOD

We conducted a qualitative study in order to observe voice interactions between user and voice assistant. We first did observational study to observe the behaviour of the user and the feedbacks given by the voice assistant, to understand the level of ease in experience. Then we interviewed the participants and asked questions about their experience. We transcribed the data into a data matrix based on a format designed to facilitate easy understanding of recurring patterns and observations made from the recorded videos. Finally we analyse the inferences based on different parameters discussed in Section 2.1.

3.1 PARTICIPANTS

We took participants of age group between 22-28 years because they are the most frequent users of voice assistants in current scenario. All the participants are interaction design students to get insights from the perspective of both, user and the interface Using stratified sampling method, we took users based on their frequency of use of voice assistants and classified them into three categories: Rare Users (frequency of usage is less than 5 times a month), Moderate Users (frequency of usage is between 5 to 20 times a month) and Regular User (frequency of usage is more than 20 times a month). We also tried to create heterogeneity in terms of cultural diversity since different parts of India have different cultures and different English dialect which directly affects the ability of voice assistants to understand natural language.

3.2 ENVIRONMENT

Participants performed a set of given tasks on their own personal Android phones of version 5 or higher as we wanted to observe the user interactions in a scenario where Google Assistant also knows about users individual preferences and personality. The users' facial and audio reactions and their mobile screen were recorded for observational study and the study was conducted in a quiet room to avoid any background noise in sound recordings. In real scenario there will always be background noise but we eliminated that factor to simplify our experiment.

3.3 GENERAL PROTOCOL

In our pilot study, we explicitly specified a set of tasks that were to be carried out with the help of voice assistant. But we observed users were picking up exact words from the written tasks for voice inputs. Therefore we modified our procedure and changed from specified tasks to scenario-based tasks. The scenario comprised of 2 Simple Tasks and 2 Mission Tasks (Kiseleva et. al., 2016). This ensured diversity in giving voice inputs.

3.4 USER STUDY

Users were given a scenario to perform a set of tasks with vthe voice assistant. We kept the scenario same for all the users to do comparative analysis and find recurring patterns. Since we didn't explicitly specify tasks and framed a scenario instead, it gave users the

flexibility to use their own vocabulary and talk to the assistant in their own natural language. We encouraged users to ask questions like “How are you?”, “Can you tell me a joke?”, to get comfortable with the assistant and start a natural conversation in the given scenario.

Scenario:
“You wake up in the morning at your regular time and you decide to go for a movie “Padmavat” for which you want to know where and when the movie is screening. Then you decide to ask your friend to come with you in whatsapp and you finally add this event in your reminder list.”

Therefore, the tasks performed in the scenario were -

- Task 1- Setting Up an Alarm
- Task 2- Search for Movie Theatre and Timings for Hindi Movie “Padmavat”
- Task 3- Send a Whatsapp Message to a Friend
- Task 4- Setting up a reminder to book tickets at a specified time.

Task 1 and 4 are Simple Tasks which involves sending voice input and receiving a feedback on completion of the task. Task 2 and 3 are Mission Tasks which involves multiple dialogs to achieve the goal. Later we asked users some questions based on their experience, which were-

- How natural was interaction compared to human-human interaction?
- How did you interpret the completion of tasks?
- Which tasks were easier to execute?

The conversation between user and voice assistant was transcribed in a log sheet, where we further added observations and comments. We designed a format to differentiate between the user dialogs, voice assistant dialogs and observations (see Figure 1).We color coded the dialogs and observations based on similarities and noted down our inferences.

LEGEND	TRANSCRIPT
“USER DIALOG”	**“Hey google, can you please ask Prabhakar if he is free to watch a movie tomorrow ”**
“VOICE ASSISTANT DIALOG”	*“okay message to Prabhakar. Do you wanna use whatsapp, sms or hangout?”*
(Observations)	(message is not seen yet) (GA reads out all the options) **“Use Whatsapp”** *“Got it, do you want to send it or change it?”* (Shows the message)
<On Screen Text>	<message: if he is free to…. tomorrow>
Natural Conversation	

Figure 1: Format of Transcript of User Study written in log sheet

RESULTS AND FINDINGS

In this section, we grouped the inferences under the parameters mentioned in Sec. 2.1.

4.1. CONTINUITY IN DIALOG FLOW

(i) The continuity is interrupted when user doesn’t receive the desired results. (ii) Google Assistant fail to register the voice command in case of halting or latency in formation of sentences. (iii) User remains in flow of conversation when the task has been successfully completed and due to prior mental engagement and therefore forgets to invoke again with phrases like ‘OK Google’ or ‘Hey google’.

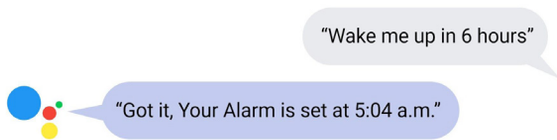

Figure 2: Voice Conversation for Setting an Alarm

4.2. NATURAL LANGUAGE

For simple tasks, Google Assistant succeeds in identifying the intent when different users form different sentences or when user doesn’t specify the entity in her conversation. For e.g. when user ask “Wake me up…” or says “Set an alarm…”, google assistant identifies the intent (i.e. setting up an alarm) in both the cases (see Figure 2). Regular users use more human-like dialog as compared to rare users.

4.3 PRESERVING CONTEXT IN CONVERSATION

For function based Mission Tasks, Google Assistant could remember the context in the conversational flow successfully. For eg. (see Figure 3) Google Assistant opens whatsapp when user says “Open Whatsapp” and it preserves the context (whatsapp in this case) when user says “send a message”. However in case of search based mission tasks (in case of finding where and when the movie is screened), Google assistant lost the context and couldn’t detect the intent of the user.

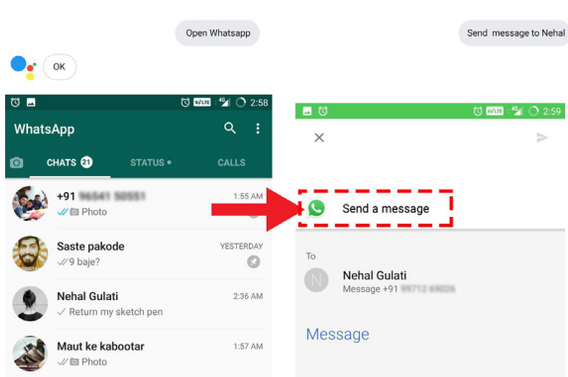

Figure 3: An example of function based Mission Task

4.4 MULTISENSORY FEEDBACK

In simple tasks, users depend mostly on voice feedback for confirmation. But in mission tasks, users look at screen to check the screen for visual clues for either confirmation of a task or understanding what went wrong with it. Also, while in a conversation with other humans, humans tend to use phrases like ‘hmmm’ ‘okay’ ‘yeah’ ‘nice’. NLP without the help of GUI makes it difficult to understand the essence and intent behind these phrase. Therefore, it is important to en-

gage multiple senses to understand feedback which will help maintain a conversational flow.

CONCLUSION

This paper aimed to understand the current scenario of voice interactions with AI and finding out inferences which can be considered to for further development in the same. We present our evaluation of ease of interaction with voice assistants using various parameters such as visual feedback and user emotions. We understood the factors which limit natural way of interacting with voice assistants e.g. invoking GA using 'OK Google' again and again amidst conversations. The paper suggests that relying completely on voice feedback cannot be a solution and other ways of feedback such as visual feedback and tactile feedback will also help user in understanding the interface of voice assistants. We also found out, problems like failure to detect intent, limit our interaction with the assistant. Overall, we set up scope for further study in this field by giving insights about user interactions with voice assistants.

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CONSIDERATIONS FOR CREATING MEANINGFUL INTERACTIONS BETWEEN USERS AND INTELLIGENT AGENTS

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ABSTRACT
This paper describes the process and result of developing 7 design considerations for human-agent interaction (HAI) by analysing literature from the past thirty years. We conducted an interpretive study of the literature where the primary focus was on how meaningful interactions can be created be-tween the users interacting with intelligent agents. The collected data was then synthesised creating a proposition for 7 design considerations for interaction designers. Lastly, we discuss the considerations revolving around applicability, transferability and possible implications of not adhering to a user-centred approach.

INTRODUCTION
Explainable AI is becoming more and more relevant as we see the development escalating towards the incorporation of artificial intelligence in everyday appliances and in our working lives. Significant institutions such as In-tel, MIT, and Google are in the midst of handling the problem, which might be a response to the larger regula-tory body of EU releasing its General Data Protection Regulation (GDPR) taking effect in 2018, which states that "meaningful information about the logic involved" must be a part of automated decision-making.

An important psychological aspect of user's comfort with their actives is the feeling of control they have over their activities and their personal life. They must be comfortable with the actions performed for them by intelligent agents, in part through a feeling of understanding, and in part through confidence in the systems.

In his article, "How Might People Interact With Agents", Norman (1994) considers the themes that might make or break the introduction of intelligent agents. He argues that there are two overarching areas in which technology must meet the requirements in order to be considered acceptable, namely the technical area and the social area. These considerations will only consider the social area concerning experience and usability of the agent, leaving technical implementation

considerations aside. Three decades later, the considerations in Norman's article turns out to still be valid, and even more relevant today than when it was conceived. Our paper is a response, in demand of the development of design guidelines for how we should interact with agents, now and in the future.

METHOD

The point of origin was the aforementioned article by Don Norman (1994) "How Might We Interact With Agents", where central topics were deduced: Feeling of control, overblown expectations, safety, privacy, interaction, hiding complexity & simplicity. The next step was a structured exploration process where the deduced topics served as a keyword in combination with Intelligent agents, artificial intelligence, HCI, human-agent interaction. The results revealed misalignment between some of the topics and the established keywords within the re-search community. We separated Feeling of control into the three keywords 'Power structure', 'Transparency' and 'Interaction' as these were aspects of the underlying issue. *Overblown expectations* became 'Anthropomorphism' as this was the true issue. *Hiding complexity* and *simplicity* contributes to 'transparency'. The overarching consideration about intelligent agents was discovered to be personalisation, as it was mentioned in the majority of articles in relation to many of the other considerations.

7 CONSIDERATIONS

In an attempt to understand the undertaking of explainable AI we sought to uncover previously conducted re-search with regard to how should be facilitated. Inspired by Don Norman's Article "How Might People Interact with Agents" (1994), 7 Design considerations were devised. These considerations encompass research regarding social science and Human-Computer Interaction.

PRIVACY

"The need for privacy is not only concerned with avoiding the detection of wrongdoing. White lies, and other deceptions are an essential, positive aspect of social interaction, allowing for smoother, friendlier social dis-course." (Norman, 1994)

Privacy is tightly linked to the user's trust in the intelligent agent. If the agent is unable to keep confidential in-formation private, it is not only a privacy concern for the user but a possible security risk. The idea that intelligent agents could have access to personal records, correspondence, and financial activities is disturbing to many individuals, no matter how helpful the agents might be.

TRANSPARENCY

"Agent transparency is the IA's ability to communicate information to the human operator in a clear and efficient manner, which allows the operator to develop an accurate mental model of the system and its behaviour, leading to calibrated trust in the system (Chen et al., 2014; Lee & See, 2004)."

Agents offer the possibility of providing friendly assistance so smoothly that users need not even be aware and promises to hide the complexity (Norman, 1994), and with transparency be easier to trust (Mercado, et al, 2015; Chen & Barnes, 2014) and easier to accept (Cramer, et al, 2008). The issue with intelligent agent collaboration it that it may violate the usability principles developed for direct-manipulation systems. Those principles include giving the user control over the system, making it predictable by showing a correlation between input and response, and making the system transparent to enable user understanding of the mechanics of the system. Intelligent agents may change behaviour according to changing user requirements and thereby violate the principle of predict-ability. Furthermore, it may not be transparent and thereby diminish the user's feeling of control of the system (Höök, 2000).

Transparency does not advocate complete insight into the inner workings in all its detail (Internal transparency), instead of allowing users to build adequate mental mod-els and provide a useful focus for collaborative discussions and the social construction of knowledge. The "black box in a glass box"-metaphor is an example of this, where the complex inferencing of users' goals is hid-den in the "black box", and instead of showing a simplified view on what is going on, in the "glass box", to the user. For intelligent agents, the challenge is what to place in the glass box and what to place in the black box, where the glass box may well be a metaphor used to convey the state inside the system (Höök, 2000).

INTERACTION

The interaction between the user and the agent should be as natural to the context as possible and suit the users' needs.

Successful HAI relies on the agent being believable, in the sense that it encompasses personality and emotion (Neto & Da Silva, 2012), and it has the ability to engage in sufficiently social communicative behaviour (Krämer, Von Der Pütten & Eimler, 2012).

Believability is strongly tied to the agent's ability to show signs of affection that incorporates mood, personality and emotion. By doing so, the agent is able to behave in a manner that is closer to that of their human counterparts, making the social boundaries between human and agent imperceptible. In turn, it permits the creation of a bond which could turn into a relationship but is still largely dependent on the benefits the user can achieve (Krämer, Von Der Pütten & Eimler, 2012).

Human communication relies on basic abilities as prerequisites for interaction and communication, where

it is difficult to imagine a way to interact with partners that do not possess these abilities. Developing radically different forms of interactions that would need other prerequisites that are easier met by agents, would also be problematic as the human collaborator would have to adapt to the new ways of interacting, aggravating the usability of the agent and thereby its probability of acceptance (David, 1989).

On a more surface level of interaction, the agent has to discover what type of assistant an individual user wants, as well as the particular assistance requirements the user has in a different context (Schiaffino & Amandi, 2004). However, this aspect is more related to 'Power Structure' and 'Personalisation' even more.

FEEDBACK

"An interface agent has to learn from implicit feedback since the explicit feedback is not always available. The reason is that not all users are willing to provide explicit feedback, mainly if this demands them a lot of time and effort." (Schiaffino & Amandi, 2004)

Feedback must be able to work both ways. The user should be able to provide feedback to the agent without turning it into a situation where the agent interrogates the user (Murray & Häubl, 2009). The system should provide the user with feedback ensuring them that everything is alright from a technical standpoint. The amount of feed-back will likely need to be toned down over time as the user gains confidence in the system, and may start viewing constant feedback as a nuisance. At the same time, the system should be able to process feedback provided by the user automatically (Schiaffino & Amandi, 2004).

POWER STRUCTURE

"Mixed-initiative interaction refers to a flexible interaction strategy in which each participant, user or agent, contributes what it is best suited at the most appropriate time (Hearst, 1999)".

In the human-agent collaboration, at any time one of the participants might have the initiative while the other works to assist. In any given situation the agent should be able to analyse the user and determine what type of agent, i.e. authoritative, collaborator, or delegator, and what assistance requirements he/she might need etc.

According to Schiaffino & Amandi (2004), an agent should be endowed with the capability of acting and autonomously propose solutions according to the current problem, but the power structure should work towards enabling the user's possibility of controlling and inspecting the agent's decisions. Furthermore, the agent should be designed so that the user has the final word with regards to the actions performed and additionally allow the user to trace back the actual sequence of acts and undo any that are seen as unwarranted (Norman, 1994).

ANTHROPOMORPHISM

Anthropomorphism (or personification) is assigning human qualities or features to non-human entities. Added to an agent design, it can create a more engaging experience, but might also be counterproductive and can create overblown expectations towards the agents' intelligence.

Anthropomorphism must be carefully considered as the user might believe the agent to have human-like intelligence and attributes. This can create frustration and the user might even feel deceived by such a system when it does not live up to their expectations. However, some agents might benefit from the added immersion created by anthropomorphism (Norman, 1994) (Hertzum, et. al., 2002).

PERSONALISATION

In order to create the most relevant and compelling agent, it is essential to predict and analyse the personality of the users, enabling the agent to shape to the users' needs.

Personalisation is related to many of the other considerations: Privacy, in the sense that some people might not be too worried about it. Transparency, as people are different and needs different things in their 'black' and 'glass' boxes to understand the mechanics. Interaction, as mentioned, specific users work best with specific types of agents. Feedback, frequency tolerance and interruptions are highly individual. Power structure, also related to interactions, some users value more initiative from the agent and vice versa. Lastly, Anthropomorphism, as some people benefit from the increased immersion. Over-all, agents must embed their user's values into a variety of suitable personalities appropriate for their particular context, because there is not one universal personality that suits every situation or every person.

Given that humans tend to treat computers like people, it is reasonable to suspect that users would prefer if computers acted more like people. So far, intelligent agent's user profiling process gets turned into an interrogation, aggravating its usability and generally asking far more questions than a human advisor would before providing a recommendation (Murray & Häubl, 2009). Other studies show that it can be lowered, down to a level with minimal user involvement making it seem like the agent learns from implicit feedback often, which is generally preferred (Schiaffino & Amandi, 2004; Soltysiak & Crabtree, 1998).

DISCUSSION

The considerations presented in this paper gives an over-view of what interaction designers or any designer must take into account when designing for interaction between a human and an Intelligent Agent. The considerations are derived from existing literature because in order to see where the HAI paradigm lacks completeness, we must first assess what is already

at hand. A possible next step would be to further solidify or dissolve the considerations into design guidelines by performing studies involving users. Some considerations might be more important than others and this must also be explored further.

This paper is not alone in creating considerations for HAI. One angle on this is Intel's 6 challenges within Explainable AI (Intel, 2018). Where Intel's challenges focus more on the entirety of intelligent agents and artificial intelligence. By that, they are not specifically targeting the problem of how users experience this interaction. In our opinion, we, as designers, need to have a user-first focus on artificial intelligence and ensure that design considerations support that.

The considerations presented in this paper is an attempt to set a direction for devising design guidelines, that can be utilised to ensure higher user value and meaningfulness. Most importantly, we are hopeful that the human is never forgotten in the field of AI, and hopefully one day, a unified usercentred theory of HAI can be conceived.

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AUGMENTED SOCIAL NETWORK ARCHITECTURE

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ABSTRACT
The current model of social media interaction uses GUIs which limits the quality of social interaction and faces a lot of socio-technical issues. In this paper, I explore a conceptual framework, ANSA (Augmented Social Network Architecture) for an AR/VR social network platform using the existing system architecture and mental model of users. The framework primarily consists of the virtual container, context-based content, and frequency-based content and attention mediators as the backbone. It has been developed through a co-creation, qualitative user interviews and a series of VR prototypes namely, virtual cylinder, virtual dome box, networked virtual cylinders. The paper further addresses the benefits and issues related to the application of the framework.

INTRODUCTION
Social media has become entangled in our day to day life. The embodiment of the technologies with the users has diminished. This has further poised technical issues related to the quality of interaction and sociological problems like disembodied users (Hardey, 2002). A new wave of explorations to create social media applications user AR/VR has been explored in the domain of online video games, finance application, video chat, and similar activities where the identity of the user is limited to his/her avatar interaction. Secondly, it raises ethical issues concerned with ownership, identity, and privacy of the user in this new form of virtual space. In order to build a platform in the medium like VR/AR, the designer's role expands beyond tracking the head movement, ergonomics, and applications in 3D User interfaces to augmented infrastructure created by these platforms. Unlike, social networks, this form of augmented infrastructure encounters an entirely different social form of communication, content, dynamics, and mediators. Designers and technologist need to design, novel mediators like attention currency (Davenport, 2001) to create a sustainable AR/VR social network interaction. With the proliferation of non-human entities like artificial intelligent chat bots, it is getting harder to check the difference between a real and fake user. Hence, a study of assemblages of social network actants (Law & Hassard, 1999) like human and intelligent chatbots acting and affecting each other in a

cohesive network needs to incorporated into the design consideration.

In the first half of the paper, I explore the 3D mental model visualization of existing social networks. It is created qualitatively through a co-creation workshop and a series of iterative VR prototypes. In the second half of the paper, I speculate a conceptual framework called ASNA (Augmented Social Network Architecture) that combines human and non-human entities, reflecting upon the knowledge gained from VR prototyping and explorations.

THE MENTAL MODEL EXPERIMENT

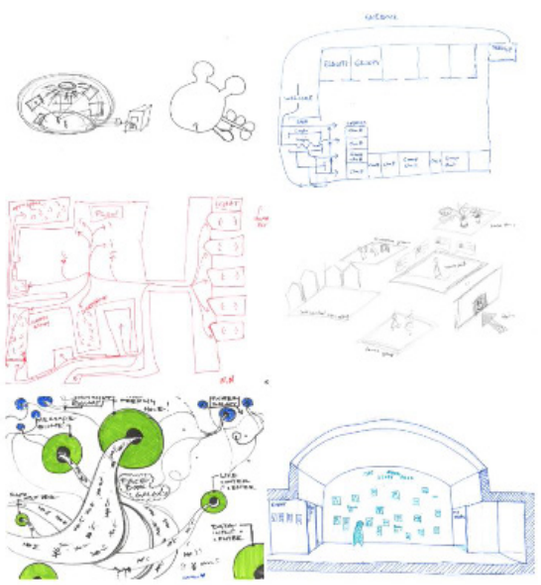

Figure 1: Results from the participant's co creation workshop

The aim of the experiment was to study the 3D mental model of virtual space for a social network website used frequently by billions of user across the globe. The target group consisting of 14 participants spanning from the background digital media, architecture, industrial design, and interaction design from Umeå University were invited for a co-creative design workshop. The participants were asked to brainstorm of their mental imagery of one of the widely used social media called Facebook individually or in the group. At the end of the workshop, the model sketches were collected to be studied further.

OBSERVATION

A qualitative semantic study on the drawings (Figure 1) revealed a recurring pattern in the way the participants translated and recreated 3D space of a social media website. It was observed that

- The chatroom was depicted as cubicles separated by opaque walls.
- The newsfeed content was depicted as a gallery surrounding the viewer.
- The user profile was depicted as an isolated blocked space.
- The events were depicted as a sticky note wall,
- The login windows were depicted as narrow corridor with multiple entry points.
- The homepage was described as an open and empty space.

In the second half, the participants were asked to reflect on emotions associated during and after using this 3D social network space in their day to day lives. In the second half, the participants were asked to reflect on emotions associated during and after using this 3D social network space in their day to day lives.

PROTOTYPES

The qualitative data from the co-creation and follow up discussions were further used as an inspiration to build artefacts for AR/VR social media platforms. Three artefacts were designed e.g. virtual cylinder, virtual dome box and networked virtual cylinder to visualize these perceived mental models in 3D. The prototypes were created in a VR environment using Google tilt brush VR tool.

VIRTUAL CYLINDER

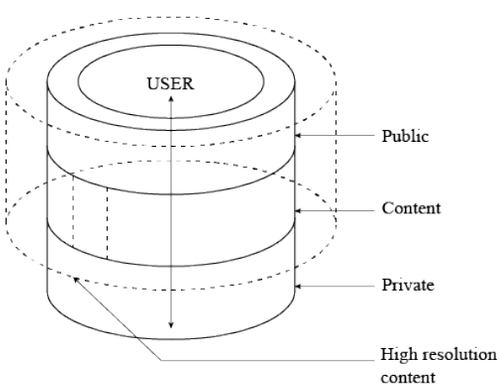

Figure 2: schema of virtual cylinder

In the mental model experiment in the previous section, it can be observed that the virtual spaces like walls and rooms are a mere projection of user's privacy of data and accessibility of its content. For example, the user profile was depicted as an isolated blocked space where as the homepage was described as an open and empty space clearly showing the division by privacy. The prototype named virtual cylinder was created combining the values of the users. It consists of a cylindrical container (Figure 2) embedded around the user with contents shown on the curved surface of geometry. The container is divided into three vertical sections i.e. private section, content section and network section. The layered concentric cylinder acts as an extension of content section to adjust the resolution. For example, the inner layer consists of a slowly moving content ring, as the user selects a

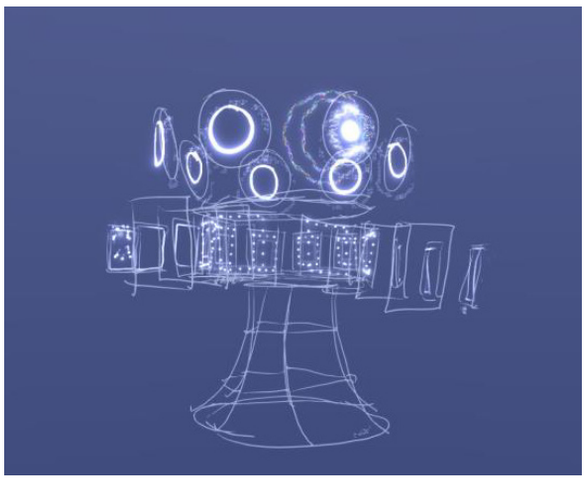

Figure 3: VR wireframe Virtual Cylinder

content ring, the ring expands into rich and detailed outer layer. The virtual cylinder wireframe was created in VR space (Figure 3) and it was qualitatively evaluated by the users to test the usability. However, the user interacts as a static observer in this VR space switching vertically just between private, content and public section. But, for a richer quality of interaction a context-aware (Mayer et. al., 2016) space was needed to create valuable social encounters. This led to a next iteration called *Virtual Dome Box.*

VIRTUAL DOME BOX

The dome-shaped virtual container is spatially mapped exactly like a real-world context-based navigation (Figure 4) where the contents are located precisely at the point of their original generation. The user can navigate through this space while retaining the embedded *Virtual Cylinder.*

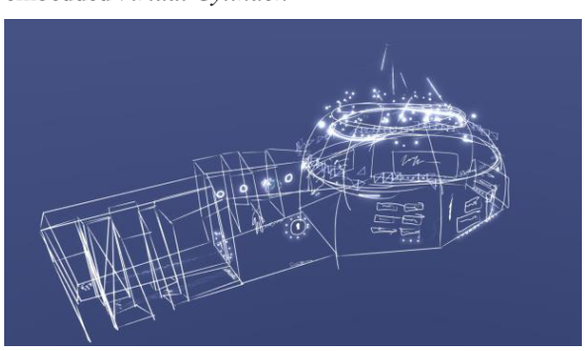

Figure 4: VR wireframe of virtual dome box

The Virtual Dome Box creates a richer space for human-human interaction. However, it faces the similar problems that exist in current social media. For example, how can the user differentiate between human and non-human entity in this virtual space? Who defines the ownership in this context aware hybrid digital space? Will the advertisement proliferate space the same way as the current social media networks?

The questions addresses the socio-technical complexity that challenges the human-centred methodologies used to create social media platforms these days. Hence, *Virtual Dom Box* is iterated further to create a conceptual model called *Networked Virtual Cylinder.*

NETWORKED VIRTUAL CYLINDER

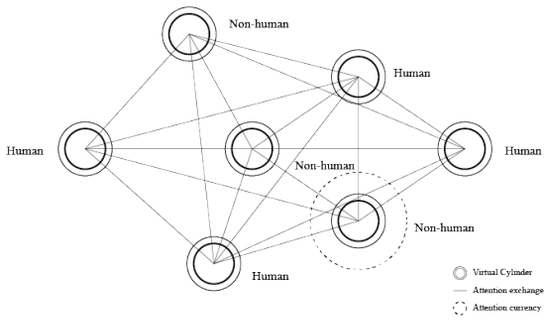

Figure 5: Networked Virtual Cylinder

The networked virtual cylinder (Figure 5) acts as an assemblage of human and non-human entities in the social media having peer to peer contact.

The feedback loops of content generation and mediation through likes and emojis seems to limit the capacity of expression in social networks, so a mediator variable called *attention currency* is designed to make the feedback loop sustainable. The exchange between the user and content is primarily calculated by the attention given to content in VR. In a broader sense, it unifies the currency used by the human entities i.e user and non-human i.e entities A.I. chat bots or similar. The non-human entity can now interact with the content of human entities and vice-versa.

The time based content sorting or the newsfeed might not work in this *Networked Virtual cylinder*. For example, the information and messages stored across various social media are valuable, but they are sorted linearly with time. This leads to irrelevant and unorganized information placed next to each other in social networks. Hence, a frequency based information sorting designed to display the content sorted by its relevance and decays with time. The frequency-based content sorting is inspired by a method called *Fourier transform* in a way similar to how a musical chord can be expressed as the frequencies of its constituent notes.

RESULTS

I reflect upon my learning from the early VR prototypes and *Networked Virtual Cylinder* concept to propose a framework called ANSA (Augmented Social Network Architecture) with three basic foundations at its core.

CONTEXT-BASED CONTENT

The content in the framework is location based or contextually generated (Mayer et. al., 2016) by human and non-human entities. The user consumes the information by navigating through multiple layer of the same content by physically or virtually. This eliminates the misinformation, information isolation, as the user can navigate to the root location of the content.

FREQUENCY-BASED CONTENT
The content is stored and delivered to the entities through sorting them by the frequency based clusters or metadata instead of the time of update. This further helps the entities to separate relevant informations from the unused ones.

ATTENTION-BASED MEDIATORS
Unlike, current social network mediators, the framework uses a novel mediator called *attention currency* (Figure 5) to create a common language in the economy of the users of the social media. The relevance of a content can now be calculated through the attention spent on a certain content by a human or non-human entity instead of number of likes and reactions on a particular content.

REFLECTION
The mental model experiment suggested that social network acts as a virtual living space for user. It facilitates a form of interaction between the virtual avatar of the user and the assemblages of human like the virtual avatars of friends, family, non-human entities like *chatbots* indistinguishable from each other. These kind of interactions are mediated by the algorithmic data of emoji, reactions, advertisement and content. Unlike current human-human interaction, human-machine interaction mental models, the form of interaction emerged in these platforms is like passive interface between a human and an assemblage.

DISCUSSION AND CONCLUSION
The next wave of social network interfaces embodies us further into head-mounted displays; it goes deeper into the sensory motor skills of human. However, it has its own benefits and consequences which calls for interaction designers to not only look at the quality of interaction between human-human interactions in these social networks, but also to design the socio-technical systems and frameworks around it.

The proposed framework is the first step towards creating an inclusive interactive systems consisting of human and non-human entities in AR/VR social platforms. First, it starts with zooming in the development of skeuomorphic interfaces for users called *Virtual Cylinders* taking an inspiration from the qualitative outcome from co-creation workshop and user reflections. Second, it zooms out to visualize the application of *virtual cylinder* in an assemblage of human and non-human entities called *Networked Virtual Cylinder.* The framework needs further empirical research, testing and artefact creation in collaboration with linguist, anthropologists, architects and scientists in order to create a fluid, evolving, organic, and decentralized digital architecture for AR/VR social network. Although, the framework can alleviate some issues in social networks like filter bubbles, fake news, in a conceptual level, still it has to consider the issues like ownership of the this augmented space. For example, one of the proposed aspect of the framework called *context-based content generation* needs a physical space layered over existing infrastructure like google maps or physical location to store and deliver the content. But the companies might still compete for the attention in this new infrastructure. The ownership of space in the proposed framework is still remains an open question to the research community.

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POSTERS

UNLEASH YOUR CARE

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ABSTRACT
As designers we have the power to influence how others engage and experience the world around them. Designing within the emerging field of embodied design, we are not just designing objects for the worlds and bodies that we inhabit, but we are designing for the worlds and bodies that other organisms inhabit. In this work, we wanted to consciously design for other embodied beings, and understand what other ethical questions and design challenges emerges in such a particular design process.

INTRODUCTION
Just as our nervous system, our body and environment is an interactive dynamic cognitive system (Barrett, 2011), we co-inhabit the physical world around us with many different organisms and are intertwined and affected by them When we talk about embodied design, we often refer to our own physical bodies, along with the senses that it entails. However, designing for the human body is still very abstract, if the designer does not develop sensitivity to the fact that each living human inhabits a different body. Thus, each human has individual past experiences with their bodies, diverse relationships to their bodies and very different ways of experiencing and understanding their bodies. Having this as an initial standpoint for the design project, we wanted to explore how diverse we and other organisms experience our bodies in relation to the material world.

The scope of the project brief was initially very broad. There were no particular creative constraints, apart from the objective of using the technology of soft robotics to design an embodied experience.

Through the application of different embodied ideation methods (Wilde, Vallgårda and Tomico, 2017), field studies and prototyping, we were able to develop a concept, embodied through a physical prototype.

EMBODIED EXPERIENCES
To initiate the project we made observations of

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EMBODIED EXPERIENCES

To initiate the project we made observations of different environments in our every day lives and noted down the different embodied encounters we had or observed others making. Doing this, we eventually had a collection of sketches, notes and pictures of diverse embodied experiences, which we could further explore. We wanted to understand how these experiences could be enhanced, changed or re-learned.

Inspired by the work of Wilde, Vallgårda and Tomico (2017), we applied different embodied ideation methods in which the focus was on the concept of estrangement. By making an experience strange and de-familiarizing ourselves with it, it demanded attention and brought forth questions to re-think what we usually took for granted (Wilde, Vallgårda and Tomico, 2017).

We did different experiments such as disrupting the body by restricting its movement with materials (eg. tying the arms while drawing, wrapping soft plast around the body while walking). Doing this we were made aware of our bodies in new ways, noticing new details about how we use utilize our bodies in different situations.

There were three particular embodied contexts we wanted to explore through the use of materials. One was the different sensations you have in the morning related to the weather outside. The second was the situation in which you unconsciously snore while sleeping, while the third related to the experience of walking a dog.

The latter, we initially understood as an embodied experience for the human. However, considering that an embodied system alters the environment in which it is embodied (Barrett, 2011) we realized that there were two bodies involved in that particular activity. Obviously; the human and the dog. We wanted to understand it from the dog's perspective and applied the EI methods, by tying ourselves as a dog with a leash. These different activities, brought forward many questions that we had a hard time answering. For instance; *Are we designing for the dog or the human or both? How do we do this, if the experiences are so different? How does a dog actually experience the act of being taken for a dog? Are we as humans simply imposing our designs on others?*

All these questions were too difficult to answer, which led us to the decision of visiting a dog shelter.

FIELD STUDY AT A DOG SHELTER

We went and visited a dog shelter in Kolding, Denmark, where all of our assumptions got shattered. The woman at the dog shelter explained how the dogs per nature, does not enjoy being kept in a leash. She explained how it was animal abuse, and that dogs, if treated well, could freely walk without the leash. She told stories from experiences she had, and introduced us to different dogs, each with their own horrifying stories. One was sexually abused, while another was starved. These different experiences, highly affected how the dogs would react to humans, and how they would respond to potential new owners coming to see them. She stated, *"each dog has a past and experiences that shape how they use their bodies and how they engage with the world"*. This finding made us re-evaluate our design ideas, and led us to shift our focus of design. We wanted to understand how we could design for a dog-human relationship, in the situation where new potential owners come and visit the dogs. Knowing how terribly these dogs had been treated; many of them understandably had trouble trusting humans. How could this trust be regained? How could the difficult process be aided?

UNLEASH YOUR CARE

Through several explorations with the technology of soft robotics, going through several design iterations, we eventually designed a concept for a dog-human relationship. As a statement against our initial idea, related to the design of a leash, we called our concept "Unleash your Care". The design consists of a wearable for the human as wristband that contains a soft robot, which imitates the breath of the dog that he or she is visiting, through movement. By stroking/scratching the wristband, the dog will feel it in a light vest that it is wearing (physically detached from the wristband worn by the human). The strokes/scratches of the human are directly imitated on the dogs back. If the dog feels stressed, excited, etc. the wristband, which the human

is wearing, will behave accordingly.

According to Väätäjä (2015) tactile human animal interaction seems to have benefits to both, this can be visible in the increased oxytocin levels post interaction. And in this way increase relatedness and perceived intimacy in human animal relationship (Cheklin et al. 2016). Therefore with this design, we were trying to create an embodied connection between the dog and the human before they actually physically encountered each other. So far most of the animal-centric technology have been typically focused on human advantage and perspective (Hirskyj-Douglas, Read & Cassidy, 2016). Therefore, with our concept we tried to avoid that, and give both dog and human equal consideration. We were aiming to bring forward new questions related to how dogs and humans can have different experiences, (especially in such a sensitive situation as adoption, in particular, when it relates to the adoption of dogs with abusive pasts) and how dog's experience can be easily overlooked.

CONCLUSIONS

The project lasted for less than 10 days, so our aim of this project was not to propose a concept that we wanted to develop as a specific design proposal. Rather, we wanted to provoke our fellow design students in reconsidering the approach we have to design, and bring awareness to how we as designers have a responsibility to understand how our designs affect other organisms. Further we wanted to state with our concept, that similarly to how we as humans experience our bodies differently – other organisms also have diverse embodied experiences. Our aim with our design was to bring forward questions that could bring awareness to how we as humans are not the only ones living in this world. Considering, how we as designers had a very human-centred approach to designing, our next question is; how do we start involving other races than the human race in our design process?

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BIOSONAR SKIN – REIMAGINING HUMAN VISION

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ABSTRACT
Biosonar Skin is an experimental project created during a 7-week long course in Wearable Technologies. The project's goal was to find out whether biosonar, a unique navigation sense used by animals, is transferable into a wearable experience for humans. Supported by electronic prototyping and user testing, the outcome of the project is an interactive wearable prototype that allows the user to see with their skin through haptic feedback.

INTRODUCTION

Animals, like dolphins (Au et al., 2012) bats (Suga, 1990), and some trained humans (Thaler, Arnott and Goodale, 2011) can see without eyes using biosonar (also called echolocation or "clicking"). Biosonar is the ability to navigate by emitting a high-pitched sound and listening to the echo. As an example of biosonar, bats let out high-pitched shrieks that bounce off their prey, which enables them to hunt in the dark.

Biosonar Skin is an experimental project in the domain of embodied design. The goal of the project was to create a wearable that empowers the user to experience the world in a novel way: seeing through haptic feedback. To achieve this, we built on research from the field of neuroscience and interaction design.

RELATED WORKS

Echolocation (locating with sound) does not uniquely belong to the animal world: humans are using this skill unconsciously every day in situations like hearing a bottle fill with water or knocking on a container to see whether it is empty or not. Some individuals developed echolocation to another level. Research on blind echolocators shows that the human brain can learn the ability to see without using the eyes). While the subjects were navigating through "clicking", Thaler, Arnott and Goodale (2011) recorded neural activity in their visual cortex instead of the auditory cortex, as opposed to sighted people who do not echolocate.

Prior research suggests that neuroplasticity, the ability of the human brain to transform itself through learning new skills, makes it possible to see without using the eyes. When considering ways to substitute sight, tactile feedback is a very effective method with many possibilities. Providing tactile feedback on the tongue has been proved to be a successful therapy method for people who lost their ability of balance or sight (Bach-y-Rita et al., 1969).

Biosonar navigation has already inspired numerous technological innovations (Müller & Kuc, 2007). However, there is a lack of research regarding the use of biosonar as a wearable navigation tool. During the project we explored the design space on the human body, to determine how this knowledge can be combined with the possibilities of wearable technologies.

Thus, we utilised Biosonar Skin to look for a literal answer to the philosophical question proposed by Nagel: "What is it like to be a bat?" (Nagel, 1974). To design a new human skill, it built on both biomimetics, using nature as an inspiration for new technologies, and neuroscience, studying the possibilities of the human brain. The research questions of the project were the following: How could biosonar be transformed into a wearable experience? Can a new human sense be designed with the help of technology? To determine the answers to the above questions, we set up the following practical goals: Finding the optimal type of haptic feedback for wearable biosonar, finding the most effective feedback placement, choosing the appropriate materials and exploring possible future applications of a wearable biosonar experience.

DATA AND METHODS

Thaler's research on human echolocation showed that flexibility and control (e.g. the ability to turn the head) are important while navigating. The two possible locations on the body with appropriate amount of control are the forehead and the palms, so these were chosen as potential sensor placement areas. After this was determined, we tested the two options. The electronic prototyping was done with an Arduino Uno board. It had a detachable circuit board to which different output devices were connected. Our user testing consisted of sensor-placement evaluation and feedback location evaluation.

SENSOR PLACEMENT

To test the sensor interaction without the haptic feedback, during our exploration we used a system with an ultrasonic proximity sensor as the input, and a buzzer as the auditive output. The input transforms reflected ultrasonic waves to determine the distance of surrounding surfaces. The output was the sound of the buzzer, with increasing frequency as an object became closer to the sensor, which we validated before using. Sound was controlled with a potentiometer, which simulated the output of the ultrasound sensor.

To evaluate the usability with sound patterns as feedback, the user was asked to navigate through a crowded space with eyes closed (Figure 1) with the ultrasonic proximity sensor fastened to her body. She used only the auditive feedback provided by the prototype. She completed this task two times, with the two sensor placements: forehead and palms. She was observed during and interviewed after the testing to determine which sensor placement method was more effective.

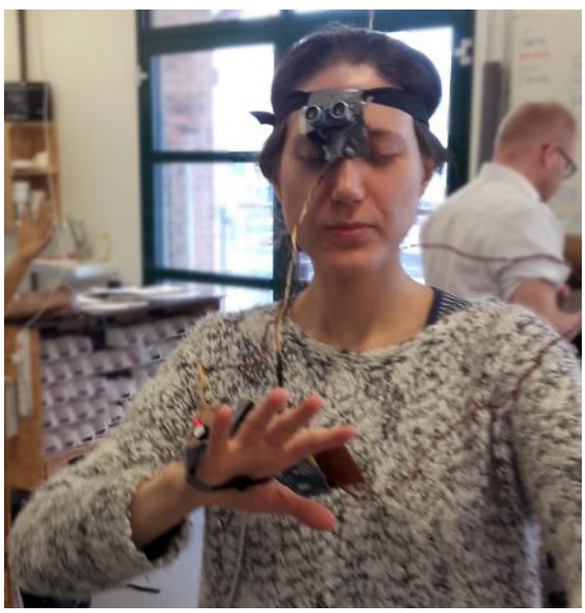

Figure 1: Sensor placement testing in a crowded workshop

FEEDBACK TYPE

Several feedback types were considered before the navigation testing: heat, vibration motors, vibration from small speakers, electrotactile feedback, pressure using a servo motor. Due to time-constraints for user testing, vibration from small speakers, electrotactile feedback and pressure are beyond the scope of this paper, and we focused on vibration and heat. We explored conductive heat for thermal feedback, however when applied on the skin, it was too slow to use for navigation testing. While we suspect that it is possible to have faster thermal feedback with higher current and therefore response-time, we left it out due to safety reasons. Thus, vibration was chosen as the final form of feedback for the test prototype.

FEEDBACK LOCATION

To gain an understanding on the vibration motor's impact on different parts of the body, five participants (3 male, 2 female) tested the feedback device. They were instructed to imagine that they have to navigate in a dark, crowded room, and vibration was the only way of seeing. Then they were given a small vibration motor, controlled by a potentiometer, to spontaneously place on their body and give feedback on how they feel about each placement choice. During this, we noted the motor placement choices and the comments on a human body outline sheet. (Figure 2)

EVALUATIONS

The result of the placement testing was that even when the sensor was placed on the forehead, the subject was still using the palms to navigate, for greater sense of control and safety.

Feedback placement results suggest there are personal preferences, however two outcomes were common in all subjects:

The area on and around the head was the most uncomfortable, as it was not only tactile but also an auditive input. *"I can hear it…this is not pleasant."* (P1) and *"If I put it close to my ears, it is frustrating"* (P2)

Some also commented the lack of tactility *"Let me try the forehead again…no, there is not enough contrast"* (P2), however the vibration on the palm provided the best input for navigation, *"On my palm…it helps you find your way."* (P1), and *"Placing in on my wrist is like…it keeps you alive... The vibration on my fingers tell me if I am about to touch something."* (P2). Some clearly indicated preference to the hand *"I prefer it on the palm, with my hands closed."* (P3).

The heat map on Figure 2 illustrates the results of the answers from the five participants. The image is the same as the one used during each test session to mark the feedback. Each dot represents a vibration motor placement and the intensity of the color represents how many participants gave the same answer. The red areas show negative, while the green areas show positive feedback.

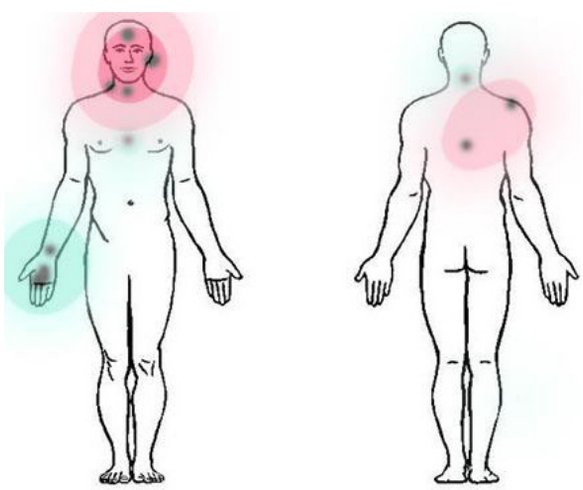

Figure 2: Heat map – vibration feedback placement

Vibration on or close to the head proved to be very noticeable. However, to maintain the experience of a natural sense that is not too distracting, the second option was chosen for the final concept.

RESULTS

The final feel of Biosonar Skin took inspiration from the octopus: octopuses can see with their skin using lightsensitive skin cells that are also able to change texture when exposed to different circumstances. Building on biomimetics, the final material of the prototype consists of an electroconductive thread circuit embedded into silicone.

Based on the prototyping and user testing results, the final concept is a glove-like silicone wearable with a proximity sensor and a small vibration motor placed on the palm.

DISCUSSION

Biosonar Skin imagines a future where humans can see with their skin. The possible uses of this new sense are endless, from seeing in the dark or through smoke to feeling air pollution on our skin. The plasticity of the human brain combined with emerging technologies, like e-skin, make this a possible reality.

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STORY BLOCKS: A TANGIBLE LANGUAGE FOR TEACHING COMPUTATIONAL THINKING

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ABSTRACT
This poster describes a tangible didactic language designed to support education within Computational Thinking for Danish third-grade school children. Based on Jeanette Wing's thoughts on computational thinking we collaborated with a school teacher to develop and test low-fidelity prototypes supporting algorithmic thinking and logical reasoning in a classroom setting. Focusing on engagement and perseverance, we built and evaluated a functional prototype of Story Blocks as the Smart House, supporting logic reasoning with playful storytelling.

INTRODUCTION

In the recent years, we have seen a push to introduce programming to the Danish primary school curriculum For the larger part of the population, coding and programming are perceived as a secret language that can only be understood by the few. Current Danish teachers education does not include coding or programming, meaning that the teachers are poorly equipped to take on the responsibility of teaching within the subject. Working with teachers, we discovered this to be true and also noticed a lack of resources towards time allotted for teachers to develop new educational content. This means that teachers are pressed on time and would need didactic tools that support their existing knowledge in order to introduce teaching within the fields of programming.

BREAKDOWN OF PROGRAMMING

There exists a world of programming languages. There are also numerous platforms, frameworks and paradigms, each catering to a different type of problem or system. So what is relevant when we discuss programming in a primary school context?

In the work presented here, we have based our understanding on the theory of Computational Thinking (CT). Defined by Jeanette Wing (Wing, 2006), CT is *"A way that humans, not computers, think"*. This has been applied in a Danish primary school context by Erkmann & Petropouleas (Erkmann & Petropoulas,

2017), supplying a didactic framework for activities within education in CT. From this framework of CT, we apply two concepts - *logic reasoning* (the same input should always give the same output) and *evaluation* (the act of predicting the outcome of a logic statement).

CONCEPT

On a conceptual level, the language consists of four abstract Story-classes: The *Environment, Hub, Block* and *Character.*

The Environment sets the scene for the narrative: This is where the story happens and is played out. The Environment has a number of actuators, which can change state by adding statements to the Hubs. The statements are logic statements represented by one or more Block(s), each containing a story element. The elements can either be environment state, or can be Characters - story actors, whose movement within the environment may be picked up by Environment Sensors, inducing changes in the environment state. The Characters are represented in the language by Value Blocks, which allow Blocks to be assigned a variable.

IMPLEMENTATION

We implemented the language first as a low fidelity cardboard wizard-of-oz prototype. The Smart House Environment was chosen as it is naturally understood by children and teachers alike. Simple concepts such as weather conditions, day- and nighttime are used Familiar characters are introduced - the boy, the girl and the cat. The house functionalities are basic - opening of a door, activating the outdoor light. This allows the child to produce narratives and play, making the environment come alive by adding the Story Blocks to the Hubs.

LEARNING

After testing the cardboard prototype with 3rd grade school students and their teacher (see figure 1), a functional prototype was developed. The prototype compiles real-time, allowing instant feedback on the logic statements that are set up. This supports *logic reasoning* in a learning-through-playing or even learning-through-storytelling situation. During or after play, the teacher may discuss the narrative and the Logic Blocks setup with the child. This can be done through inquiry (*"how do you want the Smart House to perform?"*, *"why have you set the Logic Blocks in the way that you have?"*) or even through setting up riddles for the child (*"How would the Smart House react if we add this Block?"*). This child-teacher dialogue supports the concept of evaluation.

Figure 1: Cardboard prototypes of the blocks and hubs were constructed and tested with 3rd grade students.

COMPLEXITY

The complexity for the Story Blocks consists of three levels of logic complexity. The first level revolves around attaching one block to one hub. The block may express a situation within the reactive-environment that is either true or false (see table 1, row 1+2).

The second level of complexity is by connecting two or more blocks to one hub and thereby creating either a "OR"-expression, or an "AND"-expression (see table 1, row 3-6). It is also possible to combine these expressions. As the Story Bricks enables all kinds of boolean logic it is even possible to create a complex logic construction such as the "XOR" (see table 1, row 8).

The final level of complexity is to construct logics that can maintain a state of the system. In Story Blocks there is a block that is controlled by the hubs. By adding this block to the same hub that is controlling it, the hub becomes active indefinitely. By adding a start expression and a stop expression it is now possible to set a hub active with one expression and have it maintain that state until a certain condition is met (see table 1, row 7). These levels of complexity enable the teacher to facilitate differentiated instruction by providing the necessary blocks and hubs for each student to meet their abilities.

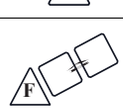
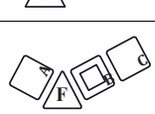
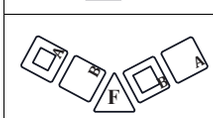
Illustration	Boolean expression
	! = #
	! = #
	! = # ∨ %
	! = # ∨ %
	! = # ∧ %
	! = # ∨ (& ∧ ()
	! = ($ ∧ &) ∨ ($ ∧ &)

Table 1: This table illustrate the complexity levels of Story Blocks. Triangles represent hubs and squares represent blocks.

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DESIGNING HEALTHY DIARY FOR THE ECZEMA SUFFERERS

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ABSTRACT
Eczema is a serious skin disorder that caused many bad effects to the life of people who suffered with it. Many of them don't have the broaden knowledge about the right treatments for this diseases until they become addictive on using topical corticosteroids and experiencing the red skin syndrome (RSS). Doing an elimination diet can help the patients to boost their immune, reduce the eczema symptoms, and even get healed for uncertain period of times. However, running a diet and doing healthy treatments with a high level of discipline is a big challenge. Hopefully, a healthy diary that specifically designed to help people with eczema doing the elimination diet and keeping update about any information related to eczema will support and guide them to get rid of this diseases.

INTRODUCTION
The aim of this research is to develop a design idea to help people with eczema find the way out of their illness by doing the proper diet and apply the right treatments.

Around 20% of children and up to 3% of the adult population in the world are affected by eczema, the chronic inflammatory condition that cause the skin to become red, itchy, and inflamed. The most common type of eczema, called the atopic dermatitis. The symptoms of every person with eczema can be vary. They often experiencing a chronic itch and flared-up skin that can lead to sleep disturbances. Moreover, it creates a limitation for doing daily activities. In some cases, it is very painful for the people with eczema to wash their hands or just go for a walk. Some of them couldn't go to school or work because of this illness. Most of the eczema sufferers are frustrated and feel embarrassed by their appearance. Even so, some kids with this disorder face bullying.

In order to reduce the inflammation and relieve itching, doctors typically suggest the patients to use the steroids cream. Unfortunately, using large quantities of topical corticosteroids (TCS) for long periods of time will make skin worse and patients may present as the red skin syndrome (RSS). When people suddenly stop using the steroids after a frequent use, they will experiencing the topical corticosteroids withdrawal

(TSW) where the burning bright red skin is appeared.

The stories and experiences of some eczema survivors shown that doing a certain diet can help them to get rid of this skin diseases. Eating alkaline and anti-inflammatory foods will boost the immune system and reduce the eczema symptoms. Marlisa, an Indonesian eczema survivor telling her stories facing the eczema and TSW until she got healed by doing elimination diet. She wrote an e-book and actively spread the information related to eczema . However, implementing the proper diet itself is very challenging. I takes a lot of hard works, extreme discipline, and supportive environment.

It is necessary to gain awareness of eczema, the side effects of steroids, and the right treatments to relieve the symptoms.

Therefore, designing a specific diary for eczema sufferers to monitor eating habits, treatments, and the progress of their skin condition will be very useful.

METHODS

This research use a method called a diary study, which is used to collect qualitative data about user behaviors, activities, and experiences over time. In this case, the participant who did the study is the writer of this paper, who has been living with eczema for almost 20 years.

RESEARCH THROUGH DIARY STUDY

To begin with, while doing the elimination diet, a daily time table was made to record the eating habits for two months, from May 2017 until July 2017.

Figure 1: Monthly time-table as a food diary.

This daily time works as a tracker of the eating habits. Secondly, it can be turns into an analyzer which analyze the cause of skin or health condition, whether it gets better or worse, based on the foods eaten. After that, it is good as a controller and reminder to continuously taking care of our health since there is a guilty feeling when we realize that we eat bad foods. Furthermore, seeing the records of healthy habits which caused the good effects can motivate us to keep going on the diet.

On the other side, this diary still have some shortages. It doesn't guarantee to be 100% discipline. Sometimes, the user may forget to immediately write down the eating habits. The daily column also too small to record the other factors that could influence skin condition such as exercises, weather, sleep-hours, moods, and another treatments like applying the skin care products.

IMPROVING THE DIARY'S DESIGN

Some columns were added to record the sleep hours, moods, exercises, and symptoms that appears on each day. Those additional factors should give more information to analyze the relation between the habits and the symptoms.

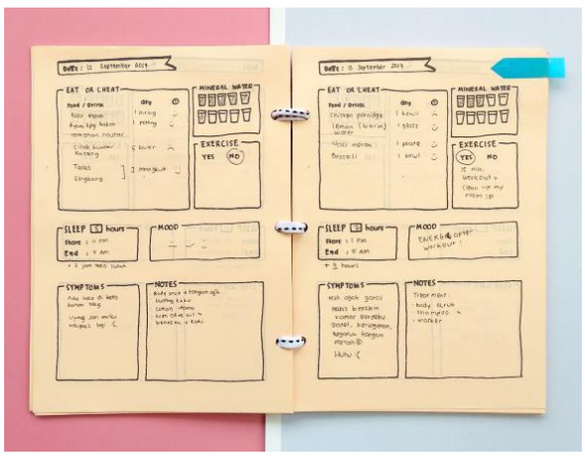

Figure 2: The improvement of healthy diary.

RESULT

The diary is useful to analyze the correlation between the habits and the symptoms of eczema. For instance, it can be shown that eating dairy products like eggs and having less sleep hours has a strong correlation with the bad skin condition. In contrast, eating more vegetables can faster the skin cell regeneration. The elimination diet itself brings the positive impact for health. There is no more suffering from flu after consistently eating alkaline foods for about two months.

EVALUATION

The eczema diary doesn't cover the needs of capturing pictures of the habits and symptoms. It will be easier to monitor the progress by comparing the skin condition day by day through some pictures. In addition, it will be good if the insight from keeping this diary is easy to share to embrace other people on living a healthy life and get aware of eczema and the other skin issues. It should be nice if this diary then developed to be digital.

CONCLUSION

Keeping a daily food and habits diary can help people with eczema to build a self-discipline while doing an elimination diet. It can also bring a knowledge about whether some foods, habits, or treatments are good or bad for their skin and health. Moreover, there should be some improvements to create a better diary and make it more accessible and can connect the eczema sufferers around the world to support each other.

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