



The PEP

Creating and evaluating a user centered speculative design that aims to trigger discussion around the consequences of technology on mental health

Master's thesis in Interaction Design and Technologies

JENS HULTEBERG & VENDELA STENSON

MASTER'S THESIS 2021

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UNIVERSITY OF
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UNIVERSITY OF GOTHENBURG
Gothenburg, Sweden 2021

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Master's Thesis 2021

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Cover: An infographic showing the PEP and some of its use-cases.

Typeset in L^AT_EX

Gothenburg, Sweden 2021

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Abstract

In an increasingly digitalized and connected world it appears important to cultivate healthy and constructive relationships between humans and technology. In this thesis, a speculative design has been created and evaluated with the aim of triggering discussions around the consequences of technology on mental health among young adults. The thesis investigates if a prominent user centered focus could enrich a speculative design so that it appeals to the general public and specifically to young adults. A thorough user study was conducted and the target group was constantly considered throughout the whole project process. The final speculative design is a wearable that harvests the user's body heat in order to generate electricity in a fictional future where electricity is scarce and society does not want to give up the comforts of technology. The evaluation proved that the speculative design clearly connected to the target group due to aspects of the product that was based on the user study. This validates that the user centered approach did enrich the design. Continuing, the result shows a rich data set on the target groups opinions, dreams and fears for the future of technology in relation to mental health as well as discussions on different aspects of design that the user group appreciates.

Keywords: Speculative design, Wearable, user-centered design

Acknowledgements

We would like to thank:

Our supervisor Mafalda Samuelsson-Gamboa for her being ever present with guidance, inspiration and input through the project.

Sara Renström from RISE for her insightful feedback and creative input.

Peter Ljungstrand from RISE for getting us on the path that led to this project.

The many interviewees and workshop participants for sharing their experiences and helping us gather invaluable user data.

Siw Eriksson for her help with prototyping materials and workshops.

The psychologists for taking the time to talk to us and helping us get a deeper understanding of psychological issues.

Friends and family for interest and support through the project.

This project would not be the same without you, thank you all for your support.

Jens Hulteberg & Vendela Stenson, Gothenburg, January 2021



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0.1 Glossary

- **Speculative design** - The design practice of creating artifacts for critique and provocation rather than economical gain or functionality. The artifacts are often based in alternate realities. The practice has much in common with other practices like critical design, design fiction, discursive design and design probes.
- **Mental health** - Mental health is not only the absence of mental problems but also the presence of positive mental attributes. Mental health therefore also encompasses to be aware of ones worth and abilities, as well as the ability to cope with the ups and down of a normal life. Furthermore, the term encompasses the ability to work productively and contribute positively to ones community [1].
- **Mental disorder** - Mental disorder is a broad term with a wide array of causes and effects. Generally mental disorders are a combination of abnormal thoughts, emotions, behavior and relationships. The term includes depression, bipolar disorder, psychosis, dementia and mental development disorders [2].
- **Digital native** - Describes a person that has grown up in the digital age and knows the "digital language". The terms is contrasted by *Digital immigrant* a person who has learned to use technology later in life [3].
- **FOMO** - Abbreviation for *Fear Of Missing Out*. It refers to a social angst that stems from the fear that other people in ones social sphere are aware of and taking part of in activities that one self is not privy to [4].

1

Introduction

In a faster and more connected world, technology has integrated itself into a major part of our lives. Parallel to this we have seen an increase in mental disorders in the western world. Out of the Northern countries this negative trend is most severe in Sweden [5]. We believe that the growing mental health disorders are partly caused by the growing digitalization and constant access to the internet. As there is little indication of a future decrease in digital impact on our life, we believe that if not addressed today this might lead to bigger consequences in the future. The digitalization of our everyday life has happened so fast that we believe we lack important critical frameworks to handle the constant flow of information. We believe that we need to cultivate a critical thinking towards technology in order to engage with it in a more constructive way. We need to understand *why* we want to have a digital world.

We hope that by using speculative design to tackle these problems we will get a solid basis to trigger discussion on the topics at hand. By using speculative design we both address the problem today and hopefully prevent aspects of it that are to come. Speculative design is a fitting approach as it by definition deals in fiction and the evaluation of technologies of the future[6]. However, speculative design has often been criticized for being too elitist or too academic. The practice runs the risk of being confined to museum exhibit or other academic settings and not truly connect to the broader public[7]. In relation to related research on the subject our aim was to make speculative design with a more active user focus. The hope was that this would create a design more suited for a specific target group.

1.1 Hypothesis

We believe people seldom reflect on the impact of technology. In the western world, technology is rarely seen as an alternative but rather as a constant of life. We believe that speculative design could be an appropriate tool to trigger reflective thinking around these issues, as it by its very nature deals with scenarios alternate to the status quo and thus critical thinking about our current way of life. Continuing, we believe that young adults will be a good reference point for a study that aims to evaluate mental health and technology as they are a target group well versed in the subject and that lives very close to technology in general.

Lastly we believe that a user-center approach to speculative design can be beneficial in order to have greater impact on a target group. By conducting rigorous investi-

gation into the user groups preferences as well as activating the user group directly with co-design workshops we hope that the final artifact will appeal to them and thus be effective as a discussion starter.

1.2 Research questions

- In what ways can a user centered design approach enrich a speculative design?
- What should be considered when designing future products regarding issues of the impact of technology on mental health among young adults?

1.3 Delimitations & Limitations

As the project mainly deals with the use of speculative design we will not put emphasis on the psychological aspects of the subject at hand. Some initial investigation will be done into the field in order to better understand the subject of mental health and avoid common pitfalls. However the subject of mental health is extremely complex and, as designers, we are not truly equipped to contribute much to the field. Thus, the project will have a generally simplified version of the subject based on expert knowledge gained through literature review and interviews. We will *not* try to present an answer to the question of the negative effects of digitalization.

We are also limiting the project to focusing on western society. More specifically Sweden and young adults aged 16-25. This because they are digital natives that live lives completely permeated by technology. This makes them ideal and important for a study that handles technology and mental health. Continuing, as our project runs parallel to RISE's project that also has a focus on Swedish society it seems appropriate to have that same focus and target group as them.

Lastly, this project was conducted during the Covid-19 pandemic which affected the project in several ways. Therefore, all target group interviews and one of the workshops had to be conducted through a digital medium which was not optimal. Also, the final evaluation had to be conducted digitally as well and thus we needed to rethink the evaluation setting. This complicated the evaluation of the interactive aspects of the speculative design.

1.4 Stakeholders

This section describes the different stakeholders involved in the project and how they will shape and affect the our goals and methods.

Chalmers University of Technology

Chalmers has several requirements and guidelines that will shape the project and the final report. Chalmers provides an examiner and an academic supervisor. The supervisor will provide guidance during the project.

University Students

As a master's thesis it is not unlikely that this report will be read by other students going through the same process as we are currently. In order to help them the same way that other reports has helped us we will aim to structure the report in such a way that information we believe relevant to future students will be easy to find.

RISE Interactive

RISE Interactive is a part of RISE which mainly focuses on research into interaction design. Our project will run parallel to one of RISE's projects but no specific deliverables has been decided upon. Instead both parties (RISE and us) hope to exchange valuable insight and knowledge into the fields of mental health, technology and interaction design.

Young adults

Our main target group is young adults aged 16-25. They are part of Generation Z - people born from approximately 1995 to 2010 - digital natives that have been exposed to the internet, social media and mobile systems from a very young age [8]. As they are heavily involved in the project it is important that we conduct our research without in any way mentally hurting the user group.

The team

The team consist of two students at Chalmers University of Technology from the same bachelor program (Industrial Design Engineering) but different masters programs (Interaction Design and Industrial Design Engineering). This project marks the ending point of both of our masters degrees. Thus we aim to, as far as we are capable, produce stellar work showcasing our capabilities and expertise. Furthermore we both aim to produce a report of academic value, an artifact of high quality and conduct a project we are proud to put in our portfolios.

2

Background

This chapter aims to give the reader a better understanding of the research problem, project background and research area. The chapter also describes relevant earlier projects that relate to similar themes and methodology.

2.1 Research problem

In an increasingly digitalized and connected world it appears important to cultivate healthy and constructive relationships between human and technology. However, today's human/technology relationship can hardly be seen as strictly positive. The debate on how and why mental disorders appear in relation to technology is ongoing and it is not clear exactly how and why the negative effects occur [9]. However, as technological development continues into the future we believe that we need to be critical towards technology and learn to have a healthy relationship with it, in a more symbiotic future. Therefore we believe speculative design is a fitting tool for kickstarting both a debate and a critical mindset in society towards technology.

Speculative design has been criticised as being too academic in the past [7] and as we are trying to tackle societal problems it seems important to create speculative design artifacts that are truly interesting and thought provoking for the public. In relation to related research on the subject we try to make speculative design with a more prominent user focus. The hope is that this will create a design more suited for a specific target group. Because of this, we employ a very open approach to this project and therefore there is not a fully defined outcome. Instead of pre-defining speculative scenarios and artifacts we want to co-create these aspects of the artifacts together with the defined user group. This will hopefully lead to a final speculative design that connects more to the general public and specifically the user group at hand.

2.2 RISE project

RISE (Research Institutes of Sweden) are currently in the middle of a project on behalf of Region Stockholm concerning growing mental health issues among young people between the ages of 13 and 25. They are designing a digital platform for promoting mental well-being with the aim of preventing mental illness on a national scale [10]. Their vision is to create a joint space where people can find information about different aspects of mental health and get easy access to a number of

high quality digital services, outside of the health care system, that support mental health. So far they have delivered a prototype that demonstrates what this type of platform could look like based on a user-centered pilot study [11].

2.3 Research area

Here we present earlier and related work that is an important context for the project. Firstly we present design research that is relevant to this project followed by a presentation of general mental health research.

2.3.1 Related design research

There are several examples of speculative design that highlight the relationship between technology and humanity. In fact, most definitions of the term has the technology link as an integral part of the definition of speculative design [12]. Thus most of what is labeled as speculative design explores the technology/human relationship.

Out of the papers we have read in preparation for this report many did not conduct a thorough exploration of the problems and users [13, 14, 7, 15, 16, 17, 18, 19]. Furthermore, it is possible to see two distinct ways speculative design is employed. Firstly, as a medium for discussion [15, 19, 20]. Secondly, as the result of a workshop usually in the shape of an artifact [13, 14, 7]. These workshops were also generally carried out with experts such as design practitioners or other expert stakeholder. There seems to be a lack of user-centered speculative design in general and the artifacts are seldom tailored to appeal to a specific user group. Instead they are used to explore a topic (often a chosen technology) in society at large with a very broad or unspecified user group. Many speculative designs, also, do not tackle a specific problem but rather highlight technology to be discussed.

A quick scan of design for mental health outside of speculative practices show a far more user-focused approach. This might not appear surprising, as they generally employ a more traditional design approach and thus rely far more on gathered data from stakeholders.

For example, a British study highlight the importance of being user-centered by using co-design in mental health scenarios. Arguing that working with vulnerable people and complex services lends itself to a more collaborative approach [21]. A research team from Australia also developed a clear methodology for designing for youths with mental health problems, highlighting the importance of participatory design and rigorous user studies [22]. Lyon also puts emphasis on the importance of being user-centered when handling mental health [23]. This in line with other product development projects outside of purely method based research [24, 25].

2.3.2 Mental health and Technology

The debate on the relationship and causality of mental health and technology is ongoing and it is hard to determine that there are negative effects on mental health

caused by use of technology [9]. However, more and more research on the subject has been conducted in the last decade and it seems clear that the two at least affect one another [26]. For example connections have been seen between mobile phone use and lack of sleep, increased stress, depression and loneliness [26]. Furthermore, links has been observed between loneliness and internet addiction and that one seem to feed the other. That increased time using the internet leads to loneliness and that loneliness leads to more time spent on the web [27].

According to Statistics Sweden, the amount of young people with mental disorders has increased during the last 30 years in the Nordic countries. Out of those countries, the problem has increased the most in Sweden [5]. Not only does this cause suffering for the affected, but may also lead to long term consequences for individuals as well as for society. Mental disorders such as depression, stress and burnouts are the most common cause of sick leave [28]. What causes this development in Sweden is affected by a number of complex relationships, and clarifying these relationships is a major challenge [5].

One thing we know is that parallel to the increase of mental disorders, the use of digital devices has escalated at a rapid pace [9]. There is an ongoing debate that revolves around whether there is a correlation between these trends. The Swedish public health authority, for example, states that there can be both positive and negative effects from digital activities and that there is not enough studies on the subject to draw specific conclusions [29]. Therefore it is not yet certain if the increasing digitalization is detrimental to mental health or not. However, several research papers and other sources indicates that there is a correlation between extensive usage of digital services among young people and a variety of negative mental symptoms such as stress, depression, FOMO (Fear Of Missing Out) and sleep deprivation [9, 29, 30, 27, 26].

2.3.3 Earlier work

Some projects do employ a more user-centered approach even though they generally lack a thorough user study. Naseem et al. specifies both a clear problem and user group when they researched well-being for elderly through speculative design [15]. Sondergaard et al. investigate a specific chosen technology with participatory design when researching Digital Personal assistants [16]. A case has also been made for a more dynamic testing scenario by Noortman et al. who with their “Design Fiction Probe” *HawkEye* (2.1) evaluated the design in the participants home during three weeks. The *HawkEye* study also had a more clear cut user group and problem in the focus on dementia patients [19].

Some other user-centered project are Disalvo et als. Robot Radio [17] that was developed closely with users and Forlanos and Mathews urban planning project that had several workshops with both expert and novice stakeholders [7].

In Lawson et al’s *Problematizing Upstream Technology through Speculative Design-Design: The Case of Quantified Cats and Dogs* [20] several speculative prototypes

2. Background

was developed and presented through fictional websites which was inspired by typical modern start-up aesthetics and language. After they invited users to observe and discuss the prototypes and their websites in focus group settings.



Figure 2.1: The Hawkeye design probe [19]

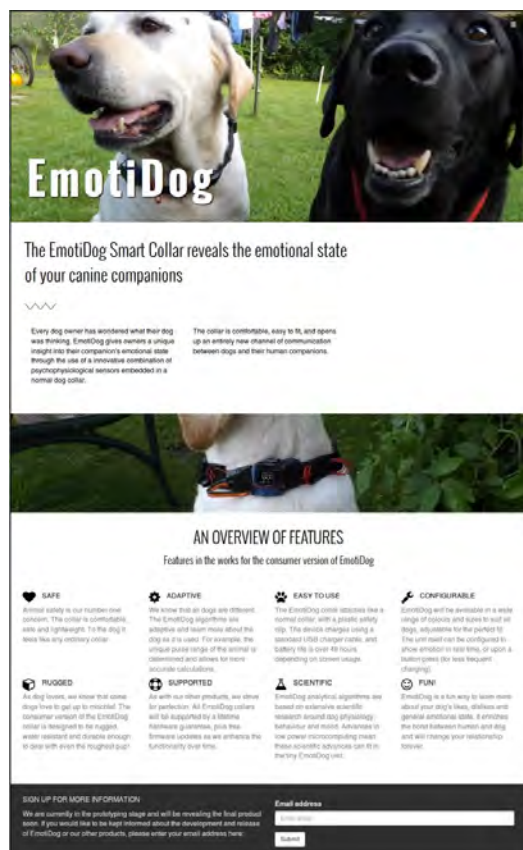


Figure 2.2: Example of website used in evaluation session in Problematising Upstream Technology through Speculative Design: The Case of Quantified Cats and Dogs [20]

3

Theory

This chapter aims to cover the relevant concepts and frameworks used in this project. Firstly it lays out our basic theory of user-centered design and speculative design. Continuing, it also describes general theory that is of value to the project.

3.1 User-Centered Design

User-centered design places users at the forefront of a design process. By working closely with and towards users the designers hope to create products that matches the users' preferences in a more successful way [31]. To achieve this, designers employ a variety of methods that engage a user group in the design process. These tools can take on a variety of forms but they all aim to gather data on human needs and behavior from a wide set of areas: anthropocentric, emotional, psychological and sociological to name a few [32]. This is done both through verbal methods like interviews, questionnaires and scenarios and non-verbal methods like cultural probes, games and different kinds of observations [32]. User-centered design can be used to understand the users on a deeper level, mapping needs and behavior the users themselves seldom realize.

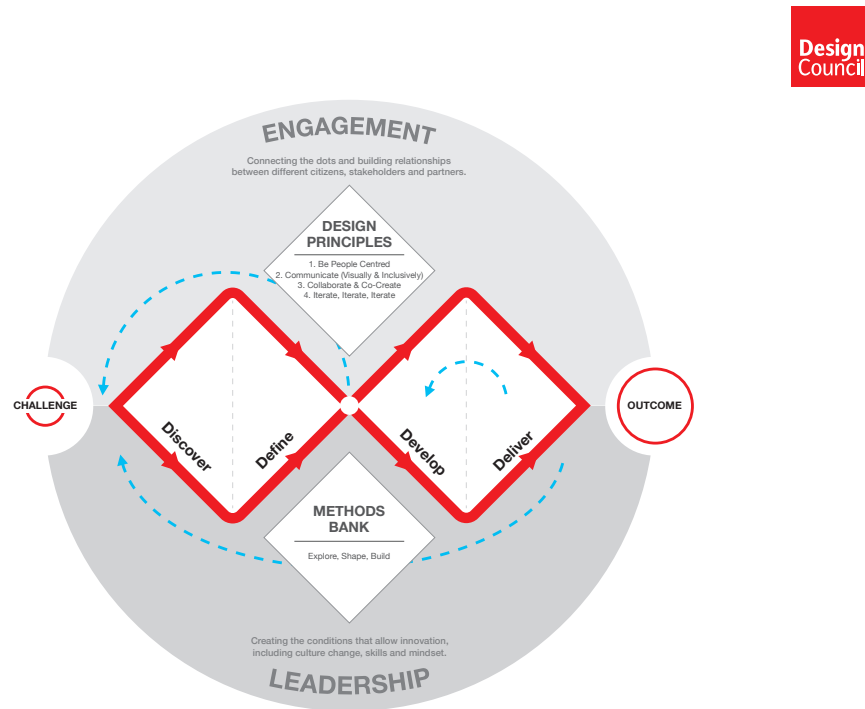
3.1.1 Double Diamond Design Approach

A design approach that encompasses iterative and exploratory aspects in order to adapt to complex problems. As a design process often is chaotic by nature with constantly changing scopes and ideas the method tries to adapt to the nature of design being a highly iterative and adaptable approach [33]. In the design process, user-centered exploration is often carried out by observing and interviewing users and co-designing with stakeholders. Furthermore, exploration is often carried out by testing ideas early and often with, for example, rapid prototyping. In the process the designers work themselves through a series of steps to complete the project. In this project we have chosen to work with a four stage process from the British Design Council. Developed by the council in 2004 the double diamond approach is a visualization of a design process that is both exploratory and highly iterative [33]. The double diamond approach consists of four steps that are as follows:

- **Discover** - In which a research group explores and tries to understand a problem by interacting with the people who are affected by the issue.
- **Define** - In which a research group defines the challenge with the help of the insights from the previous step.

- **Develop** - In which a research group designs a plethora of solutions to the defined problem seeking inspiration from all kinds of sources. Co-designing with individuals of different expertise is also encouraged.
- **Deliver** - In which a research group tests the ideas out rejecting ideas that do not work and improving on those that will.

It is important to emphasize that it is a non-linear process where iteration between the four stages is crucial [33].



© Design Council 2019

Figure 3.1: The Double diamond model according to the British Design Council[33].

3.1.2 Co-design

Co-design has been around for almost 40 years under the name of Participatory Design [34]. In the 70's, the Nordic countries established the Collective Resource Approach [35] aiming to increase the value of industrial production and improve the quality of work-life [36] through engaging workers in the development of new workplace systems. Since then it has grown and spread within the design sphere under different names, definitions and approaches.

In this report, we will use Sanders and Stappers [34] definition of co-design, that is “the creativity of designers and people not trained in design working together in the design development process”. It is a user-centered approach involving active user and stakeholder participation throughout the whole design process [37]. The

approach utilize the expertise and skills of designers together with the situated expertise of the users, for the purpose of creating products or systems that are more suitable to the user. Users then become, to varying extents, part of the design team as experts of their experiences.

In a classic design process, the researcher typically possesses the role as a translator between the users and the designer. When co-designing however, the designer or researcher (who may be the same person) serves as a facilitator. The facilitator's role is to lead, guide and incite creativity among the non-designers. In order for them to be creative, the facilitator must provide the right tools for ideation and expression. In the end the designer plays a crucial role in giving form to the ideas [34].

3.2 Speculative Design

Speculative design has become well known in HCI (Human Computer Interaction) since the early 2000s [38]. As a term speculative design is hard to define fully. It has much in common with other similar practices like critical design¹, design fiction² and discursive design³. In fact, the common factors in these methods are sometimes so many that the results are almost indistinguishable from each other [39]. Furthermore, the terms speculative design and critical design have been known to be summed up in one single abbreviation SCD (Speculative and Critical Design) [40] showcasing the similarity of the terms in some contexts.

What these practices have in common are mainly (1) an unshackling of the commercial constraints present in traditional design and (2) the usage of alternate realities to present artifacts, systems, worlds or ideas [39]. In this report, these practices will be summarized as speculative design as we consider it being the most descriptive word for the aims of this project. Inspired by the reasoning of James Auger [39] speculative design is in our opinion the least problematic of the terms. Speculative design - as a word - does not elude to any specific value or goal. It instead references the practice that is central to the method. The term "speculation" also references a link between fiction and reality that is desirable in the practice. Critical Design hints at the practices intentions of starting debate and analysis - something that might alienate individuals from outside an academic space. The term "design fiction" also clearly reveals the practice as dislocated from reality. It hints at the ideas coming from another reality in a way that might be detrimental.

Speculative design separates itself from market-driven design, it explores a parallel channel with a more open ended goal. Instead of solving a problem it uses design to pose questions, criticize, inspire and provoke by standing in contrast to trends and systems in today's society [6]. By speculating in alternative futures or parallel realities it creates a lens through which we can question our society today. Through these fictional realities Speculative Design explore what kind of products, trends and ideas would exist in such an scenario and how they relate to our reality today.

It is this link to reality that is the key to a speculative design's success. If a de-

signer moves too far into speculation they risk to lose the audience when they are confronted with an unbelievable or alien idea [39]. There needs to be a link between the speculative reality and our own in order for the design to be relatable.

That being said, it is wrong to assume that a speculative design needs to be “possible” or even fully functional. Instead the artifact can very much be “impossible” but not “improbable”. Ergo it needs to make sense that it exists in the fictional reality it is presented as a part of [6]. The artifact needs to engage the user in such a way that it invites them to suspend their disbelief and ask themselves what the consequences of the artifact are in relation to the fictional space. Speculative design is therefore a constant balance between fiction and relatability, a balance which is extremely hard to get right, but very effective if done correctly [6].

3.2.1 Speculative Design approach

Speculative design consists of a very diverse set of approaches. It is therefore difficult to present a definite toolkit[41]. In our project we have been inspired by a approach presented by Damien Lutz [42]. His article gives an example of what a simplified speculative design method *could* look like and presents it in five steps:

- **Step 1** - In which “signals” of emerging technologies and trends are identified
- **Step 2** - In which different speculative design tools are used to ideate a future artifact
- **Step 3** - In which an artifacts is designed that might solve a problem in a speculative future world. The artifacts form and function should tell a story about the future world it exists in and inspire the observers imagination to fill in the gaps. This will inspire and spark the discussion in step 4.
- **Step 4** - In which the speculative design is shared to generate discussion. The designer should make it easy for the observer to express their interpretation of the artifact. Be prepared with questions that encouraged them to express their feelings around the concept.
- **Step 5** - In which the designer acts on the result. According to the author, speculative design does not normally include follow-on action. Therefore he suggests to include this final step which could be to, for example, ask for feedback from experts or potential users of the artifact, or creating a promotional website for the future artifact where one can track and record feedback and reaction.

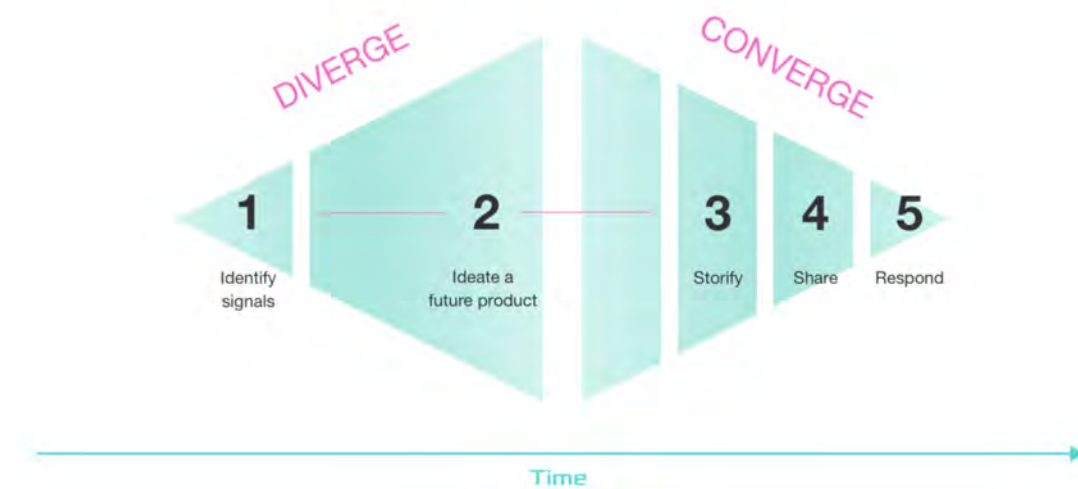


Figure 3.2: An example of a simplified speculative design approach [42].

3.3 Wicked Problems

Wicked problems were first coined by Rittel and Webber and refers to a problem that is not clearly solvable by scientific means. Scientific problems have clear definitions and objective solutions while wicked problems are by their nature hard to define and lack clear solutions. They are complex problems with a plethora of solutions where any one solution might lead to several new problems cropping up [43]. Wicked problems therefore need to be tackled in a dynamic way where the designer solves and explores the problem in parallel, constantly redefining both the aim of the research and scope of the problem. Thus wicked problems are inherently hard to plan around. A wicked problem is never simply solved and the solution is never truly the right one. A solution to a wicked problem might be good but not objectively true. As the problem is so complex the solving process is never truly finished but the problem is instead abandoned for other reasons like: time constraints, budget or the solution being “good enough” [43].

Classic examples of wicked problems are, collected from the Interaction Design Foundation: poverty, climate change, sustainability, and homelessness [44].

In order to be prepared for unforeseen complexities in design work the designer needs to be adaptive and flexible. The designer needs to constantly reflect-in-action in order to tackle uncertainties and unforeseen consequences [45].

4

Methodology

In this chapter, relevant methodology for this thesis is explained. The majority of the methods have been chosen due to their effectiveness in human-centered design processes and in speculative design.

4.1 Interviews

Interviews are a qualitative data gathering method that relies on first hand contact to gather data from participants. The shape of the interview can vary from structured, with a set script, to relatively unstructured, with room for dynamic conversations with investigatory detours. However, even in unstructured interviews the interviewer has at least a set of topics to guide the interview in a desirable way. The questions asked and the structure will vary depending on the design inquiry at hand. Generally the interviews tend toward the unstructured side if the research is of an exploratory kind. A more structured approach is appropriate if more quantifiable data is desired [37][46].

4.2 Focus Groups

A focus group is a qualitative data gathering method that, like the interview, relies on first hand contact in order to gather data through conversation. However, while an interview is often conducted with a single person a focus group utilizes group dynamics in order to make participants more likely to share their thoughts. By carefully selecting participants and guiding the conversation, the focus group can result in a open environment where participants freely share their wants, biases, fantasies, etc. A focus group is a good method for uncovering data related to group activity and behavioral underlying data not usually exposed in one-on-one conversations [37]. The moderators main goal is to keep the conversation flowing without letting any single participant dominate the conversation [46].

4.3 Sensitization

Sensitization is a method that aims to encourage the participants to think and reflect on their own experiences around the topic of study before a design workshop. This can increase the quality and quantity of their contribution during the group session

[47]. Normally one or several smaller exercises is sent out to the participants days or weeks before the session. The quality of the insights gained from the participants during the session is depending on the length and depth of the sensitizing activities [47].

4.4 Co-design workshop

Co-design workshops can be used in several stages of the design process. In the exploration stage they can be utilized to gain deeper understanding of the users needs and context. Here the facilitator can make use of methods such as collage, mapping or diagramming exercises. Co-design can also be used in later stages of the process with exercises such as flexible modeling, ideation, generation of future scenarios and concepts, and verifying design scope and direction. In the evaluation stage, one can utilize co-design workshops in order to let the participants review concepts, give feedback and supply insights for further iteration and refinement [37].

4.5 Collage

Collage is a method often utilized in co-design workshops to get the users partaking in idea generation and product development. Collage making allows participants to express experiences, dreams and hopes through images and words [48]. The method, put simply, is to provide the participants with an image bank they use for collage making. The image bank should consist of images open for interpretation to avoid influencing the participants too much [49]. Afterwards, the participants explain what the collage and images mean to them. This data is then collected and analyzed by the researcher. Collages has also been argued to be a very good tool for generating speculative design due to how quick it is and supports creative thinking [50].

4.6 KJ Technique

The KJ Technique is an efficient method used to structure and analyze large amount of qualitative data. The exercise involves selecting relevant statements from interviews and observations then organizing and grouping them into different categories with different themes. This helps formulate and identify problems and requirements [37].

4.7 Brainstorming

Brainstorming is a method used to spur group creativity, incite ideas, and solve problems. In the beginning of a project it aims to generate as many ideas as possible without questioning their applicability. This can be achieved by creating an open, non-judgmental environment where the group can build on each others ideas [51].

Brainstorming is usually credited to Osborn and first described in his book *Applied Imagination* [52]. In this book he proposed four important aspects of brainstorming in order to succeed, these were: do not criticize, quantity is wanted, combine and improve suggested ideas, and say all ideas that come to mind, no matter how wild.

4.8 The Thing from the Future

The Thing from the Future is a creative card game with the aim of creating thought-provoking sketches and/or descriptions of speculative design artifacts from different futures. Each round the players create a prompt with four cards that: (1) frames the type of future the artifact should be created for, (2) defines what culture or part of society it belongs to, (3) portrays what type of artifact it is and (4) propose what kind of emotional reaction it may provoke in a present audience. Afterwards, each player writes a description of an artifact that fits the outline of the prompt. The players then get to vote for the description they think is the most interesting, creative and provocative [53].

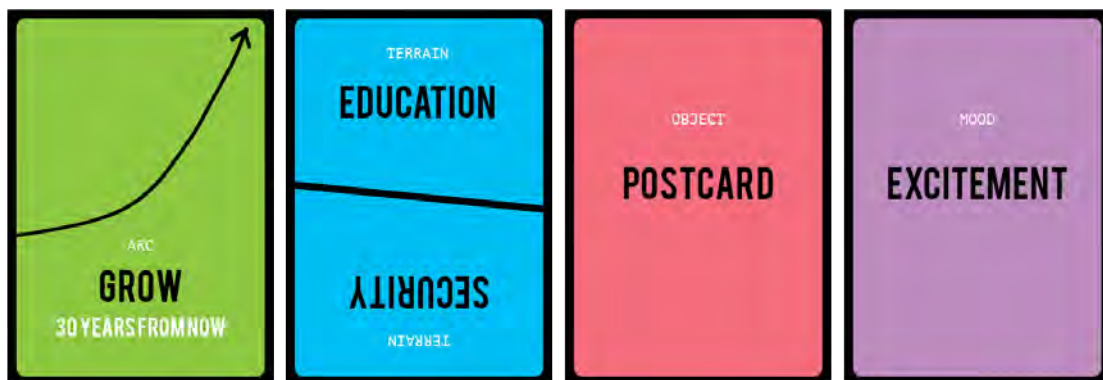


Figure 4.1: One example of a prompt from The Thing from the Future. Participants create concepts based on the prompt. [53]

4.9 Future Scan

Future Scan is an ideation tool that helps imagine how the world could look like in the future and what products and services would be relevant for that world. It can be useful both as a simple exercise or as a tool in a bigger speculative design process. The chart contains around 150 potential future scenarios. The idea is to pick a number from any sector and brainstorm around how to tackle your specific challenge in this future scenario. [54]

4.10 Weighted matrix

A weighted matrix helps manage potential design ideas by evaluating them against different criteria rated on a scale. The criteria are defined by the team and stake-

holders and should represent the most important aspects for product success. The weighted matrix is useful as support for shared decision making. Important to note is that the conversations this tool generates among the team can be as useful as its result [37].

4.11 Prototyping

Prototyping is the creation of artifacts in order to further explore and crystallize the form and function of an idea. Prototypes can come in different levels of complexity from simple drawings to complex wire frames almost indistinguishable from the finished product [37].

Low-fidelity prototyping

A low-fidelity prototype is common in the early stages of a design process and often work as an internal tool for testing out ideas. However, it also does an excellent work evaluating more general concepts towards stakeholders outside the design team [37]. Some examples of low-fidelity prototypes are: sketches, simple digital wire frames, and storyboards.

High-fidelity prototyping

A high-fidelity prototype is higher in detail and functionality. It might lack some important functionality but contain the look and feel of the final artifact. They are useful for later stage testing where the aesthetics of a product are more central to the experience [37]. Some examples of high-fidelity prototypes are: complex sets of wireframes, CAD models, and physical models of great complexity.

4.12 Seven Foundations model

Seven Foundations is a foresight model that can be helpful when imaging and building new visions of the future. This vision and future world can then be used as a tool to create innovative ideas and strategies. The model takes the shape of a circle divided into seven topics(foundations) that are filled with reasoning surrounding the scenario one is creating. For example: the model can be used as a chronological tool where events close to the center of the sphere represent today and those further out are the events and cultural themes of the future.

The foundations are: political, economic, environmental, scientific and technological, social and artistic. These are the most fundamental parts which together make up a mental model of a society. The Seven Foundations model can be used for several purposes such as strategic foresight, systemic design, product innovation and science fiction prototyping [55].

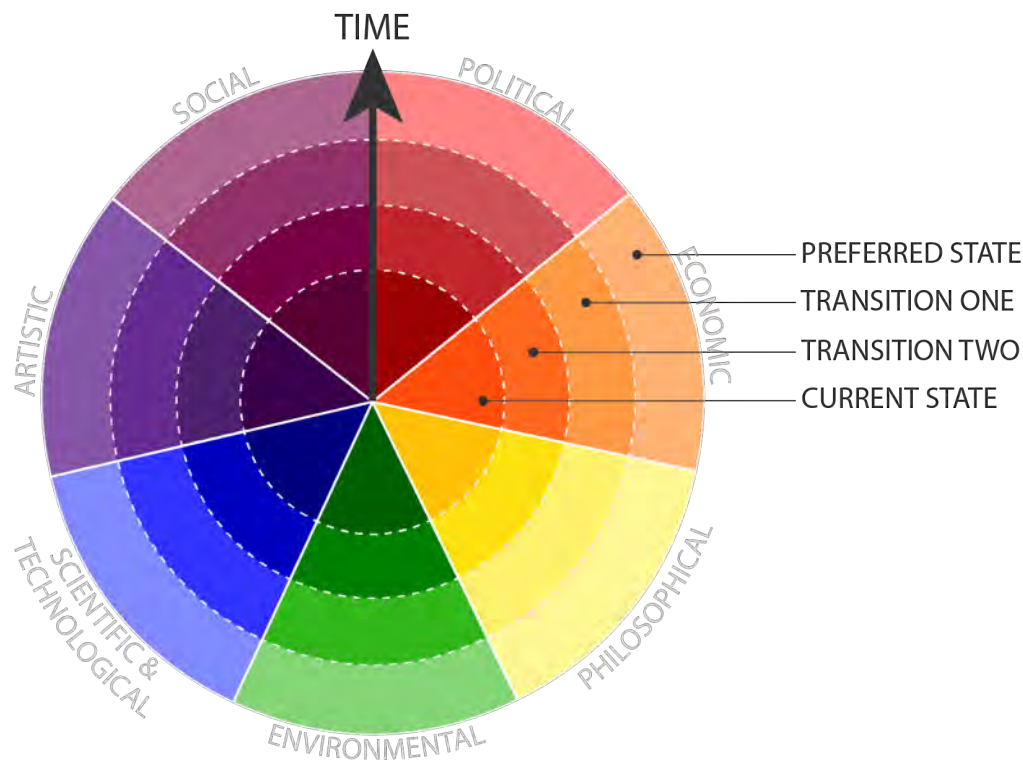


Figure 4.2: The 7 foundation model explained. This shows the incremental version. [55]

4.13 Scenario

A scenario is a design method that aims to concretize a product use-cases in everyday life. The purpose of this is to understand the users behaviors and drives. Also, to understand the interaction with the product from a users perspective to better communicate how that interaction works [56]. By describing an everyday user and her interactions with a product the scenario can work as an anchor for a development team making sure that the design does not loose a cultural significance and a connection to the end user. This way the product is kept from straying to far into its technical requirement instead putting the focus on creating product that has a place in a day-to-day life [37].

A scenario can take on many different forms. It could be written as a short story, or take on a more visual form. A scenario is most often created from a personas point of view creating a subjective view of the product [37].

4.14 Bodystorming

Body storming is a role-playing technique employed in order to get an understanding of a user experience with a product. With the help of simple prototypes a designer

can act out scenarios and interactions with a product, moving through space and situations. Bodystorming has a number of use-cases, it can be used for ideation, concept generation or testing both individually or in parallel. Benefiting from its improvisational and active approach bodystorming can lead to new spontaneous ideas being born from an acted interaction [37].

4.15 Auto Ethnography

Auto ethnography uses a researcher's personal experience to explore a system or a product. With careful self-reflection a researcher can use their own experience to describe and critique cultural beliefs, practices, and experiences [57].

4.16 Co-Discovery

Co-Discovery is a user experience evaluation method. The idea is that two participants, preferably friends who know each other from before, explores a product or concept together and freely discuss about it, with or without a moderator. Sharing an experience with a friend can trigger more authentic and experiential comments than a normal interview or discussion with a moderator. However, as this is a method where the participants will control the discussion to a great extent, it can be difficult for the researcher to decide the direction of the discussion. Therefore there is no guarantee that the session covers all the topics that the researcher desires. This can be solved by having a moderator present during the session leading the conversation towards these topics. Or asking the participants beforehand to talk about these specific subjects. However, the more the researcher influences the discussion the less spontaneous it becomes. Furthermore, this method is suitable when trying to look into the initial responses to a product or concept [58].

5

Execution and Process

This chapter describes the process and execution of the project. We employed a flexible and open approach in order to easily be able to adapt the project towards the target group (young adults, 16-25 year old). Thus we began the project with only a singular theme to explore - the relationship between mental health and technology. Further we employed methods to help us understand and map details within this theme that the user group found interesting, relevant, and relatable.

Throughout this project we aimed to combine speculative design theory with a user-centered focus. Firstly, we conducted a thorough user study in order to map the wants and struggles of the target group. We did this in order to get an understanding of how the user group relates to technology on a personal level, we also wanted to research what kind of technology the user group related most heavily to in order to pivot the project to focus on that technology. Secondly, we conducted future themed co-design workshops together with representatives from the target group. We aimed to design for their vision of the future rather than an academic future vision.

By constantly adapting and pivoting the project towards themes that seemed central to the user group in question we hoped that we would create speculative design that not only appeared appealing and thought provoking to the user group but also to the public at large. This would hopefully lead to an artifact that in a successful way sparked discussion on topics of mental health in relation to technology.

By modifying the double diamond process from the British Design Council[33] with the Speculative design process by Damien Lutz[42] we constructed a process that fit our goals and incorporated both user-centered and speculative approaches. The process has been divided into a series of distinct stage to clarify the structure of the project. However, in reality the steps had significant overlap and iteration. The steps are as follows:

- Empathize and define - In which we explored the user group documenting their relationship towards technology through interviews and co-creation workshops.
- Ideation - In which we used the insights to create future oriented concepts.
- Prototype - In which we constructed prototypes and role-played in order to crystallize and improve on the ideas from the previous step. This step also included backstory and construction of the artifact's setting.
- Test - In which we evaluated the artifact with the users in order to validate if it archived the set out goals.

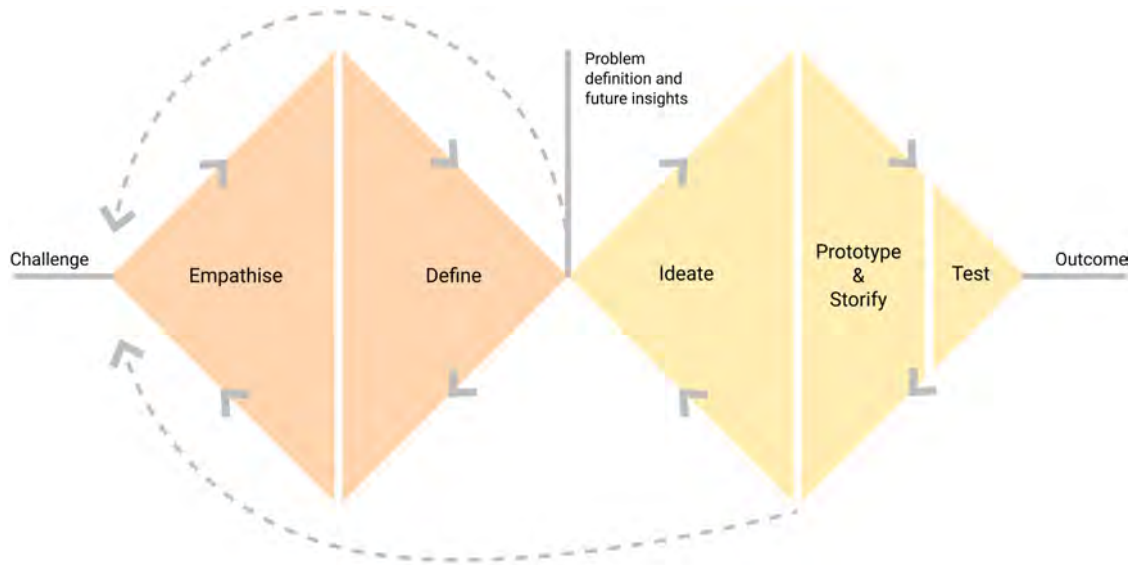


Figure 5.1: The project process. A modified double diamond approach.

Each stage of the project is described below followed by relevant methods used during that specific stage.

5.1 Empathize and define

The first stage puts focus on understanding the problem, its context, and stakeholders. During this stage we used exploratory data gathering methods and co-design workshops to paint a picture of the target group and research field. Emphasis was firstly put on understanding the target group and their relationship to technology, and secondly on understanding their view on the future in order to create believable scenarios that appeal to them. Furthermore, we focused on collection of qualitative data. As we were mainly interested in exploring the problem from different angles, the personal opinions of the different involved parties was therefore highly relevant.

The insights gained were analyzed and synthesized in order to define the core problems. The hope was to through analysis methods concretize the data set into an understandable picture of the target group - their thoughts and desires. Specific care was put into defining the target groups' relationship towards technology and their vision of the future, as this was considered paramount in relation to our research questions.

5.1.1 Interviews

In order to get an initial grasp of both the field and the target group, we conducted a total of twelve interviews over a period of four weeks. Two of them were expert interviews and ten of them were interviews with participants from the target group. The participants were recruited through convenience sampling. The interviews were semi-structured in order to keep the conversation open and flexible [37]. Our main

interest was in the interviewees' rich understanding of the issues, rather than gathering quantitative data.

Psychologist interviews

At a very early stage of the process two interviews were conducted with four practicing psychologists. The interviews had the main purpose of familiarizing us with the topics that we will handle during this project. The interview template was the same for both interviews. As stated earlier, we are not knowledgeable in terms and methodology within psychology and to gain a baseline understanding of the mental health issues was very important to us in order to fully understand the problem.

The two interviews in question were one focus group interview with three school psychologists and a one-on-one interview with a child psychologist that were conducted through a video conference tool. Both interviews had fruitful outcomes and yielded data and understanding of the topic. Most notably the expertise from the interviewed psychologists helped us complexify several statements that we, up to that point, had perceived as simple facts.

	Age	Sex	Work Experience	Interview medium
Group Interview	34	Male	5 years	Physical meeting
	33	Male	5 years	Physical meeting
	39	Male	5 years	Physical meeting
Individual Interview	27	Male	1 year	Digital meeting

Table 5.1: The participants of the psychologist expert interviews

Target group interviews

We conducted ten interviews with participants from the target group in order to map how they see their own technology. The interviews were semi-structured and all had the same template (see A.1). Starting out with broad questions we quickly localized the technology that that specific user saw as the main problem and thus let them shape the interview themselves. We sought answers to (1) what is a specific technology that is problematic for the target group and (2) problems that the target group identified with.

As the interviews were semi-structured, there was room to both skip and add questions if a topic proved extra interesting. The interviews had the following phases:

1. Introduction to our research problem, consent, and formalities.
2. Warm up: questions and inquiry into the main technology the participants used in their daily life (computer, smartphone, or other). We also probed for screen time per day (in hours) and other use related questions.

3. Psychological phase: questions on the feelings of the participants towards their own use of technology, and how they felt the technology affected them negatively. This section contained both open and concrete questions to accommodate for all participants.
4. Speculative phase: questions on the future of technology. This phase was initially added because we intended to gather data on how the participants saw the future, but also to gain an initial picture on how straightforward it is for the target group to speculate on the future. This knowledge was later used when constructing the follow-up workshops.
5. Ending with a round-up where we asked the participants whether or not they had thought and discussed any of these topics before the current session.

All in all the interviews were interesting and successful, many interviewees showed a genuine interest in the topics and had a lot to say on the subject.

Age	Sex	Occupation	Interview medium
16	Female	High school	Digitally
16	Female	High school	Digitally
16	Female	High school	Digitally
19	Male	Working	Digitally
21	Male	University	Digitally
22	Female	University	Digitally
22	Female	University	Digitally
23	Female	University	Digitally
24	Male	University	Digitally
24	Male	Working	Digitally

Table 5.2: The participants of the target group interviews

5.1.2 Co-design workshops

Two co-design workshops was conducted together with participants from the target group. All participants were recruited through convenience sampling. Two main goals with these workshops was set: (1) to gain a deeper understanding of their current experience, context, and needs; and (2) to understand their thoughts, ideas, and hopes about the future and its possible products and services. Thereby the workshops also served as an important source of inspiration. A main focus of these workshops was to co-design future scenarios together with the target group. The scenarios and artifacts generated from these sessions were more or less interesting and useful in themselves. However, the reasoning, dreams and feelings behind them proved very interesting and useful.

Workshop 1		3 hours, Physical setting	
Participants			
	Age	Sex	Occupation
	24	Female	University
	25	Female	University
	26	Female	University
	25	Male	University
Workshop 2		3 hours, Digital setting	
Participants			
	Age	Sex	Occupation
	22	Female	University
	22	Female	University
	20	Female	University
	16	Female	High School

Table 5.3: Workshop structure and participants

Both researchers attended the workshops. One serving as facilitator while the other carefully took notes and kept track of time. The workshops were analyzed using the KJ technique in an almost identical manner as with the target group interviews.

Workshop 1

The first workshop was conducted with four participants in a physical setting. This workshop had an additional goal, besides the two main goals explained above: to test our method Imaginary Employer, see 5.2.1. A sensitizing exercise was sent out a few days prior to the workshop to encourage the participants to think and reflect on their own experiences around the main topic of the session before the workshop. This was a simple exercise with questions to reflect on about life as a human in the

5. Execution and Process

future such as:

- What could a vacation look like in the future?
- What could a new subject in school be in the future?
- What kind of pets could be common to own in the future?

In order to break the ice and create a relaxed and open environment we prepared a warm-up *quiz walk* about the future for the participants to start the session with. The *quiz walk* contained questions set in the future, that is, the questions concerned events that had not happened yet, thus the questions had no wrong answers. This sparked speculative and future oriented thinking in the participants. Then we introduced them to our project and explained the workshop timeline and goal.

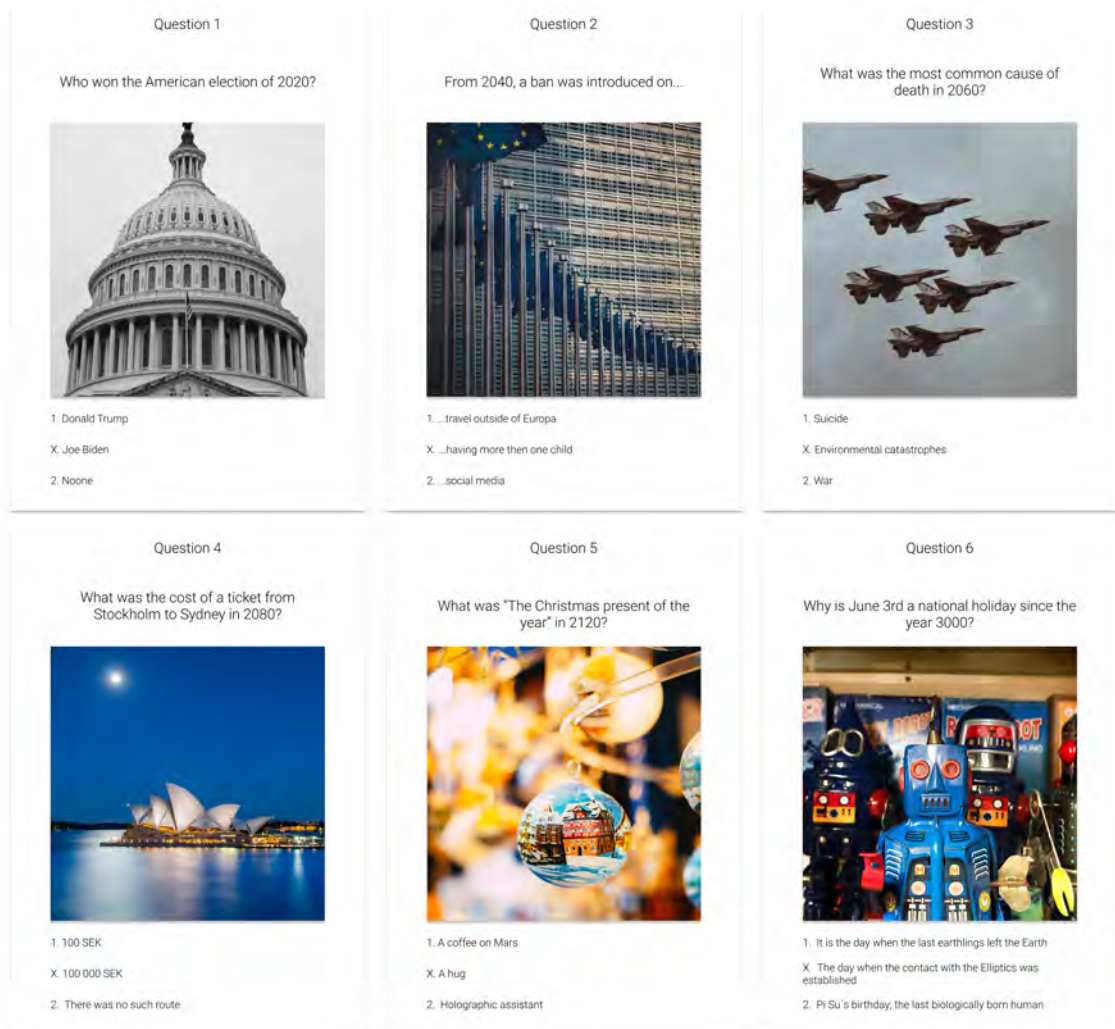


Figure 5.2: The questions of the Quiz Walk translated from Swedish to English. (Note that the quiz walk was conducted before the 2020 American election placing all the questions chronologically in the future.)

We used a *quiz walk* firstly because it is a very relatable activity that we knew our

participants would be familiar with. Secondly we believed it a playful activity that would spark creativity and create an open, non-judgemental environment for the workshop.

Next step of the workshop was to start generating ideas. We had prepared for them to play the card game *The thing from the future*^{4.8}. This method was used to trigger participants to let go of the present and create innovative scenarios and artifacts for a possible future. The participants got five minutes on each randomized prompt to generate ideas. When the time was up they were asked to take turns presenting and reacting to each others ideas.

After a break we started the next step of the workshop which was to ideate with the method Imaginary Employer which we developed ourselves in order to help generate speculative ideas for an alternate reality. The participants were told to imagine themselves being an employee at two different future companies explained by the facilitator. (1) *Codine* - a huge multinational software company that focuses on creating innovative software that makes everyday tasks more efficient, and (2) *Teknikgranskningsverket* - conducts research of both software and hardware related to stately matters, and evaluates technology and its impact on Swedish society.

They were then asked to generate ideas around two different scenarios as an employee at each of the companies, i.e. creating the best possible solution for them. The scenarios were used as a communication tool towards the participants to get them in the right mindset. We created these prompts based on the most interesting themes from the interview data. In short the scenarios were as follows:

- *The year is 2040 and you want to create products that urges constant use. Make people spend more time, gladly unhealthy amounts of time on the product.*
- *The year is 2120 and you are ordered to create new ways to socialize digitally and find a way to truly mimic a genuine real life meeting.*

After each stage of the session the participants fastened their ideas on a white board and at the very end of the workshop they were given small sticky notes and were told to rank their two favorite ideas with a short motivation.

Workshop 2

The second workshop was held in a digital room with four participants. The time plan was similar to the first workshop, see 5.3. However, instead of using the Imaginary Employer method we conducted a collage making exercise as a medium through which the users could visualize their thoughts, feelings, hopes, and desires. This replacement was made as the collage making exercise is, in our experience, an effective method to use in a digital workshop and was expected to give similar insights. Furthermore, we did not want to repeat the same structure with the Imaginary Employer method as it was not an established method and did not yield desirable results in the first workshop. The same sensitizing exercise was sent to the participants a few



(a)



(b)

Figure 5.3: The co-creation workshop in action. Showing the participants ideating (a) and showing the participants ranking the different ideas (b).

days before and once again the quiz walk was used for warming up, only digitally this time.

The sensitizing exercise was discussed and after that it was time for the collage making exercise. The participants were given a digital "sheet of paper" and an image bank and were asked to describe what they think a day in their life 2120 would look and feel like. This by choosing images from the image bank and assembling them any way they preferred. To unprompted put oneself in a creative mindset is hard and with help of this method we could remedy this by letting them create an artifact through which their thoughts appeared. The reason for choosing collages specifically is that people in general are uncomfortable with sketching and we hoped that a more structured prototyping method would make it easier for users to engage in the workshop. After 15 minutes they were asked to take turns presenting their collages while the facilitator asked further questions about the images to dig deeper and truly understand what they were trying to express.

After a 10 minutes break the workshop continued with *The thing from the future* and later a wrap up with ranking of ideas and discussion.

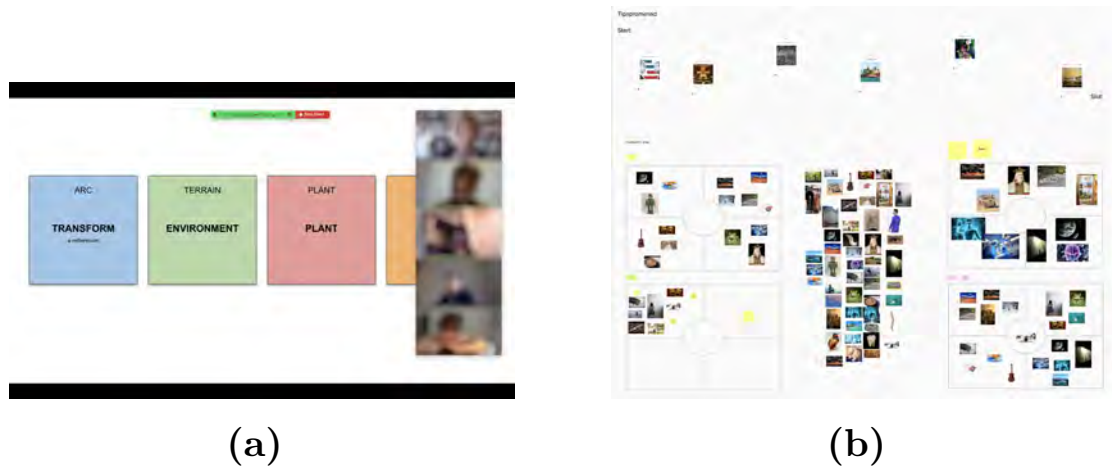


Figure 5.4: The co-creation workshop in action. Showing the participants ideating (a) and showing the participants ranking the different ideas (b).

5.1.3 Transcribing

First, the recorded interviews and workshops were transcribed in order to more easily isolate quotes from the material. This was also paramount in order to not introduce bias from the research group at an early stage of the analysis. If other methods would have been employed we would run the risk of losing quotes that does not clearly show interesting points but might have a deeper meaning. By transcribing all the audible words of the interviews/workshops we instead worked with all possible data from the start.

5.1.4 KJ technique

With the transcribed data ready we started to group it into more understandable chunks through the KJ technique, see 4.6. All data was grouped and categorized in order to map the commonality of a specific opinion or themes in the data gathered. The KJ work was an iterative process and many parts of the data were reevaluated in light of other quotes. Themes changed and quotes were moved until we believed we had a good picture of the collected data. The result was then transferred into written form by scanning through the themes and summarizing the quotes in written form. This approach was used for both crystallizing the data from the interviews and the workshops.

5.1.5 Result from empathize and define stage

In this section we present summarized versions of the result from the pre-study. The result from the psychologist and target-group interviews is presented as well as the result from the workshops. Finally we also present concrete takeaways that was carried over into the next phase.



Figure 5.5: The KJ analysis for the user group data.

5.1.5.1 Result from psychologist interviews

The psychologist interviews gave a much deeper understanding of the problem through the interview itself. As the interview had a rather conversational tone it created less of a one way interview setting and more of an open conversation that we believe helped in getting concrete analysis and opinions on the topics for discussion. We left the interview with a deeper understanding of the issue of mental health in relation to technology, an understanding that permeated the whole project and gave us confidence in believing that the we had a more correct and complex analysis of the issues. From the psychologist interviews we condensed a couple of topic/opinions that we thought interesting and relevant.

The following statements should be seen as no other but these specific individuals opinions. However, as they are all practicing psychologist they can, at least, be seen as their *professional* opinions and thus have value as inspiration.

The psychologists made a point of the way that we today socialize heavily through digital media. They believed this to be problematic but had a hard time formulating specific reasons why. There was also discussion on the relatively novel term parasocial relationships⁴ and how they might be replacements for classical mutual ones. In the pshychologists opinion this is not problematic per se but if the parasocial relationships substitute mutual ones it could lead to loneliness and lacking social skills. However, they also noted that a parasocial relationship can have positive effect in that it can train a person in social skills that later will be employed in classical mutual relationships.

The psychologists had opinions on the ease of distraction in modern life. By having the possibility to constantly be distracted we have become worse at remembering specific facts and instead better at *finding* facts when needed. This is also mirrored

in how the school system has an increasing focus on deploying skill sets rather than just remembering raw facts. The constant distraction has also led to us removing ourselves from our own feelings. That is, not confronting the woes of our lives, instead opting to blur them out with constant distraction. The psychologists argued that this has led to a generally low bar of what is considered mental problems. As we are uncomfortable in states of mental distress and chose to distract ourselves from our own feelings, we lose the skill to handle stressful situations.

People in today's society are forced to present themselves "in the manner of products". Instead of presenting our lives in a natural way social media pushes us to constantly only show happy and exciting parts of our lives. This creates a norm of persistent happiness that clashes with the natural way of having a life with ups and downs. In extension this creates a general opinion that feeling low is considered negative and unnatural, not a part of a successful life. The psychologists perceived this as negative as it makes people ill prepared for the natural ups and downs of life. It also creates unnecessary stigma around mental health. An interesting part of this argument was that they meant that even social media profiles that extensively present their own mental health do it in a disingenuous way: simply showing the "cleaner parts" or lacking the necessary terminology to represent their issues in a meaningful way. Instead they present a general picture of mental health lacking in personal observations.

The psychologists seemed apprehensive towards quantifying mental health. They argued that the human mind is too complex to be reduced to just bars and numbers. Instead of working with blanket terms and set solutions society should focus on helping individuals with the methods that work best for that specific individual.

5.1.5.2 Result from user study

Analysis of the interviews resulted in 23 categories, see A.2. Some general takeaways can be gathered from the extensive data set. The vast majority of the interviews were pivoted towards the topic of mobile phone use. This because most of the interviewees described that they used their phones far more than any other technological platform and that it was specifically phone use that was their concern in their everyday life. Many describe the phone as often being a distraction and a time waster. Furthermore many discussions turned towards social media as a problem, this because the interviews perceived it as the kind of programs (apps) they used the most and had the most complex problem towards. Only one interviewee used their computer more than their phone as that interviewee played computer games as a pass time.

"I think they take too much time, a I think they take up *too* much time, often you open them up because it is a simple pastime for a few minutes and then suddenly it has been half an hour instead."

For clarity the participants has been divided into two groups: those that perceive their technology use as a problem and those who do not. The ones who do think it

is a problem are in this case heavily in the majority. However they do have many different tactics to handling the problem. Some have vast networks of tricks and activities to lessen their phone use, these are also the same people that have extensive analysis on the subject and most prominently present themselves as being negative towards their vast amount of everyday phone use.

“Yes, it[the phone] just locks itself and then in order to access it you could still enter a code and I noticed that I entered this code every time and used it anyway.”

The rest of the group have varying degrees of action and analysis towards their own phone use. From maybe trying out some simple tricks to use their phone less to just acknowledging the fact that there is a problem without doing anything about it.

Some participants expressed that they did not perceive any problems with their phone use. However, it seems to us unlikely that a person who uses any tool 5-10 hours a day will not see both positives and negatives with that tool. Thus it seems peculiar that some interviewees did not have anything negative to say on the subject of their phone use. This could be due to: (1) the questions being too abstract, (2) these people having a bias towards negative talk about technology (as this is a common confrontation from teachers in school and thus they knowingly withheld information in the interview in order to not paint their phone in a bad light), and (3) they simply live such technology impregnated lives that they can not visualize a life without their phone, making the question irrelevant for them.

It is clear from the analysis that many participants want genuine social interaction and perceive technology as being in the way of more natural opportunities for socialization. However, they have a hard time describing why digital socialization feels less valuable.

“Social exchange is so important to people. And I think that the mobile phone can also sometimes be a social escape, that you flee to the phone and then it is no *social* media.”

This view is also mirrored by almost everyone the project has come in contact with outside of the user group representatives. Participants find to important to live a life with physical social interaction where two (or more) people meet in a loving and empathetic way, they also often perceive technology as being in the way of such activities.

Many found it hard to spontaneously speculate on the future. Those who actually answered the future oriented questions at all did so with generally shallow answers and well established tropes such as robots, space, etc.

“I do not really know but I think we will mostly see development in smartphones and cars and games and stuff. So I think it will be easier

to get around and find things out and hold things that are thinner and so on, I do not really know...”

As the questions regarding the future was added with the expressive purpose of probing for the interviewees capabilities to spontaneously speculate this is not a problem per se. However it is clear that it will be important to use appropriate methods during the workshops in order for the participants to be able to speculate beyond the contemporary.

One thing we found both interesting and worrying was how common the topic of younger generations were during the interviewees. The interview had no pre-defined questions regarding the topic of children and their technology use and the fact that the rather young user group still lifted the subject hints at the importance of the topic to them.

“I see younger children who sit glued to their tablets and their phones and stuff like that. Then I think back to when I was little and did not have all that stuff in the same way and I always think that I had so much more fun When I was little.”

Interesting to note is that very few interviewees mentioned data privacy. We had anticipated this as being a much bigger issue that the data shows.

It is also important to note that many participants described positive aspects of technology as well. More functional apps such as bank apps, public transport apps, etc., seem to be very uncomplicated in their use case.

“It is practical to have music, banking, e-invoices, it is easy to be able to get in touch with people quickly. if you are late or something has happened. I feel that I have talked a lot about what I think is negative but I obviously think that there is a lot of positives with it as well.”

5.1.5.3 Result from workshops

Analyzing the workshop resulted in 15 categories, see A.3, and a great amount of ideas. The ideas were more or less useful in themselves for us to continue developing. Instead, the concept and reasoning behind them gave us ample understanding of the user group’s view on the future.

The workshop showed that almost all workshop participants had a focus on climate change when envisioning the future. Even when discussing or ideating on matters not apparently demanding a climate angle they still created scenarios and solutions that had the environment in mind. In general the participants seemed to put their hope towards technology to solve the climate crisis, however the importance of there being motivation for deploying technology in order to save the environment was also brought up. One example of an idea on this theme was: a meat eating plant that was

a result of our climate destruction. The plant eventually grows huge and combats society. Interestingly, this idea was pitched as neutral or even positive even though the plant would eat large amounts of people. Another idea was a set of dice that randomly determines what bare necessity moon-colonists needed to give up in order for others to survive. This, we believe, expressing a want for people to reduce their extensive consumption of natural resources.

When participants were asked to brainstorm on the subject of state and governance many of them came up with ideas that had dystopian undertones and existed in surveillance societies. For example - an AI system that reads people's minds and catches and acts on destructive thoughts that people have. These ideas were created relatively unprompted showing that many fear a future with increased surveillance and dictatorial aspects of state. However, as earlier prompts in the workshop had a somewhat negative tone, this may have affected the participants' state of mind and therefore also the results.

A technology that recurrently mentioned through the workshops was VR technology. Several people created scenarios where humanity more or less lived in VR, this was often combined with climate disaster where VR was an escape from a dying and more hostile world.

Another thing that was mentioned several times was robots. One example being that automation will make most jobs obsolete and people instead work with observing robots at work. Several had ideas about robotic pets or plants with varying degrees of personality and function. For example: an extremely invasive plant that grows all over your home to cure depression. The singularity ⁵ was also mentioned as a possible future scenario.

Some ideas had to do with how different cultures and our psychological well-being and opinions will change in the future. For example one person expressed that cultural activities, such as music and cooking, will disappear. Another hoped that the future would be more spiritual as a revolt against a technology based and information dense reality. One participant mentioned that the future is often presented as being more relaxed and harmonious but that this is not necessarily the case. This showing fear of shortage of reflection in our society on the consequences of the technology development.

Many ideas were projections of technology that we see today being developed further. The participants envision a more digitalized and efficient world where all aspects of society and life are "improved" by new and more advanced technology. Some mentioned new school subjects that might be needed due to this, for example software development and mental health in relation to social media. Some ideas also showcased a belief that the future may hold more emotional technological improvements to life. For example cloning deceased loved ones back to life or cloning dead pets.

Some ideas handle systems that help people make important life choices. For exam-

ple a cylinder that helps one vote in elections by analyzing ones' "true" wants, or a system that analyses your brain at an early stage and tells you what you should work with.

In general, the participants expressed a feeling of hopelessness towards the climate aspects of the future. They also described concern for the future and a fear of it developing in the wrong direction. Some highlighted the dissonance between society and human nature saying that we do not fit into the way society is constructed. Furthermore they argue that this dissonance will increase as society moves into a more technological future. The participants mentioned aspects such as the human need of physical contact, or to experience nature. There were general mentions of poor mental health in the future as we increasingly disregard basic human social needs. According to the participants, people will become more lonely in the future as technology makes a lonely lifestyle more viable. They mentioned that we need to learn how to live with technology to keep social interactions alive.

5.1.6 Takeaways from empathize and define stage

- Mental health is a complex subject and many things that seem like fact are more ambivalent when under scrutiny. For example: the growing mental health statistic in Sweden is not necessarily due to a growing mental health problem. Other factors could be the reason for the trend, increased testing, for example.
- Phone use is by far the most represented and problematic technology in the user group. As it is so relatable problematic in its use cases the final artifact should in some way focus on the phone directly or indirectly.
- The user study clearly shows that the topic of social interaction is entangled with one of mental health and technology. Many perceive technology as being in the way of more genuine social interactions and technology leading to loneliness and by extension mental disorder. The artifact should in some way incorporate these themes in order to resonate better with the user group.
- In many cases the future is synonymous with dystopia according to the user group. The scenarios often contain climate change at its core. As it is such a central theme the final prototype should encompass climate change in either its use or setting/backstory.
- It is important now and going forward to be technology critical and not technology negative. Furthermore we need to generate ideas that embrace technology rather than disregard it, very much in the same way as the user group sees their relationship towards technology. There are problems in the human/technology relationship but none of the interviewees expressed a want to fully remove technology from their life. The question at hand is that of having a *healthy* relationship towards technology.

5.2 Ideate

During this stage our main focus was put on generating ideas based on the gained understanding of the problems and the target group. In order to generate ideas, we used a diverse set of methods from both human-centered design and speculative design. The execution and takeaways are described in this section together with concretization and final idea selection.

5.2.1 Internal ideation

With help of different ideation methods and tools, we worked to create as many ideas as possible. Firstly quantity over quality and further ahead in the process narrowing them down to fewer ideas of high quality. The internal ideation consisted of many iterations and was carried out throughout the whole project process. The methods and tools used within the team are explained below.

Brainstorming

The brainstorming technique, see 4.7 was heavily used during the whole process. We always strived for an open, non-judgemental environment where we felt comfortable to communicate all ideas that came to mind, no matter how wild, and build on each other's ideas.

The Thing From the Future

This card game, see 4.8, was played early in the ideation process to widen our views and look beyond solutions that are fully reasonable. The prompts given triggered us to generate ideas in wild future scenarios. This was not always easy, seldom the idea itself was the most interesting part but instead the accompanying backstory and motivation. When looking at the ideas derived from this method they all had something to say in a bigger context of human thoughts, needs, and desires. It was after a successful pilot test of the method with two external participants that we decided to use this as a method in the co-design workshops. We expected that the method would reveal the user group's feelings and visions of the future which, in relation to the research questions, were more interesting to us than the ideas for future products themselves.

Future Scan

Another tool used in the ideation phase was Future Scan. This chart of 150 potential future scenarios served as inspiration and constraints which we ideated within. The tool generated many interesting ideas, however the constraints led to ideas not clearly connected to the topic of study. Our hypothesis was that if we make our own list of potential future scenarios, based on our target group's view of the future, we could achieve more relevant ideas. Therefore we went through the categories in the result of the interview analysis and tried to translate each of them into at least one future scenario. We concretized the scenario in one sentence and stated how

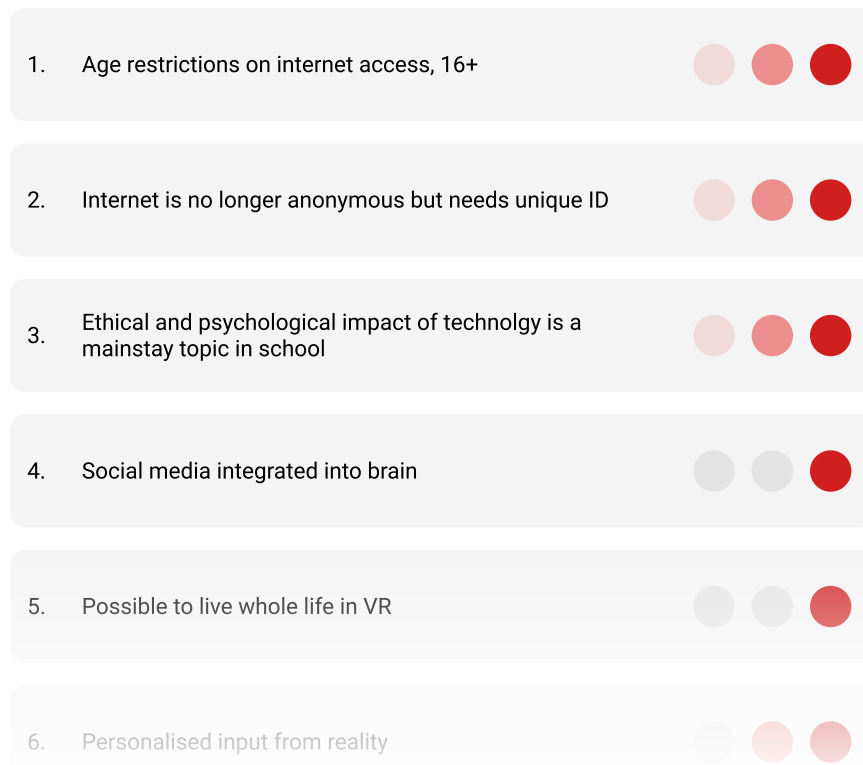


Figure 5.6: The first couple of items on the 31 home brew future scan list.

far into the future it was taking place. This resulted in a list of 31 future scenarios (see figure 5.6) which we then used for ideation. The ideas generated from this list were highly connected to the topic of study, as predicted, and several of these ideas helped shape the final concepts.

Imaginary Employer

When brainstorming on the topic we sometimes had difficulties concentrating our thoughts into a specific product. This was probably because we had access to a sizable data set but not a clear problem to tackle. As we are doing Speculative Design there is no real problem to solve but rather a discussion to be had and we felt uncomfortable in the role of provocateurs instead of problem solvers. To remedy this we created several fictional organizations to work towards in order to hijack a more problem solving approach that we felt more comfortable with.

By role-playing as designers employed at these organizations we were able to create ideas that seemed more grounded and motivated. It also had the added effect of making us let go of our personal values and adapt the values of the organization at hand. Depending on the values of the organization the ideas could still be very much critical in nature, or rather, cynical as they wholeheartedly embraced the value centered approach of (some of) our fictional organizations.

We had a very open approach to the topic and instead let ourselves be restrained by the organization’s main expertise (For example: hardware or software) and values. However, we believe that with a clearer problem the approach can be used effectively to ground early ideas and have a value centered approach. The method also had an added effect of creating ideas with the underpinnings of a backstory, being produced by a fictional organization, making the ideas feel a bit more believable.

We decided to continue developing this method and created templates with empty boxes each with a specific purpose for other designers to fill out and use.

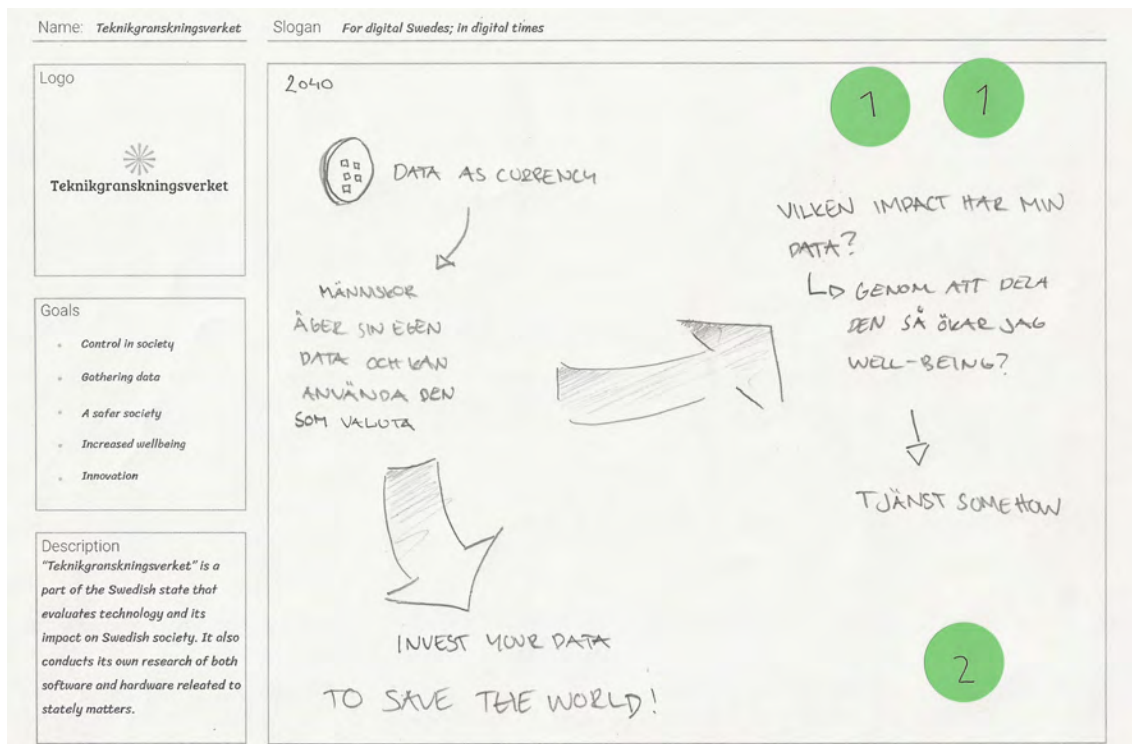


Figure 5.7: A template of the Imaginary Employer method filled in by a Workshop attendee.

5.2.2 Concretization and idea selection

After an intense period of ideation and iteration, all ideas were reviewed and the most interesting 14 ones (see A.4) were picked based on a set of criteria presented below. The criteria were created based on common and important aspects from theory on speculative design artifacts, see 3.2, the research questions, see 1.2, the relevance of the target group, see 5.1.5.2 and the interest of the team.

These 14 ideas were then concretized and evaluated using the same criteria as listed above. Four of the ideas were then chosen to proceed with.

Believeability	How reasonable it seems that this design could exist in the future
Provocativity	The ability of the design to create a strong emotional response from a user
Inclusivity	To what extent the design builds on concepts that are easily understood by the general public
Affordance	To what extent the design clearly communicates its use and functionality
Symbolosity	To what extent the design is understood to be connected to a social issue or future problem
Innovativity	To what extent the design builds on novel ideas or novel implementations of technology
Prototypeability	To what extent it is possible to build a prototype of the design, digital or physical
Testability	To what extent it is possible to evaluate the design with the user group
User group relevance	How relevant the design's topics, themes and functionality is to the user group young adults
Topic relevance	To what extent the design engages in the field of mental health in relation to technology
Reach	To what extent it is possible to show/communicate the design to a wide audience
Wow factor	To what extent the design appears interesting at first glance
Fun factor	How engaging and challenging working with the design is to us

Table 5.4: The 13 categories that were the basis for the weight matrix

In order to support the difficult decision of choosing the final concept, a weighted matrix based of the criteria was used on the four ideas. This concept was to become the main focus of the project after this point and therefore it had to be the idea with the clearest connection to the user group and the idea that most clearly highlighted the issues that are the main topic of the project. With this as background we carefully evaluated every idea and decided that the idea with most potential was “Electric Clothing”. The motivation for this decision was that the Electric Clothing idea was perceived as being the idea with most potential in relation to the research question. In contrast to many other ideas it embraced technology in an interesting way, eliminating the risk of being perceived as retrograde. Furthermore, there was interesting parallels between technology and human in the design. A connection that we believed would be a good basis for bigger discussions on the topic of technology use and mental health. To physically connect the person to the phone and powering

Criteria	Weight	Digital Jammer	Communal Computers	Data Capsule	Electric clothing
Believability	3	5	4.5	4	5
Provocativity	3	4	4	3,25	3,75
Inclusivity	2	4	4	4	3,5
Affordance	2,5	3	4	2,5	4
Symbolicity	2	4	2	3	5
Innovativity	1	3	3	2,25	4
Prototypeability	2,5	5	2	5	4
Testability	2	4	2	3	3,5
User-group relevance	2,5	4	4	2,5	5
Topic relevance	2,5	5	5	3	3
Reach	1	5	3	5	5
Wow factor	2,5	3	4	4	3
Fun factor	3	3,5	3,75	3,25	3,75
Weighted total		119,5	106,25	101,25	118

Table 5.5: The weight matrix

the device with body heat would amplify the feeling of the phone being an extension of the self and therefore hopefully create interesting conversations on the topic of human phone relationships. The idea also had the sought after environmental angle that rhymed so heavily with the user group. Lastly we believed that the idea was complex enough for development and that it could easily be developed further to find new interesting avenues of discussion.

5.2.3 Result from ideate stage

In this section the four final concepts are explained. As well as motivations for why they were relevant or not for the scope of this project.

Digital Jammer

In a world where our concentration is constantly split between reality and the digital, many yearn for a moment free of technology and a true social meeting with other people, see 5.1.5.2. This artifact helps in this regard by jamming digital devices in an area around it. By disturbing digital signals and functionality a user can force those around them to focus on more physical activities hopefully creating more genuine social situations.

Very clearly this concept is a comment on today's digital society by putting into view how much we let digital devices control and dictate how we live our lives. By removing the possibility of technology, the users can reflect on how often they would use technology if the jammer was not active. Additionally the very need of having a product that forcefully removes an activity showcases how we seem to lack control over our digital use.

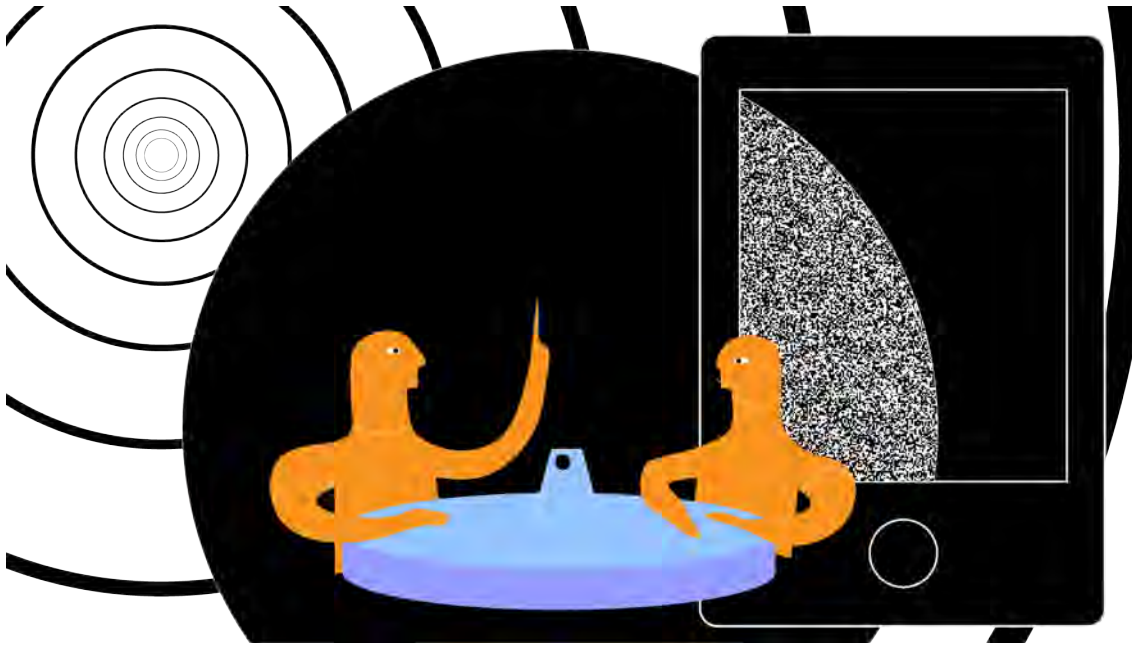


Figure 5.8: Infographic showcasing the experience of using the Digital Jammer

For the user groups this is highly relevant as one of the most common problems mentioned in the data is how a conversation or social gathering can be undermined by heavy phone use. Many users want to have a more grounded social experience and get rid of the epidemic of “phone pauses” and “google disruptions”. In general a majority expresses a want to use their phone less, see 5.1.5.2, something that this device might encourage. See 5.1.5.2.

Lastly there is a privacy angle to the artifact as it will also disrupt any possibility of recording or photos during its active use. This will create a more private setting that rarely appears in today’s society.

The Digital Jammer was perceived as one of the best ideas as it so clearly pinpointed a specific issue of phone use in social situations. It had a clear use-case as well as clear symbolic annotations. However we feared that the idea was not clearly desirable by the user group due to its retrograde solution. To simply remove electronic devices is in a way not to solve a problem in an innovative way but rather to historically take a step backwards. We also knew from research that the user group does not desire the removal of their phones rather that they want to be in control of their own use. In retrospect the artifact seemed to take a very uninitiated approach to the problem by removing electronics rather than learning to live with them.

Communal Computers

The privacy of a digital device can be both a blessing and curse. It does create more private socialization but the one-person use of a digital device can also alienate other individuals in for example a physical meeting. As digital devices take



Figure 5.9: Infographic showcasing the experience of using the Communal Computer

increasing space in our lives we need to learn how to socialize with devices as an asset and not a hindrance. This artifact attempts to solve this problem by being a computer with the possibility of several parallel users. This helps by breaking up the stigma of the digital world as personal and private but is also a tool to help people show digital media to each other in a more natural way.

The discussion at hand here is to what extent we are comfortable with technology dictating a conversation and how much private data we are willing to share. The internet is not a private place but many perceive it as being both highly private and personal. To lift this interaction out in the common space will hopefully spark discussion on how we use technology.

The user group does not enjoy conversations being broken up by the use of devices, see 5.1.5.2. Furthermore they heavily mention a conflict between digital life and real life social contact 5.1.5.2. If a communal product would become popular it could create a hybrid socialization style that encompasses the digital world at the center of a conversation leaving both digital chats and info open to all physically present people. Furthermore the artifact has an environmental angle as communal computers hint at less consumerism.

Communal Computers was born from a will to deconstruct the privacy of the per-

sonal device. The hope was to, by creating a communal digital experience one can show a user that phone use does not have to be a private affair but rather could be a part of a conversation rather than a destructive force in a social context. There was also an interesting environmental angle as the need for common computers hinted at a world with less resources and less consumerism. The idea however was never truly crystallized but rather just existed as a scenario where people use a computer together. This ambiguity in form coupled with the fact that community computers in a way is another retrograde idea (It mimics the way the family computer was once used in the early days of the internet.) led to us not continuing development of this idea.

Data Capsule

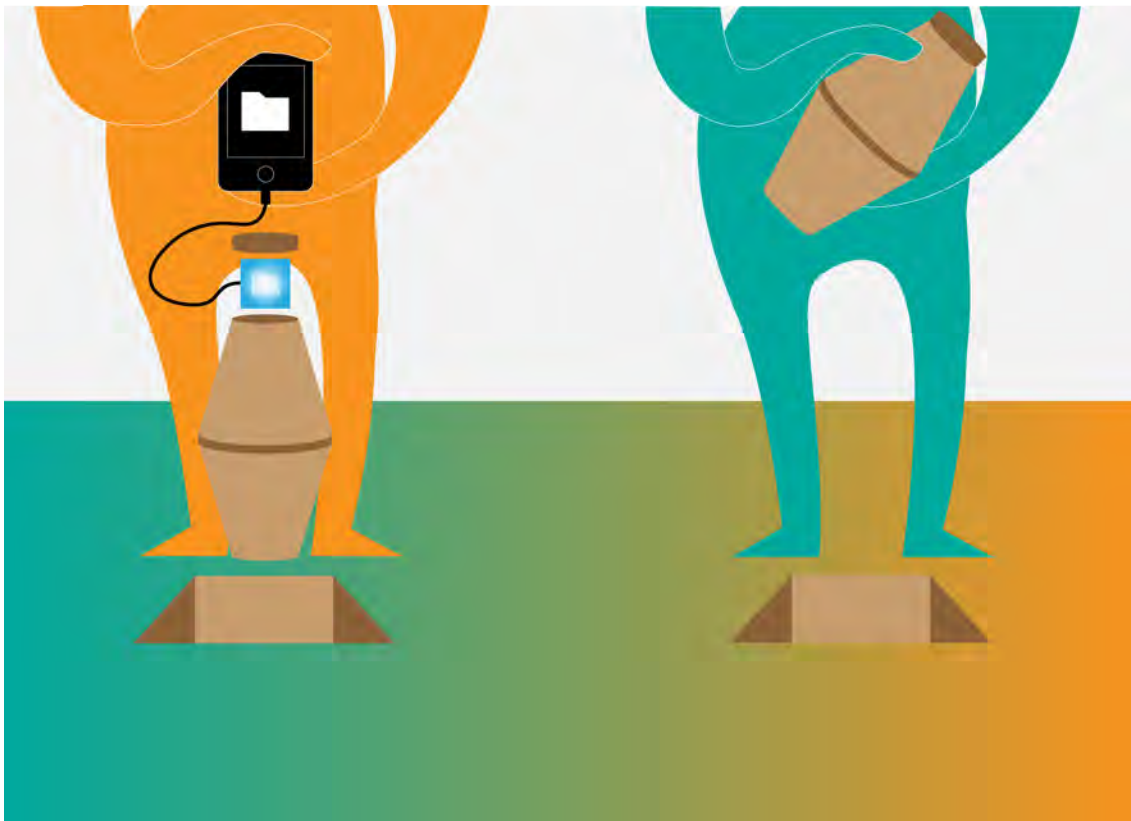


Figure 5.10: Infographic showing the data urn before and after excavation.

To secure reliable representation of our time this product makes it easy to save your personal data for future generations. By sealing a highly durable hard drive in an even more durable shell a user can ensure that their data will be secured far beyond their lifespan and hopefully found by civilizations thousands of years in the future.

Hopefully this will spark discussion on the fleetingness of data, the right of any one individual to represent our times and general discussion on our civilisational heritage. An important but not as generally known basis for this artifact is the fear

that our generation by heavily investing in digital storage will not leave any notable cultural trace in history.

The artifact is relevant for the user group because it handles data, a very common and understood concept in our day and age. As many users have a very apocalyptic view of the future, see 5.1.5.3 it will hopefully seem relevant to leave a more lasting legacy. The view that one's digital representation is not genuine is also a widespread one and the prospect of any one individual representing our society with for example their Instagram feed should probably be conceived as both provoking and negative.

Born from ideas on the varying genuinity of social media and a fear of societal collapse this idea had a Strong symbolism and a strong theme in firstly: death and secondly: who has the privilege to represent a civilization. There is also undercurrents of both historical responsibility and environmental change. However a concept surrounding death seems ill fitting for such a young user group which seldom reflects on their own mortality. The concept also felt a bit simple in that the idea itself was almost complete after just the ideation stage. There was not a lot of room to explore outside what was already done.

Electric Clothing

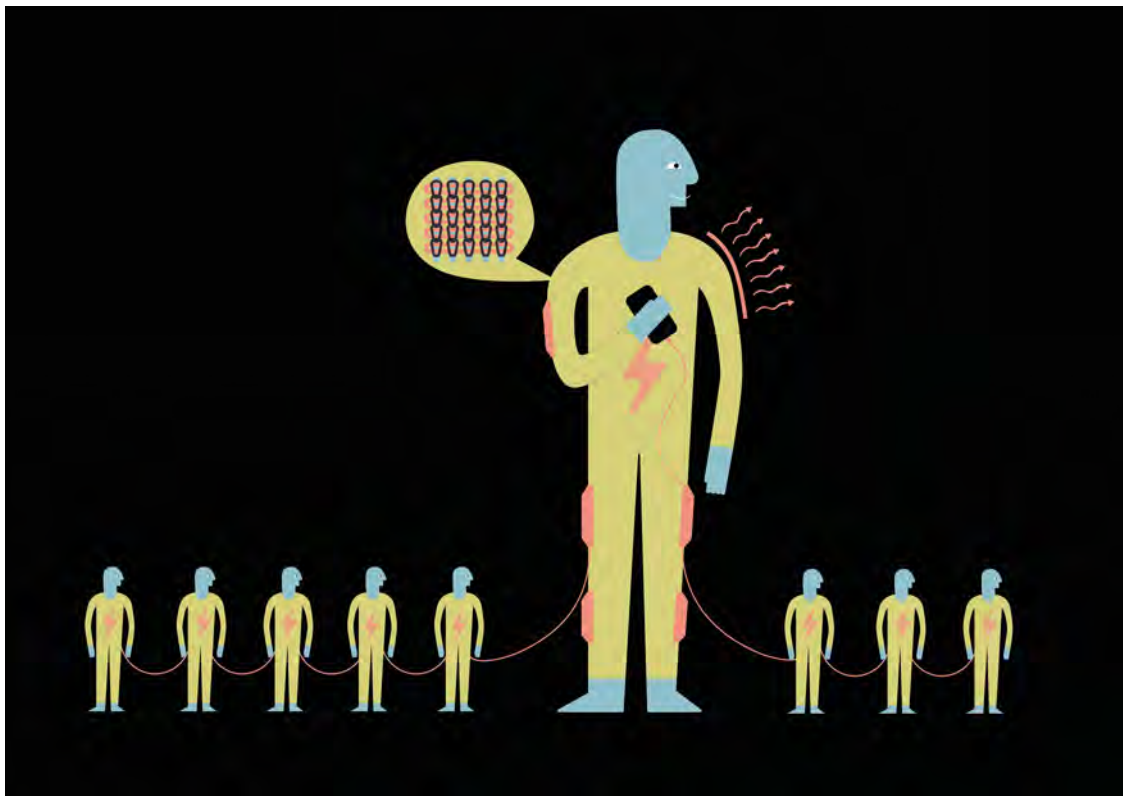


Figure 5.11: Infographic showcasing the Electric Clothing concept

The phone can easily be seen as an extension of the self as it takes such a huge role in everyday life. As we live very close to our phones and in constant stress

of them dying we believe that a system that literally keeps your phone alive with your body will be a good symbol for how the phone is an essential part of our body and self. The idea also does not work against the onslaught of technology rather the opposite. It shows the users a future where we go to bigger lengths in order to power our devices thus leaning in to concepts of constant connectedness and increasing digitalization. The concept also had strong environmental undertone which we perceived as very important for the final concept.

As society relies increasingly on secure and renewable electricity we need to find new innovating ways of producing our personal energy. This artifact therefore harvests the excess body heat from a person and turns it into electricity to be used as the wearer sees fit. Theoretically a person produces quite a lot of energy in a day which makes this artifact both very viable and reasonable. It also has the added effect of undermining the top down energy structure of society, instead making every individual its own energy producer - energy they can then use themselves or send back to the power grid for profit.

Due to the high relatability of phones and the constant stress of them dying we believe that a system that literally keeps your phone alive with your body will be a good symbol for how the phone is an essential part of our body and self. The discussion at hand is hopefully that of who is the master and the slave in the phone-human relationship and what we are ready to do in order to keep our phones alive.

As the user groups live very close to their phones, see 5.1.5.2 they will not have a hard time imagining the artifact as a part of society. The very reasonable idea of harvesting body heat will also help the artifact's believability. Lastly the environmental angle is highly relevant both for society and to the user group, see 5.1.5.3.

Additionally we had an idea that the suit might be able to produce some kind of sustenance for the user from electricity, air and water. This will not only make every person a battery but also make them semi-plants in an interesting way.

5.2.4 Takeaways from the ideate stage

The ideation stage was long and heavily iterative due to the complexity of the issues and the constant influx of user feedback through the workshops. Extensive amounts of ideas were created and scrapped before ending up with the 14 best, see A.4. Generally the process was not cumbersome but it was problematic to truly get into the speculative mindset and we constantly found ourselves re-balancing the ideas in factors of realizability and relatability. The ideation stage started out with very grounded ideas and slowly moved to more unrealistic ones as we realized gradually that we needed to make the artifact intrigue on a greater scale. Paramount in this process was the workshops which mainly functioned as a way of re-calibrating the process along the lines of the users' expectations. Furthermore they worked as important inspiration.

Out of the 14 ideas four were selected and out of those four, one final was decided upon. The *Electric Clothing* idea was selected due to its relevance in the themes located in the empathizing stage 5.1.6.

5.3 Prototype and storify

During this stage our aim was to test out the different aspects of the final concept with different prototyping methods. The aim here was mainly to test the artifact's physical attributes and function as well as produce a high fidelity prototype for the final testing. Important to note is that this stage is not as clearly separated from the other stages as this reports structure indicates. In reality there was overlap between the ideation phase and the prototyping phase and we iterated ideas several times after a prototype gave us new ideas or uncovered new issues. Thus we moved between ideating and prototyping heavily in this phase to end up with the final concept and prototype.

5.3.1 Lo-fi prototyping

Several lo-fi prototypes were built in order to test out more complex ideas of shape and function. These were generally quickly put together fabric constructions that was then tried out by us in order to evaluate ideas. The wearing of the prototypes has an added benefit of evaluating emotional values of the artifact. Through these lo-fi prototypes the concept was expanded significantly.

The Full Body Sock

The first idea of the Electric Clothing was to have a full body sock in order to maximize the body heat harvest. However the idea of having a full body design was scrapped during prototyping, mainly due to its constrained and uninspiring shape. Furthermore the full body sock was supposed to be worn underneath everyday clothing and we were afraid that the design would not be clearly visible when shown off on a model. From a speculative design point of view it would be unpractical to create concepts that are not interestingly shaped and clearly visible as they are suppose to be a medium for discussion rather than a more seamless solution. Thus, through prototyping, we realized that this was a road that we did not want to walk and we pivoted the concept into only covering part of the body and for it to be worn on top of other clothing. This made the artifact a complement to an outfit rather than something you just wear underneath.

The Visible Shape

With this new angle in mind we continued prototyping several different designs and shapes. Firstly we focused on leaving gaps in the suit creating wearable that in different ways covered the most crucial parts of the body. However, these designs did not create the desired effect and were often mostly perceived as just variants

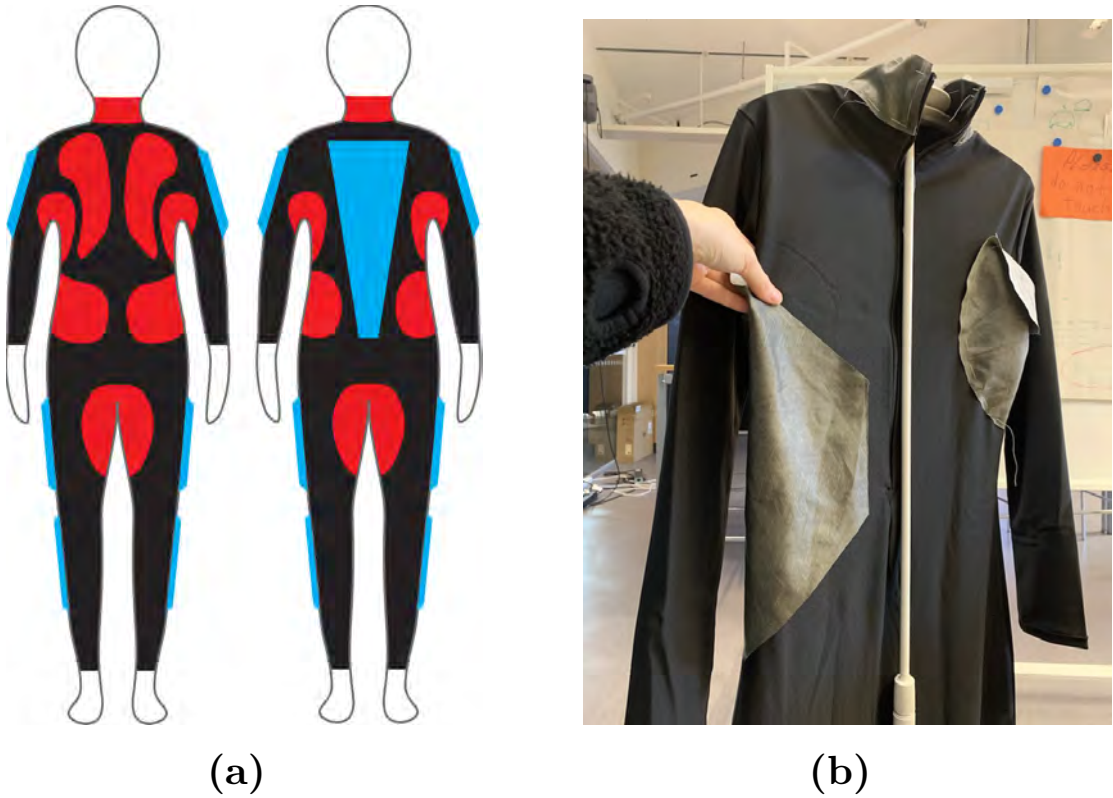


Figure 5.12: An early prototype of the body sock where the red and gray color represents more active areas of charging. Digital prototype (a) and physical prototype (b).

on the body sock idea but with holes in different places. Thus we started exploring asymmetrical shapes instead finally ending on an idea that covered one arm and chest and back. We thought this an interesting alien shape for a wearable.



Figure 5.13: An early prototype of the artifact with an unsymmetrical shape.

Cable Management

In order to clearly symbolize social aspects of the artifact we started experimenting with more defined cables as a part of the design. Up until this point the means of electricity transfer had been unclear and generally we thought it most reasonable to go with a wireless charging technology that would charge devices in for example your pockets. However we wanted to capture more interesting means of interaction and started to search for ways to make users power more demanding devices together. This also synced with the focus on social interaction present in the user studies. We wanted to create an artifact that would encourage social interaction but also embrace a life permeated with technology. Thus we tried to create new avenues of socialization through the artifact. By forcing a user to stay physically close to another one when performing the charging action and promote an easier way of charging things together we hoped to encourage more social activity around the device.

Through prototyping we thus started experimenting with different ways of managing cables. Trying out different ways of organizing the cables around the artifact, fastening them etc.

Electrical Sockets

The first concepts all had electrical sockets around the waist and as the new concept did not cover the waist we needed to prototype new ways of implementing interactability. Through testing and fastening devices to the new design we came up with the idea of having one external battery fastened to the suit. As the new design left more space around the wearer (as it was worn outside of clothing) we could introduce a substantial battery box which would house interactivity and outlets. This also had the added benefit of clearly communicating that the wearable had technical components, something that might have been harder to detect if the idea had more integrated technology.

Environmental Aspects versus Mental Health Aspects

Furthermore we feared that the environment angle might overtake the mental health aspects of the prototype. It appeared important to have a climate undercurrent in the idea but it was also important for it not to take the main stage. At the same time we thought the artifact a bit too comfortable and unafrightening, thus we introduced the ability for the user to modify the effectiveness of the charging with the cost of bigger decrease in body heat. This way the symbolism is a bit clearer as the artifact indirectly ask the user how much they are willing to sacrifice in personal comfort in order to charge their devices, coupled with a backstory of lacking electricity the artifact would hopefully have a clearer message of human sacrifice and relationships towards technology.

5.3.2 Body storming

Through different role playing techniques and embodied design techniques such as body storming 4.14 we explored the concept further and found some really interesting nuances to the idea. Firstly the social aspect was extended considerably. We had for a long time been exploring the social aspects of technology use and how phone use affected peoples feelings of loneliness and alienation. By role playing with the artifact we realized that there is a clear social aspect in that of sharing electricity between devices, that is charging each others devices. By making a user's electricity level fully visible to other users we create new avenues of socialization and signs of appreciation through the collective management of electricity. As we have already focused heavily on the social aspects we found these concepts interesting and explored them further. Through this process we found that the connection to other people is one of the strongest parts of the concept.

5.3.3 Hi-fi prototype

After great amount of lo-fi prototyping and iteration the final shape and functions were set and we could start with the hi-fi prototype. We aimed to make this prototype as realistic and complex as possible in order to get the observer to believe that it is functioning and could exist. For the look and feel we were inspired by the aesthetics of prosthesis implants and other medical technology products. We wanted



Figure 5.14: Body storming cable management.

to achieve a look that is interesting and eye-catching enough to spark questions and provoke but at the same time is relatable and believable.

Wearable

This part of the prototype was decided to be built with a soft and ductile plastic. A material that came with some challenges. We started by cutting the material in the correct shape. Our first challenge here was how to attach the different parts to each other. We tried different types of glue but as the attached parts had to be bendable, especially the shoulder part, it was not strong enough. Instead we made holes on both sides and tried different ways to sew them together. Next challenge was to get the right look and feel of the (fake) thermoelectric generators meant to harvest body heat from the user. Initially we wanted to use smaller circular parts connected with cords but after a few test with different sizes and patterns we decided to go back to the organ shaped patches that we used earlier in the full body sock. The patches was cut out of white faux leather material and the edges was sewn with white thread to get a more processed look. To give the patches more volume they were glued together with a soft, thick plastic material. We then used screws to attached them to the plastic material which gave the prototype a medical technology look. The arm of the prototype was made out of a white canvas sewed together with a strap of the same white faux leather used for the patches. The faux leather strap was then attached to the plastic material with screws. Then we cut out holes to attach the straps that goes around the body and fastened the cable management straps with screws. After that, some final adjustment in shape and size were then made to fit the photography model.

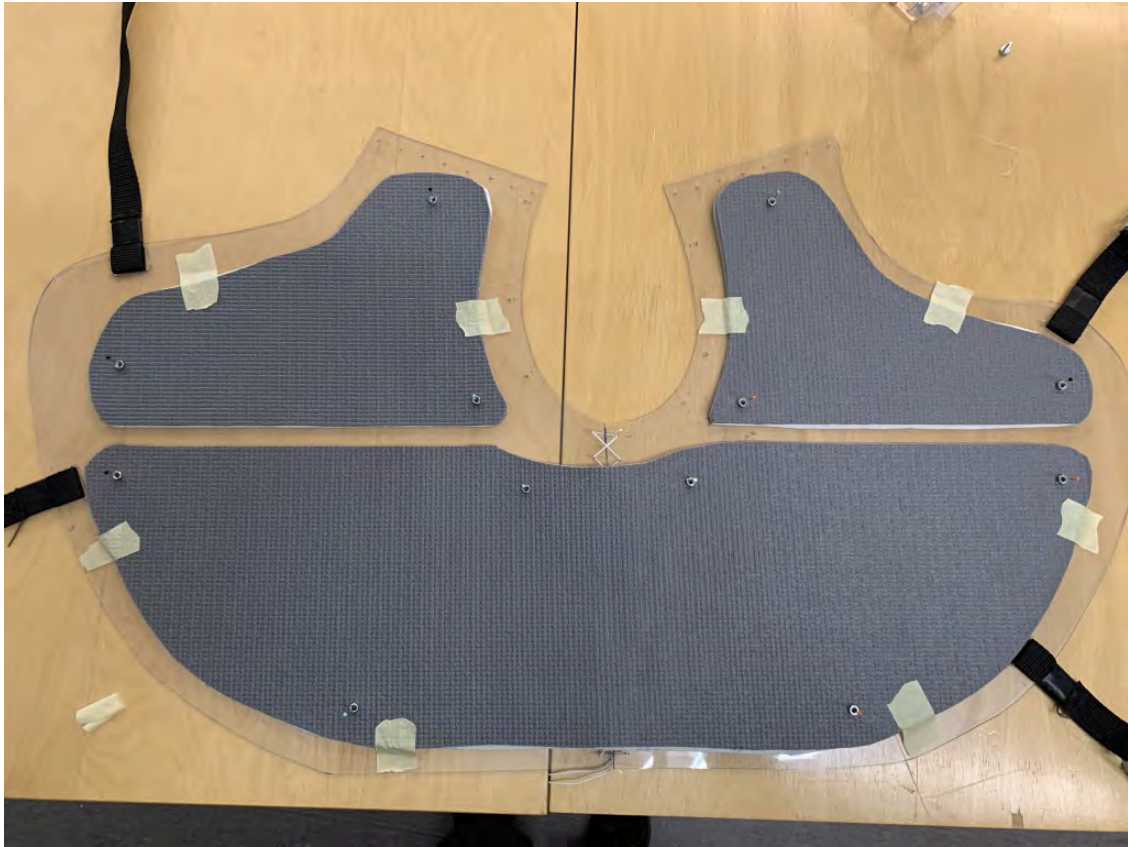


Figure 5.15: The final prototype in the making

Battery box

To get the right look and feel of the battery box we tried different approaches. One was to re-build old metal boxes originally used for other purposes such as CD players and modems. The other approach was to make a 3D-model and print the exact shape we intended. There were pros and cons with each one of these approaches when it comes to how detailed we managed to make the prototypes. The 3D-printed model was difficult to achieve a good surface finish on, and with the re-built metal boxes it was tough to reach the right level of details. In the end we chose to proceed with the 3D-printed model which we felt better represented the functionality. Final adjustments was then made such as refining the shape and building the screen.

5.3.4 Storify

As the prototype was to exist in the future we had to ideate and construct a future scenario that motivated the artifacts existence and gave it substance. This story was used both as internal ideation material but also to motivate the artifact in the eyes of the present day users.

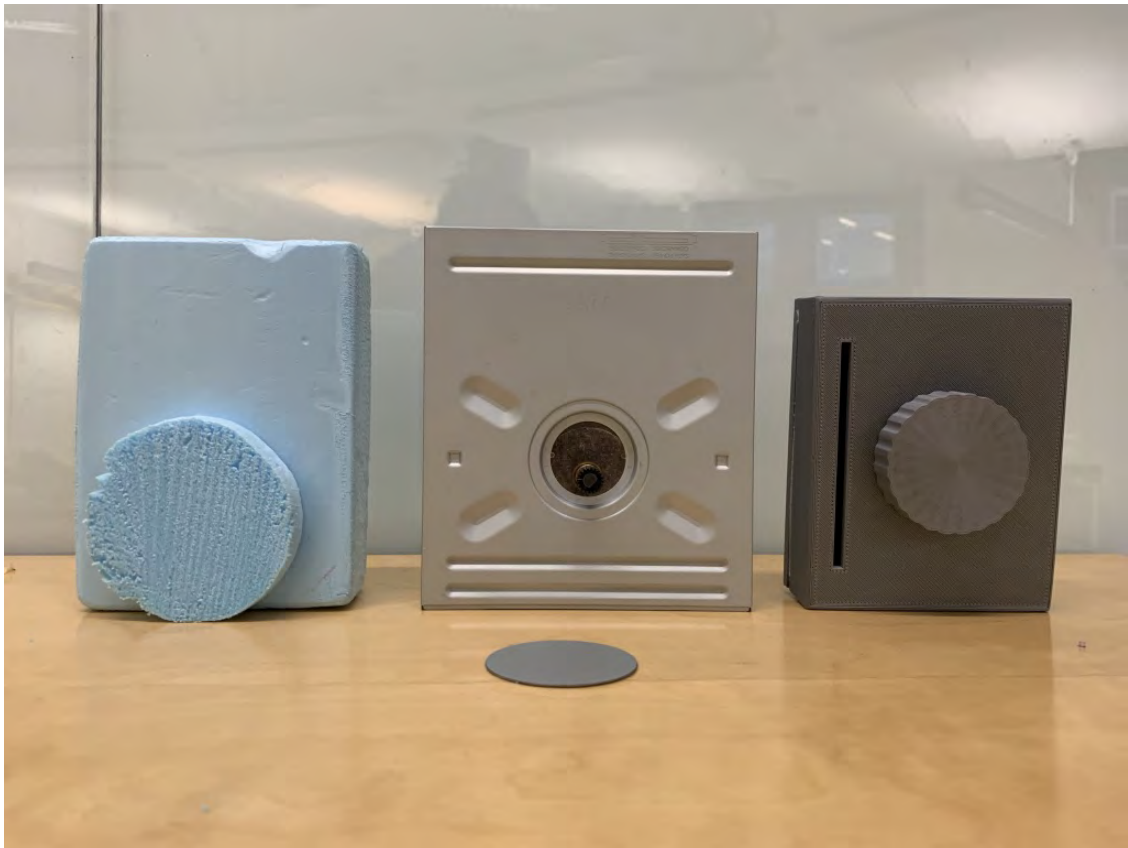


Figure 5.16: Iterations on the battery box.

Scenario

We wrote a short-story concerning the artifact in order to crystalize and manifest some more emotional aspects of the design A.6. The scenario described a day in the life of a future citizen called Sävi and her interactions with the artifact. Sävi spent her day wearing the device and her personal opinions and experiences were described as well as some aspects of her future.

7 foundations

This foresight model was used to imagine and build our vision and story of the future based on our insights so far from the study. The purpose of this was to make sure we had a common mental model⁶ of what future or alternate reality we were designing for.

Website

In order to present the artifact digitally to the participants, we created a website and a fictional tech company named *Seebeck* (after Thomas Seebeck and the thermoelectric effect - also called the Seebeck effect - used in the artifact). The idea of evaluating the artifact using a website was inspired by the research done in *Prob-*

lematising upstream technology through speculative design: The case of quantified cats and dogs[20] where a research group also evaluated using a similar approach.

Just like the above mentioned article we purposefully held the existence of the artifact ambiguous on the website instead resorting to referring to the artifact as being “in the last stages of prototyping”. Furthermore, we used overly corporate language to present the artifact, mimicking the way tech-startups present their products (“Every second your body is radiating heat. This vast reserve of energy is wasted - until now.”). However we thought it important to not skim over important negative aspects of the artifact. Thus we also included sections on the artifact making you cold and a section quickly describing the future scenario where the artifact would be used. These were presented in a positive light giving the website an almost ironic or satiric air (“We believe that electricity is a human right, and that a life without the social comforts of a phone or a computer is not a life lived in full.”).

To not make the website overly complicated and extensive to consume we intentionally left out the technical details of the artifact, instead focusing on use cases and the overall experience of the artifact. Furthermore, as the users were not able to test the artifact’s interactions we included detailed infographics describing the artifact’s interface and interactable elements. Finally we included a description of the fake company Seebeck in order to finalize the illusion of a fully functional product.

Visually the website used a clean approach mostly relying on gray colors. We used wide pictures of the artifact in very clean environments in order to make the reader focus on the artifact itself and not get distracted by settings or background noise. We also took care to include subtle hints that the website was from the future deliberately choosing slight but alien UX concepts for the website. Mainly the website used a floating circle for navigation an element not usually included in web design. Other aspects that hinted at a future company was the use of Emojis to convey emotions, the extremely subtle font change and the fact that no part of the website uses any prebuilt visual components that can be linked to an existing design-framework.

The website was prototyped in Figma and built using Javascript heavily relying on the React library. A full picture of the website can be found in this reports appendix A.8.

5.4 Test/Evaluation

During this phase we focused on verification through qualitative data gathering methods in order to evaluate the impact of the artifact. The data was collected through interviews using a method called Co-discovery, see 4.16, with a total of 15 participants from the target group; one group of three people and six groups of two. All participants were recruited through convenience sampling. As a basis for these interviews we used our website explaining the artifact in a way that made it ambiguous if the artifact actually exists or not. This was inspired by the participants and focus group process conducted in *Problematizing Upstream Technology through*

Speculative Design: The Case of Quantified Cats and Dogs [20]. With pictures, info-graphics, and text, we defined the artifacts' use-case and context as clear as possible. Through this website we were able to present the artifact to the participants and evaluate their responses. We were primarily interested in studying the effect of the artifact in an emotional response in the observer, rather than observing general positive reactions from the participants. Furthermore we were interested in what thoughts and questions the artifact triggers from the users. Lastly we were interested in how the users perceive the artifact, that is: how believable and relatable the concept is.

We chose the Co-Discovery method due to its strength of triggering experiential discussions by letting two friends discover the artifact together. However, as this is a method where the participants will control the discussion to a great extent, it can be difficult for the researcher to decide the direction of the discussion, see 4.16. Therefore there is no guarantee that the session covers all the topics that the researcher desires. Nevertheless, because we wanted to find out what topics this speculative design is actually triggering within the target group we needed the discussion to be as spontaneous as possible to get the most genuine reactions and conversations. Therefore we decided to be present during the sessions but, at first, not influence the discussion at all, and then if needed ask questions such as:

How do you think it would be to use this product?, and, *What positive/negative consequences do you think this kind of product could lead to?*. This to spark the discussion but without asking questions directly leading them to any specific topic.

Every session had the same structure starting with five minutes of one researcher wearing and pretending to use the artifact while the participants were observing and discussing what they saw. This was a warm-up task to make them focus on the interaction of the artifact and not just the overall concept which was hard to achieve without them actually interacting with the prototype in a physical setting. After that the participants observed the website together followed by individually answering a short form containing two questions. The first one was a multiple choice question asking how the concept made them feel, and the second one was asking them to elaborate in their own words why it made them feel that way. Most of the times the discussion started spontaneously after this but when needed they were asked to talk about their answers in the form which was enough to get the conversation going. At the end we explained the purpose of the session, that the product is a speculative artifact and not a functioning product.

The sessions were recorded, transcribed and the data were then analyzed thoroughly again using the KJ Technique, see 4.6.

Evaluation group	Age	Sex	Occupation	Evaluation medium
1	24	Male	University	Digital meeting
	24	Male	University	Digital meeting
	24	Male	Working	Digital meeting
2	22	Female	University	Digital meeting
	20	Female	University	Digital meeting
3	20	Female	University	Digital meeting
	25	Female	University	Digital meeting
4	24	Female	University	Digital meeting
	22	Female	University	Digital meeting
5	24	Female	University	Digital meeting
	22	Male	University	Digital meeting
6	23	Female	University	Digital meeting
	22	Male	University	Digital meeting
7	19	Male	University	Digital meeting
	26	Male	Working	Digital meeting

Table 5.6: The participants of the evaluation

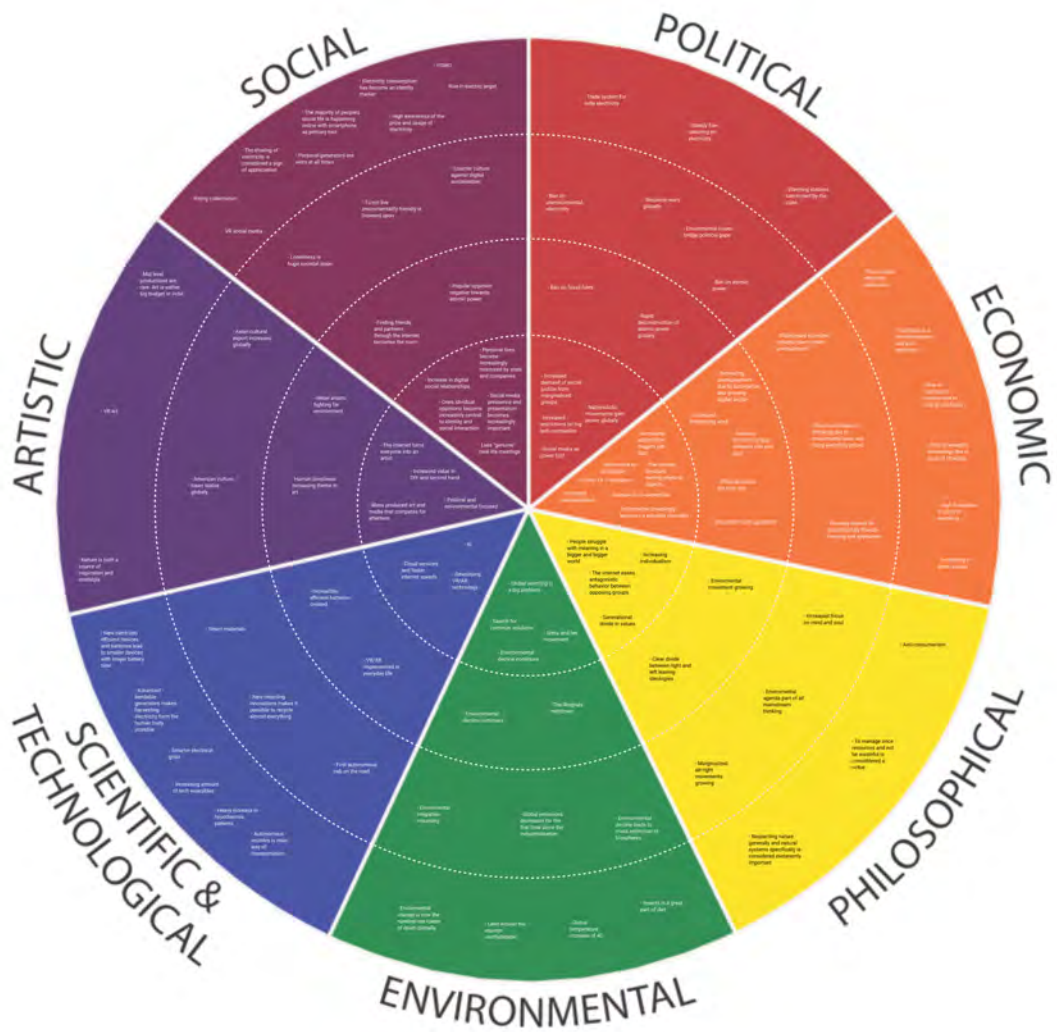


Figure 5.17: The 7 foundations map developed in order to flesh out the setting and details of the artifacts future reality[59].

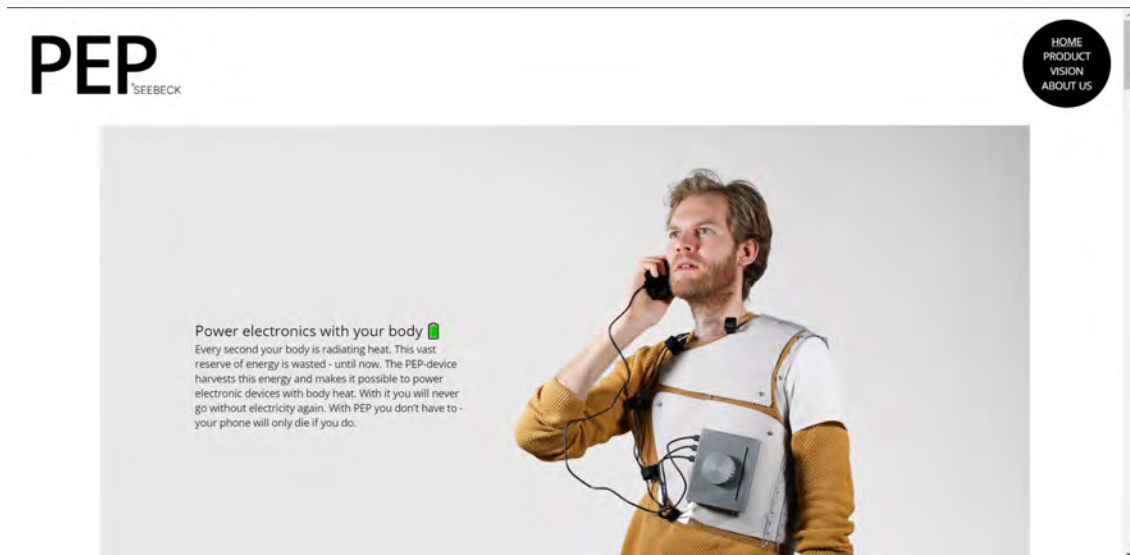


Figure 5.18: Snapshot of the website.

6

Final Results

In this chapter the final artifact is presented together with the results from the evaluation of that same artifact. The PEP is a speculative design and thus aims to inspire and provoke rather than solve a specific problem.

6.1 The final concept - PEP



Figure 6.1: A person using the PEP.

The PEP-device is a complex wearable that harvests the user's body heat in order to generate a personal storage of electricity. The stored electricity can then be consumed as the users see fit: powering their personal devices, sharing it with others, or selling the electricity back to the power grid.

The PEP-device is worn over half the torso, covering most of the chest and back as well as parts of one arm and the arm pit. The device is fastened with straps under one arm and over one shoulder to ensure a close contact between generators and person in order to maximize body heat transferal. The device is constructed to be worn over other everyday clothes making it fully visible during use and making it

possible to combine PEP with an already established clothing style. It is, of course, also possible to wear the device directly on the skin or wear something over the device like a jacket or a sweater thus integrating it more into an outfit.

6.1.1 Functionality

Beside the wearable part of PEP, the artifact contains a body battery that works as the main way of interaction for the user. As the name implies the box mainly contains a battery in order to store the generated electricity but it also facilitates both controls for aggressiveness of the harvesting process and means of distributing electricity. By dialing the wheel on the front of the box the user can control how intrusive the body heat harvesting process will be. This will result in more heat being transferred and creating a colder environment between wearable and user. Put simply: the more energy is harvested the colder the user becomes. Furthermore, on one side of the box are six USB-C ports that can work as both inputs and outputs depending on what devices are connected. This makes it possible to create networks of electrical outputs and inputs that seamlessly power devices and charges different PEPs. Both the perceived temperature and the current connections are displayed on the display at the top of the box. The interface also shows current battery levels both with a bar and a number in Wh, (watt hours) 6.2.

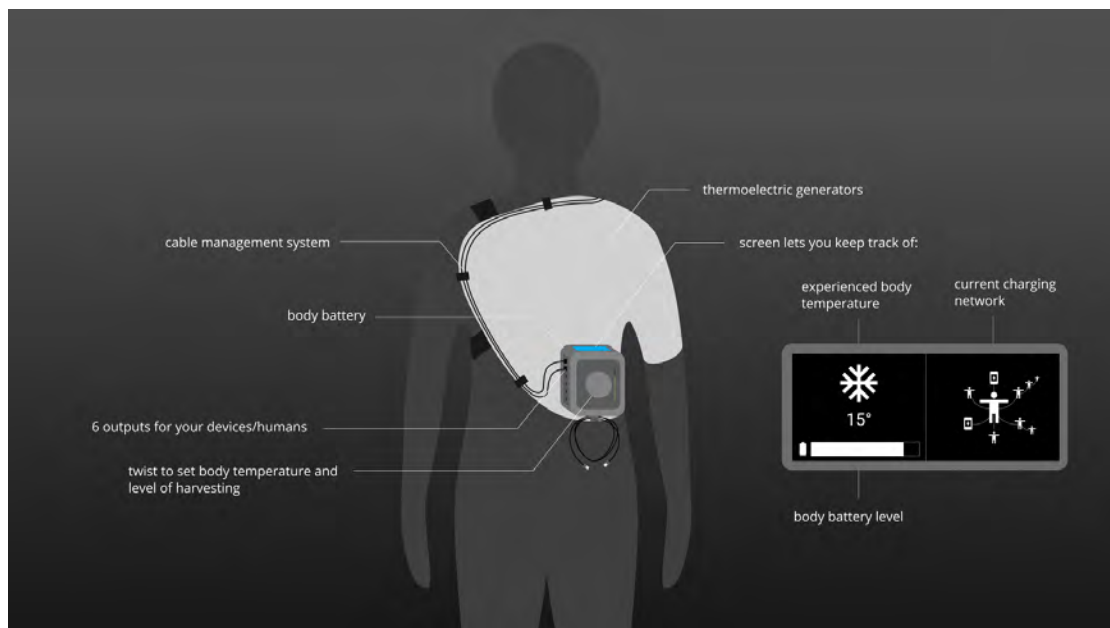


Figure 6.2: Infographic showing the interaction of the artifact.

6.1.2 Interface

The interface is a screen placed on the top of the body battery clearly visible when PEP is worn if the user looks down. The simple interface shows relevant info on the current state of PEP to the user. Half of the screen shows the perceived temperature of the user as well as battery status. The perceived temperature is simply the

temperature that would result in the same experience as the current body heat harvesting setting produces. It is not necessarily the same as the actual temperature between user and device and is thus a simplification of the system in order to clearly communicate what temperatures are being experienced. Battery status is shown by a simple bar as well as a number in Wh (watt hours). Wh is not a common unit but considering PEP's focus on electrical management and the scarcity of electricity in the future it is argued by us that the people of tomorrow will probably have a much greater understanding of electrical units than we do. Thus the number is relevant and hints at a future where laymen have a greater understanding of electricity.

6.1.3 Network

It is assumed that the artifact will be widely available and popular among the public. With this in mind society will find that, with the PEP-network installed, new ways of interacting with the electrical grid become possible; as every person is now not only a consumer of electricity but also a producer. A single person does not produce enough electricity on her own, but on a larger scale a population can make a significant contribution towards society's energy quota. The system also promotes collaboration and being social as it is fully possible to share electricity between PEP devices. This has two use-cases where the first being that of charging other's devices. If a user's personal electricity is running low, another person can step in and simply share their supply with the lacking user. Close friends and family can therefore share an electric load between them giving and receiving when the need arises. For example: a friend charging another friend to get them through the day or a child charging their parent as a sign of appreciation.



Figure 6.3: Infographic showing different social activities the PEP facilitates.

The second use case is that of increased power output with several people charging together. The more batteries are connected the more power they can output together making it possible to power more consuming devices. This can also be seen

as a social experience and one of collaboration. For example an event could power the audio system with its own party attendees or a car could be driven both faster and longer with increased amount of passengers.

Furthermore any excess energy not consumed by the user can easily be pushed back to societies power grid making every person with a PEP-device a contribute to society's power quota.



Figure 6.4: Two users charging together.

6.1.4 Technical Specifications

The PEP system uses thermoelectric generators to produce electricity. That is, by creating a temperature difference between the two sides of the thermoelectric generator a voltage can be created [60]. In PEP's case, this is the difference between the side of the generator in contact with the human body and the side that is not. With this in mind the system comes with a couple of caveats. Firstly the produced electricity is proportional to the temperature difference and thus will vary depending on the environment PEP is worn in. For example wearing PEP in a cold environment makes it more effective and by the same principal increasing ones body heat through, for example, jogging would also increase the productivity of the system. Secondly there is a physical danger in the device in that it "steals" heat from the body. PEP can function satisfactory with just consuming excess body heat, but the more aggressive the system the more electricity will be produced. This can be controlled by the user as mentioned earlier, see 6.1.1. Assuming effective generators it could be dangerous to not hinder the flux of body heat into the generator as it would severely decrease the body temperature of the user. Prolonged use on high intrusiveness could therefore have a number of side effects including: shivering, feeling tired, hunger, hypothermia and even death.

A single user can produce adequate amount of electricity from just body heat. Generally a person produces around 100 W in a resting state. So even with very little intrusion enough energy to charge a phone or power a simpler laptop can be harvested [61].

6.1.5 Scenario

As PEP is rather intrusive it should be perceived as a necessary evil in a society that is in need of electricity but lacks comfortable production means. The artifact exists in a close future where environmental change and global initiative towards greener power production has made the price of electricity extremely high. Society, however, does not want to give up the comforts of technology and has instead taken to other more individual (and uncomfortable) means of producing electricity. It is this balance that is at the center of the scenario as the PEP-network fills this niche of being an uncomfortable product that fills an important function in society. It seems very possible that the artifact itself can only exist in this transitional period where electricity production is limited. Every person is therefore living a day to day life where they manage their electricity in order to power electrical devices. To offer ones personal comfort (through increasing the intrusiveness of the harvesting process) is a common occurrence and a concept that is widely known and understood in this speculative future. Continuing, the value of electricity should be understood and measurements of electricity has entered the common language. The fluctuating price of electricity is also a central part of everyday life and affects societies personal use of devices as well as everyone's personal comfort. Furthermore the social and loving act of sharing ones electricity is a common occurrence in close relationships where friends and family do not want a single individual to suffer when there is electricity for everyone in the collective resources.

However, not all levels of society are bound by the need to produce electricity for themselves. The richer individuals of society will have the money to buy their daily quota and thus do not need to worsen their comfort with the PEP device. In fact it is reasonable to assume that the amount of discomfort an individual will experience from the PEP correlates generally with their economic standing. The working class will have to spend much of their day cold, the middle class can be a bit more comfortable but still need to use the PEP in order to balance their economy and the upper class might not need the PEP at all. Furthermore producing energy with your body-heat is now a viable income source leading to poor people taking on jobs as batteries, selling their electricity to private actors or the state. There will be negative stigmas against people not wearing a PEP, as it showcases a lack of respect for the environment or a tasteless status symbol showing the individual can afford to buy there own electricity.

6.1.6 Speculative Motivations

Instead of solving a problem, a speculative design aims to pose questions, criticize, inspire, and provoke, see 3.2. As a Speculative Design, PEP uses two themes: These themes are firstly our relationship towards technology and secondly the question of a more environmentally friendly future. It is important to note that the environmental angle, see 5.1.6, is not the main point of discussion for the speculative design but rather a setting and a link between the speculative reality and our own. This is important in order for the artifact to make clear sense and seem believable to the specific user group, see 3.2. With PEP, a scenario is created where a person is forced to manage their own electricity which puts in clear focus what devices a person still wants to use when electricity is both scarce and hard to produce. Furthermore there is a discussion to be had around what we are willing to sacrifice for our personal comfort and specifically to our digital devices. Every time a person wearing PEP uses their phone or other devices they indirectly consume a valuable resource, making the use of those devices much more important. It is clear from our user study that many people have a very complicated relationship towards technology and specifically their phones, see 5.1.5.2. In spite of this it is rare that a person would ever consider not having a phone as it would lose them social contacts, see 5.1.5.2. Would the users still feel this way if usage of phones would mean physical discomfort in the way of a lowered body temperature? Is it worth feeling cold in order to maintain digital social ties?

The social aspect is also important as many feel an alienation and loneliness in a digitalized world, see 5.1.5.2. By observing a world with PEP we can see that the usage of technology can have a more tangible and social presence in the way we provide each other with electricity. By charging friends and family, users are “forced” to interact in a physical space in a way that many feel is lacking in a present society. Maybe we can create a discussion on these more social topics by showing the way the people of the future physically connect to each other with cables.

It was clear from the user studies that the environmental angle was of high importance to the user group, see 5.1.5.3. Most participants considered questions of the future and questions on the environment to be linked and had a hard time visualizing a future without climate change playing a big role. This is why PEP leans heavily into issues surrounding the environment. As we had the goal of basing our design on the user groups’ vision of the future, we considered it a mistake to not embrace this crystal clear pattern. To clearly show the environmental motivations for PEP will help ground the speculation, making it more believable and relatable to the user group. However, this comes with the risk that PEP will trigger a discussion on environmental issues. This is not the point of the artifact but not necessarily a negative outcome, assuming that the climate discussion does not overshadow the mental health one. It is however important to note that the purpose of the speculation is to trigger discussion on the relationship between human and technology, not the environment.

6.2 Evaluation result

Following is a summary of the data gathered through the evaluation of the final artifact. The evaluation sessions showed that all participants were triggered by the PEP device. This due to the fact the participants showed no trouble initiating a spontaneous discussion around it.

6.2.1 Relatability

From the evaluation it is clear that the artifact heavily resonated with the users. Many expressed that the artifact was very believable and had a clear use-case in a close future.

“It really feels like a product that would have a market because it has a purpose that is relevant to a lot of people.”

Furthermore, a surprising amount of participants really liked the artifact and expressed a want to own it. As motivation, they highlighted the very practical aspects of having “infinite battery” describing the artifact as “useful”, “cool”, and a “great idea”.

“I would use it as soon as I go outside, I commute and travel by train and the battery is usually not enough I have to charge it sometime, it would eliminate that problem, so definitely that, or an excursion, it is perfect for excursions”

Furthermore, they had no problem discussing aspects of the artifact and often came up with new interesting ways of using it. The biggest category was hiking which was often highlighted as a scenario where the artifact would be very useful as electricity is hard to come by in the wilderness.

"if you were to hike in the mountains and you are afraid that the battery would run out, then it is damn good to just be able to put this on so you have battery at the end of the day."

Working out was also a popular scenario where many participants talked about how the artifact would be more efficient in work out scenarios. Also, that this could lead to social events - working out together to get electricity.

"I think people will live a slightly healthier life by running often or exercising more often to get more electricity"

6.2.2 Destructive phone use

Based on user studies the final artifact has a focus on the relationship between humans and technology in the form of phone use. Six out of seven evaluation groups

highlighted problematic phone use. The participants discussed how the fact that the phone would always be turned on would force people to be contactable all the time. Furthermore, the constant connectedness could lead to people being less present during physical social gatherings. The access to electricity would lead to elimination of those few moments where one is never contactable, this is described as uncomfortable or sad.

"but the consequence is that now we are creating a product that makes it even easier to be able to have the phone exactly all the time, charged, and be connected, it feeds something that many people think can be unhealthy, with stress and so on."

Continuing, many worried that the way the artifact promotes active phone use and connectedness would lead to more destructive use of phones and technology. For example increasing technology addiction. Others also highlight the implication of the artifact's existence fearing the absurdity of the lengths a user is willing to go in order to charge their phone all the time. Being cold, carrying a heavy load, paying the price of the artifact, etc.

"it feels a bit unfortunate that you have to go so far in some way to be so heavily connected all the time that you would have to create a product that allows you to"

Some even took it as far as describing scenarios where a user used the device even though the device was actively risking their health.

"They do not take it off when they get cold, "my phone dies"

Many highlighted the artifact's use as a very reasonable but scary scenario, hinting at how extensively people use their phones already today. This is often argued as being negative. Instead the participants promote more physical meetings and real life social interaction. This reasoning was also present in the user-study 5.1.5.2 and shows a strong but complex phone/human relationship. These worries coupled with the fact that many perceived the PEP as having a clear use-case and it being a "needed" product cements the theory that the target group perceives their phones as useful but dangerous.

6.2.3 Social interaction

The evaluation participants discussed social interaction with the artifact at length. Most participants speculated on how it would be to experience the communal charging. Generally they argued that it would be a more personal experience to charge together. Specifically, the act of "giving" electricity was highlighted as a symbolic and personal gift.

"If you take from my battery, my life energy, it's a greater gift. It's more personal."

Many expressed positivity towards producing electricity together. It was mentioned that it could be a conversation starter, a way of making friends, and a "fun" thing to do. The fact that the produced electricity could be used to power things together was also highlighted as positive. Continuing, many discussed the personal aspects of the charging. That they would not like to charge just about anyone but reserve the process for friends and family. The fact that one has to be physically close to the person one is charging was also highlighted as both a plus and minus.

"This with it charging a little in the background regardless of what you do and then we can make an event of it to go and charge together feels a bit exciting."

6.2.4 Interface and interaction

The PEP is an interactive design and the interactivity of it was a basis for many discussions during the evaluation. The participants mused on the experience of being cold in order to charge their devices lifting positives and negatives with it. This also fed into a broader discussion on what the artifact's existence tells about our relationship towards technology and the extents we are willing to go in order to keep or devices charged.

Interestingly some understood the fact that the bar on the front had the purpose of showing others (not themselves) a battery level, pushing social interactions.

"it is so long so it feels ... and I think it ... if I had looked down would I have seen it then or is it for someone else to see? if you look down"

Furthermore, the digital interface itself appeared confusing to some participants as they had a hard time relating to the current charging network, its function and the visualization. One participant mentioned that the screen runs the risk of having the same mesmerizing effect as a phone has, becoming an obsession where a user constantly checks their levels.

In general most people understood the interaction with the artifact referring to the dial as an understandable way of modifying the artifact's main function. The interaction was often visualized through statements. One participant specifically mentioned the importance of learning how to adjust the device to a good temperature.

"You have to become good at twisting it[the dial] so that you find a good compromising position so that the body is warm."

Many participants speculated on the experience of being cold and how it would affect them and society at large. Some were scared about the health risks while others

saw the cooling as something positive mentioning that they could use it during the summers to cool off. Furthermore some participants mused on how the interaction would feel, for example spinning the dial and being cold.

Initially, when only shown the artifact without the website setting, some users still guessed at an early stage that it would be possible to connect PEP:s to each other.

"and maybe you are able to connect several devices, that could be it, or connect it with an ECG or something, other medical tools"

The abundance of contacts also clearly hints at the possibility of charging several devices as understood by the users. This also hinted at unknown functions creating questions and speculation in the users. Furthermore, the combination of the body battery and the vest often lead to users speculating at increased functionality. The cables often put their thoughts towards charging but the visible vest creates additional questions showing the importance of having a visually interesting artifact and also a visible wearable as a hint.

6.2.5 Level of human/machine integration

Another topic that generally was discussed at length was that of human machine interfacing. For example the artifact was often praised by how it was interesting but not to frightening in that it used the body but was not placed *inside* the body.

"It feels like it is right on the edge of merging man and machine and it is a bit scary but it opens up a lot of possibilities as well. You can use your body for other things than just living."

"In some ways I think it feels new but not "too" new. It's still something that uses my body in some way, but I can take it off when I want and it is placed on me but not permanently, so I thought it felt reasonable and not too frightening somehow."

Different cyborg concepts were heavily prevalent in the pre-study especially from the workshops. The participants often seemed to fear the dangers of technology and the uncomfortable fact that something less tangible or "human" might be lost when one starts to blur the lines between man and machine.

"I thought it was very cool and that it could be a nice solution if it works but my concern was how will it affect the body in the long run, will it have some other implications, because it feels like evolution has made the body optimal so what happens if you start to interfere with those systems..."

6.2.6 Environmental aspects

It was commonly discussed how the fact that electricity is limited and sourced from the self would affect their technology use. Generally most agreed that the lack of electricity would lead to less time spent using their phone for menial tasks such as scrolling on instagram, and shifting the focus to more useful tasks. Continuing, some participants discussed how the connection between self and technology(phone) would become more personal and intimate if the phone was powered with the artifact and therefore with their own body.

"it feels like one would have been better at managing ones phone if it costs body heat to use it, not as much scrolling but rather that you actually do things that are necessary..."

Most interviews speculated on other environmental aspects of the system. For example the fact that the artifact produced very clean energy was highlighted as positive. One participant speculated that it could be a shameful task to charge from a socket in the future.

"It is environmentally friendly too. If you take it to the extreme, you can start shaming people who are charging from the wall."

6.2.7 Politics and state

Many participants described potential risks of using the artifact or it being on the market. Firstly the most common themes were political consequences mostly referring to class differences and poverty. Many participants rightly perceived the artifact as being a necessary tool to sustain a lifestyle and thus that rich people (who can afford electricity) do not need to use the artifact to that same extent. For example one participant worried that he would feel quilt towards users of the artifact as it highlights their economic standing.

"If you see someone today with jeans with holes in them, you think "ah cool style", but if you know that person can not afford to buy new jeans, it is suddenly a different feeling, that it is quite context dependent as well as if you feel sorry for the person or if it is an active choice. I think it affects a lot about how you think about the product."

Continuing this theme many speculated on how humans as a source of electricity could lead to very classicist societies where lower class people produced energy for more powerful individuals. These ideas range from simply electricity production as a low credibility job, to whole societies producing electricity for one "emperor". These concepts were very dystopian in nature.

"If there is no other way to generate energy. Then, places that need a lot of energy will have a lot of dudes just sitting there and generating energy."

Some participants feared that the artifact would make it easier for companies or governments to track a person through their phone as it makes it impossible to run out of battery. Some also speculated that an internet connection could be included in the artifact making intrusive collection of data possible.

"what if you put GPS in it? The government will track you!"

Lightly touched upon during the design process the political aspects of the artifact proved very triggering to the user group. It seems like our participants had a deep understanding of what can lead to inequalities and perceived the artifact in a negative light because of the way it can hint at a classist society.

6.2.8 Visibility and aesthetics

In the evaluation the aesthetic aspects of the artifact were discussed at length. Many participants associated the artifact with medical tools and that the unsymmetrical shape contributed to making the artifact more appealing and interesting. In general the artifact was perceived as having a sci-fi look or being futuristic. While being perceived as futuristic the artifact was also perceived by some as familiar and clearly functional, and therefore also non threatening.

"I like that it kind of looks like a sweater, it felt familiar in some way, it does not look so scary, just a bit like putting on another sweater."

The artifact was often unprompted described as being a "life support tool" or medicinal tool of some kind. The participants describe that the color choice was contributing to this fact as white is heavily associated with medicine or science. Other factors that led the thought to medicinal-tech was the asymmetry of the artifact hinting about a specific anatomical purpose, and also that it covers a substantial part of the body. The dial also contributed towards a med-tech style being described as looking like diabetic equipment. One person mentioned that if the whole artifact would have been white it would have appeared less as a medicinal tool and more like a fashionable piece of clothing.

"Yes, because I think if it had been all white then it would have felt less medical and more like an outfit, a piece of clothing"

6.2.9 Conformity

Some participants highlighted the importance of widespread use in order for them themselves to feel comfortable with using the device. It was mentioned that using the device together as a group would make it easier to try it out. Continuing, one participant said that if the majority of people used the artifact they might judge the people who do not.

"it kind of feels like a product like this would be launched and those who are very interested in technology and innovation would buy this product"

first and then it would become a thing and then the rest of the people would follow"

6.3 Analysis of result

Our evaluation had an open ended approach focusing on spontaneous discussion between users with a website describing the artifact as a facilitator. Through this evaluation we can clearly see that the PEP lived up to our goals in many regards but also that some aspects of the speculation did not perform as intended.

First and foremost the design worked as an excellent facilitator for discussion. The participants never had a hard time discussing the design during the evaluation touching on many interesting points both planned and unplanned. Furthermore a vast majority of the participants saw the artifact as very believable and reasonable as a design artifact. The human-centered approach helped greatly in making the design touch on relevant points and grounding the design in future scenarios that the users found probable.

We believe the artifact was perceived as relevant and believable *because* of how the artifact works with technology instead of being overly negative towards technology use, a view that resonates with the target group's own views. The PEP is constructive in its use cases creating new ways of interacting with technology and other humans. We believe that this combination of creative use cases and embracing of technology was the reason for the artifact's believability and effectiveness as a creative spark. Continuing, the participants spent a lot of time discussing different technical aspects of the artifact, criticizing its functions and interactive elements. This point towards the users perceiving the artifact as viable.

The PEP uses the human/phone relationship as bridge into a broader discussion on technology use and mental health as it relates to technology. The focus on phones was based in the user-study which heavily contained discussions relating to the troubles of phone use. Considering the present themes in the evaluation the theme seems to be widely relatable to the target group and a good basis for a discussion on problematic technology use. Continuing, it is clear that the artifact made the participants think about the social aspects of charging. Many expressed that the artifact would give them new ways of being social. The social angle was included in the design in order to highlight the alienation and social angst themes from the pre-study. By highlighting social aspects of technology use we not only made the artifact more believable it also sparked interesting discussion on the topics of social interaction in a digital world.

As climate change was such a central theme of the discussions and workshops it was included as a main theme in the design both in the choice of artifact and in the artifact's backstory. This in order for the design to be relatable 3.2. In the evaluation the environmental angle seemed to almost exclusively work to our benefit

often being mentioned in relationship to the artifact being believable or to stabilize some other reasoning on other topics. Only a few groups exclusively discussed the topic of environmental disaster when not related to subjects of technology use. We believe this was because we only used the climate aspects as a backdrop but never made it the purpose of the artifact. The climate disaster motivates the existence of the artifact but the artifact does not aim to solve climate disaster. Continuing, political aspects were always a part of the PEP and its setting. However they were never clearly expressed on the website. The evaluation shows that the PEP succeeds in explaining its own backstory through design alone and that its use cases hint at a more dystopian existence. Furthermore, it contributed to the artifact's believability.

The departure from a more realistic discrete design into a more eye-catching one was a decisive moment in the process of designing the PEP. The change opened up new creative avenues for us and also proved positive in the evaluation, making the PEP a striking visual artifact that was kept in focus for during evaluation.

By being interactive the PEP gives agency to the user making it easier to experience the artifact and visualize oneself using it. Even in our limited evaluation setting it is clear that many discussions were enriched by the artifact's interactive aspects.

The PEP is a wearable and thus does not lean into tropes of cyborg-technology and robotics. This created a more friendly and grounded environment for discussion where the participants perceived the artifact in a more positive light.

6.4 Evaluation of the website

Regarding the website, some participants felt that it was dystopian and overly corporate in language. Ergo, that it mimicked a way of presenting a product that seems insincere and covert. One participant even mentioned that the texts could have been written by a marketing bot. The participants felt that there were problematic aspects of the artifact not clearly presented on the website. This capitalistic aura mostly stemmed from the language used, but the color scheme was also mentioned as a contributing factor.

"then also how it is done with the pictures, there is no one who looks really happy anywhere and most of it is gray scale, the text is as if a marketing person has written it, or a marketing bot, not to be mean but this is the kind of stuff you expect to read about a product that is pitched..."

However this was not as common as we first thought it would be. Many participants never commented on the cookie-cutter corporate style and language and perceived the website as unironic. Instead, the website was highlighted as looking very professional.

The future vision the website presented was clear to some participants and commented upon. They used the “backstory” to construct their own consequences and speculations on how we will relate to technology in the future. It was also mentioned that this section of the website led the discussion towards environmental themes.

We used the website in order to present both the artifact and the scenario in which it exists. There is ample evidence to support that the participants clearly understood the setting and the artifact’s use case through the digital medium. However, the focus on digital evaluation probably removed aspects of evaluation related to more detailed and interactive aspects of the artifact. Furthermore, the website was rarely interpreted as critical or ironic but rather was mostly seen as reasonable in both visuals and language. To have an even more extreme presentation would probably have been desired in order to trigger more critical thinking and eliminate the risk of the participants not wanting to fully critique the artifact in fear of hurting the researchers.

6.5 Answering the research questions

		Relatable
Speculative design theory		Distinct look
Target group view on technology/mental health/future	No one wants to live without tech	Embraces technology
	Tropes of androids	Wearable
	Dystopian futures	Climate change
	Complex phone relationship	Phone focus
	Social factors	Social focus

Figure 6.5

The first research question was: *In what ways can user centered approach enrich a speculative design?* The artifact was proven in the evaluation sessions to be a successful discussion starter and no evaluation group had problems speculating and discussing both the artifact and the themes. The black frame to the right in 6.5 contains the aspects of the artifact that led to it being perceived as relatable and believable to the target group. The blue and red frame shows where these aspects originates. This shows that a vast majority of the aspects originate in the pre-study and in the target group preferences. For example the focus on phones was inspired

by the target group’s relationship towards their own phones. This theme helped the participants relate to the artifact and made the artifact’s use-cases relevant in the participants’ eyes. Thus the user centered approach did contribute to the artifact being perceived as relatable and believable and thus we argue that the process did get enriched by the user-centered approach in aspects of relatability and believability.

On a more general point it seems like the inclusion of the user-study in the process clearly helped when it comes to the speculative design being perceived as believable and relatable. However it is not clear that it helped in finding relevant trigger points in the speculative design. Thus we would recommend using a user centered approach in a speculative setting if it is paramount for the product to relate to a specific target group. In more general speculative design projects where the target group is broader or more undefined this approach might not be as clearly beneficial.

	Perceived negative reactions	Perceived positive reactions
Complex phone relationship	<ul style="list-style-type: none"> Makes you always connected Promotes addiction 	<ul style="list-style-type: none"> Charge on the fly Facilitates technology when electricity is not available Infinite battery
Political themes	<ul style="list-style-type: none"> Problematic political structures Threatens privacy Very eye-catching Health hazards 	<ul style="list-style-type: none"> Promotes social interactions

Figure 6.6

The second research question was: *What should be considered when designing future products regarding issues of the impact of technology on mental health among young adults?* The most recurring themes from the evaluation sessions are structured and grouped into perceived positive and negative aspects in 6.6. From these some relevant themes can be located that can be of interest both for future speculative designs and new technology in general.

It is clear that the participants enjoy the comforts of technology but they are also aware of the risks associated with relying too heavily on it. Especially when it comes to phones they have a deep analysis of both pros and cons with usage and an understanding that phone use can be both destructive and dangerous.

Continuing, they describe dystopian aspects of the future especially when it comes to environmental change and they perceive products that consider environmental

aspects as positive. Furthermore our participants feels discomfort towards systems that physically combines the human body with machines and the PEP was perceived as a positive product partly because it is not placed inside the user's body but on it.

The participants had a strong interest for social interaction and many expressively said that the PEP became interesting when they understood these social aspects. Social interaction is a core concept for the participants, entangled with mental health, they often perceive technology as being a hindrance in the pursuit of genuine social contact. However they also seem positive when presented with technology that enhances or motivates social situations.

The participants felt apprehensive towards using the device if others did not do the same, showing a strong sense of conformity and a fear of making too big of a statement by wearing the device. If a system is designed to be used by a major part of society it should probably not be too visually intrusive as it heightens this fear of not fitting in.

Lastly, many highlighted authoritarian problems with the artifact fearing the power structures the artifact facilitates. This hints at a fear of authority but also a deep understanding of social issues and negative bias against artifacts that seem to promote inequality or facilitate the means to create inequality.

These themes (and others like them in this report) can be used as guidelines in future work that focuses on similar themes. That being said they should not be seen as general themes or topics to consider in design in general. Instead they are the resulting themes from specifically the evaluation of the PEP and similar, or completely opposite, themes might emerge in other projects. These themes should be seen as general guidelines or observations from this specific project that might be applicable on other projects of similar kind.

7

Discussion

This chapter aims to discuss and analyze aspects of the project. Firstly we discuss the execution and structure followed by a discussion of the result itself. We also present ethical issues of the project as well as potential future work.

7.1 Process and execution discussion

Throughout this project our aim has been to create a speculative design based on the experiences, wants, and dreams of a specific target group (young adults 16-25). Therefore we conducted a thorough user study where we constantly considered them in all aspects of the design. By using different kinds of human-centered design methods we were able to understand the target group's relationship to technology in general and their smartphone use in particular. We believe this approach was paramount in relation to our goals of user-centered design, it made it possible for the target group to guide us towards relevant topics and technologies. This way we could define the scope of the project and focus on the issues that were most common among young adults.

7.1.1 Co-speculating with target group

In order to create a speculative design that is relatable and believable for the target group we wanted to shape our future scenario and artifact's context together with them based on their view on the future. As expected the interview setting was not optimal for this purpose. All participants had trouble expressing their thoughts on the future in the interview setting. Answers such as "like today but more technology" and "lighter, thinner products" was all we got. By using co-design workshops as a complement to the interviews we were able to fill that gap. When letting participants create collages and generate ideas it became easier for them to express their thoughts and feeling, and from that we could draw conclusions on their view of the future and potential products that may exist in the future. The Thing from The Future, see 4.8, worked really well for this purpose. It was easy for the participants to understand the method well and it helped them generate ideas within the framework given by the randomly generated prompts. However, the prompts were general and not focusing on our specific topic, it sparked ideas and concepts not directly related to technology use and mental health. Still, some of these ideas could have been developed further into speculative designs as they contained thought-provoking aspects. Therefore we argue that this method is very useful for speculative design ideation. Another

method used in one of the workshops was Imaginary Employer, see 5.2.1. The participants thought this was an entertaining method and that it worked well in combination with The Thing from The Future. The outcome however was more loosely defined ideas, descriptions or stories than actual artifacts which we were expecting. Nevertheless, it worked well in that it helped the participants let go of their own bias regarding ethical aspects which can be useful and ease the process of generating speculative design ideas.

7.1.2 Working with the data

In a more traditional design project the collected data would be used to locate a problem and a set of requirements for a specific product to solve and fulfill. However, as this project handled speculative design and thus had the main goal of spark discussion and alternate thinking patterns we were not able to use the data in that way. In our case the design did not have to solve anything, it was never the point to remedy the problematic use cases with phones. Thus, instead we had to use the data in different ways.

The first and most important way that the data was employed was to understand the users from their perspective. The data shows many nuances and use cases that we were not aware of on our own. Thus the data helped us show where in a users life technology becomes problematic and how it does so. This helped mapping out a design space showing relevant and relatable dimensions in which a speculative design could fit. We would argue that this helped us ground the design in a users worldview and everyday life helping the design to stay topical and interesting.

Secondly the data worked as important inspiration for new ideas as we used the problematic relationships between person and phone to spark ideas that would highlight a specific scenario. For example the communal computer^{5.2.3} idea where several people used the same digital device, was born from data showing that many users found it disheartening and irritating that phones interrupt social gatherings.

7.1.3 Ideating user-centered speculative design

By letting the target group guide us through the project they provided a framework for us to re-scope, ideate, prototype and storify within. This was mainly helpful as we throughout the design process almost constantly felt confident that we kept on the right track. That is, it was helpful when working with speculative design as a team, as design decisions was always based on what was best in order for the artifact to appeal to the users instead of what was preferred by someone in the team. However in some ways this framework was limiting, many of the ideas generated were highly interesting as speculative artifacts but had to be scrapped for different reasons such as them being impossible as relevant products in the target group's view on the future. This was, of course, key to our project and research questions but constrained our own imagination to some degree.

Normally, a user-centered designer works to satisfy the users' needs. In this project we instead had to work against their needs in some aspects for symbolic reasons. For example, if one were to design a *real* product with the same functionality as the PEP, one would probably make it as convenient and non-bulky as possible for the user. Instead we did the exact opposite with the hope of triggering the observer to think beyond its functionality which, when looking at the result, seemed to have worked.

7.2 Result discussion

From the evaluation it is clear that the artifact did not have any troubles engaging the user group on an intellectual level. The open approach in the evaluation created a plethora of discussions on a range of interesting subjects. However as the aim of this project was to create a design that highlights mental health in relation to technology the discussions surrounding mental health are extra important and they are in some ways used to measure the success of the project. It is therefore problematic that the bulk of the discussions did not handle that specific topic and that few participants explored mental health themes on a deeper level. We believe there are several reasons for this.

Firstly we believe that the means of testing does not lend itself to the artifact's strengths. An interactive artifact such as the PEP should in our opinion be tested in a real life setting and by actually interacting with the artifact. In fact we planned early on to have role-playing sessions where users could try out the interactive parts of the artifact and the connection to devices and other people. However these sessions were impossible due to the Covid-19 pandemic restrictions. In relation to research[62], it is our firm belief that the artifact would have performed more accurately had it been evaluated in a more fitting setting and that the setting would have made the users focus more on interactive and philosophical aspects of the artifact.

Secondly we believe that our commitment to the users problems and future vision muddled the result. For example, we focused heavily on social interaction when designing the PEP. This was because the users expressed a lot of thought and opinions on how technology affects their social life. However the link between the social aspects of technology and mental health are not completely clear. It is therefore hard to say if the fact that social interaction was a big part of the evaluation discussion means that we encompassed the theme of mental health. To have a clearer focus and in some aspects disregard the users needs would probably have been preferred in order to keep a clearer purpose and symbolism in the artifact and thus creating discussion more directly related to the topic of mental health and technology. Similar arguments can be made for the inclusion of the environmental angle or the focus on phone use which were both very prevalent in the user study but lack specific focus towards mental health.

Furthermore it is important to mention that our target group was young adults

16-25 years old. However most of the participants in both the interviews and the workshop were between 20 and 25. It is possible that this has had an impact on the result and that a more diverse recruiting would have given us slightly different insights.

7.3 Ethical Issues

The study included collection of personal data concerning mental health that may be private and sensitive. Therefore the data was handled carefully, in a way that is compliant with GDPR⁷. All participants were asked for their consent in being audio recorded, participating anonymously in the study, being quoted in the report, and saving their recordings for a maximum of six months. Interview recordings, transcripts were kept anonymous to keep any sensitive data from harming anyone personally.

Regarding the ethics of the design, when constructing possible futures one might run the risk of imprint that vision of the future in the audience. By basing our future scenario on the target groups view of the future we believe we have minimized the risk of both affecting their view negatively and skewing it towards one that is more in line with our speculation. Continuing, we presented our artifact to the target group through a website where it was not completely transparent that the artifact was in fact not a functioning product. It was therefore very important to clearly explain after each evaluation session that the artifact is a speculative design and not a functioning product as it seems on our website.

Speculative design has already been criticized for being too focused on the developed parts of the world [40][63]. It was our aim to not disregard a global perspective in our project as it would be to strengthen the western focus in research in general and speculative design in particular. Even though our target group is young adults in Sweden it was important to not narrow the scope to a purely western focus. Instead more marginalized groups were considered through the project and common classist, racist, misogynist, and colonialist pitfalls were avoided to the best of our ability.

7.4 Future work

Firstly, in order to validate the result it would be highly interesting to conduct a secondary study that does not have such a clear user-centered focus as ours. By comparing the evaluation of the two studies one can make better judgments on the positives and negatives of a more user-centered speculative focus.

Secondly, we see many positive aspects of the artifact but also many things that could have been done better. Thus it would be interesting to once again iterate the design of the artifact with the goal of highlighting more direct mental health parallels by rebalancing the user-centered focus.

Continuing, as proposed in our speculative design methodology, see 3.2.1, it could be considered important to include a follow-up step in the process that aims to act on the result, inform or push agendas in a specific direction [42]. For example this could be done by making the result or artifact available by keeping the website online and include functionality to leave feedback.

Finally, we hope that at a later date we will be able to complement the Covid-19 compromised evaluation with an interactive “research party” or exhibition where we invite participants to socialize with, and in relation to, the product. The participants will somehow during this event be “forced” to interact with the artifact. This will create natural use-cases like: charging together, plugging into electronic equipment, managing battery levels, etc. Data will then be gathered through natural conversations, observations and questionnaires. This would in our opinion be preferred as an evaluation method as it gathers data in a natural way and more clearly evaluates the interactive aspects of the artifact.

8

Conclusion

As the world is increasingly digitalized and connected, it appears important that we understand how it affects us as humans, and how we can cultivate a positive symbiotic relationship between humans and technology. The PEP was an exploratory design project where a speculative design was created and evaluated with the aim of triggering discussions around the consequences of technology on mental health on young adults. The project aimed to combine speculative design theory with a user centered approach to investigate if a prominent user centered focus could enrich a speculative design so that it appeals to the general public and specifically to young adults. The result of this work was the titular PEP - a speculative wearable that harvests a user's body heat in order to power their personal devices. The PEP was developed in collaboration with users through a series of workshops that worked as a way for the users to give inspiration and input on the design and different future scenarios. The PEP was then used to evaluate its own design and the development process through a number of open ended paired interviews. Through the project we worked with two research questions.

The first research question, *In what ways can a user centered approach enrich a speculative design?*, was addressed by observing the aspects of the speculative design that originated in user centered phases of the project and were reflected in the final evaluation. Many aspects of the speculative design were praised in the evaluation as contributing to the future product being relatable and believable. Out of the six aspects summarized from the evaluation five originated from, or were inspired by, data gathered from the user study.

Our process indicates that the vast majority of these user centered aspects of the design would not have been present if not for the extensive user study and workshops executed in the first phases of the design process. Thus it is clear that the user centered approach did enrich the design, especially when it comes to facets of relatability and believability.

Regarding the second research question: *What should be considered when designing future products regarding issues of the impact of technology on mental health among young adults?* The evaluation showed many interesting patterns that are a good basis for consideration for the future of human machine systems, especially when it comes to mobile phone usage 6.5. These themes paint a comprehensive picture of the participants' relationship towards the speculative product and similar technology that can be relevant when creating future designs that touch on similar subjects,

8. Conclusion

or target the same user group.

In conclusion it seems that a user centered approach can be a good compliment to a speculative design process if the project aims to create grounded, believable, and relatable artifacts. Furthermore, we offer a concise list of themes to be considered when designing speculative products for young adults.

Notes

¹A design practice with a focus on contemporary trends, ethics and social systems. By observing the culture of today designers can offer a critique of society through artifacts [12].

²Uses artifacts to suspend disbelief. Instead of focusing on a world or setting it focuses on objects from that world or setting. [39].

³Refers to the creation of objects that has a main goal of initiating discussion. The object showcase complex questions in society raising them to be debated. [64]

⁴A parasocial relationship is a perceived relationship between a performer/influencer and a member of their audience. The audience member experiences that they *know* the performer on a personal level while the performer does not cultivate the same personal relationship towards the audience member [65]

⁵The point in time at which technological advancements changes human history forever, forcing us to throw away all previous rules and values for a new extremely alien existence. A common example would be the creation of the first superhuman AI [66].

⁶Defined as the image of the world around us that we construct in our head. A set of concepts and links between them that a person uses to represent the real world [59]

⁷The General Data Protection Regulation, is an EU law that aims to ensure secure and private handling of personal data of the inhabitants of the European Union [67]

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A

Appendix

A.1 Interview template for user interviews

Hej och välkommen, vad snällt att du ville ställa upp.

Vi håller på med vårt examensarbete på Chalmers där vi tittar på unga vuxnas relation till teknik och hur det påverkar oss i vardagen. Vi tycker att effekten av teknik på människan inte diskuteras tillräckligt mycket i samhället och att det känns viktigt att vi börjar göra det mer. Målet med projektet är att skapa ett sätt att uppnå detta. För att lösningen ska bli så bra som möjligt för målgruppen behöver vi hålla intervjuer och workshops för att skapa lösningar tillsammans med ungdomar. Det vi vill göra är att skapa tekniska lösningar som kan komma att existera i framtiden. Genom att skapa sådana produkter kan vi skapa diskussion inte bara om hur vi kan komma att använda teknik i framtiden men också runt hur vi använder teknik idag.

Vi kommer ställa en bunt frågor, om det är något du inte vill svara på är det bara att låta bli. Vi kan även avbryta intervjun när som helst om så önskas.

Vi vill gärna spela in denna intervju för att underlätta för oss att transkribera och analysera i efterhand. Vi två kommer vara de enda som har tillgång till detta. Är det okej för dig att vi spelar in den? Är det även okej för dig att vi använder oss av denna intervju i vår rapport? Du kommer då vara anonym. All insamlad data kommer hanteras enligt GDPR.

Börja spela in

Upprepa föregående stycke

Vi är här för att kartlägga hur ungdomar använder teknik och hur ni mår av det. Känner du dig redo? Okej, vi börjar med lite enkla frågor om dig bara:

Warm up

- Hur gammal är du?
- Vad är din dagliga sysselsättning?
 - Vad för plugg/jobb?
- Har du en smartphone?
- Har du en dator?
- Använder du dator och smartphone på fritiden?
- Vad använder du mest? Din smartphone eller din dator?
 - Hur mycket?
- Vilka program/appar/datorspel?
 - PROBA (varför, vad tycker du om dem?)
- Vilka tre appar/program använder du mest på fritiden?
 - När brukar du använda dem?
 - I vilket syfte använder du dem?
 - Vad tycker du om dem?
 - PROBA

- Vilka tre appar/program skulle du vilja leva utan?
 - När brukar du använda dem?
 - I vilket syfte använder du dem?
 - Vad tycker du om dem?
 - Varför tar du inte bort dem?
 - PROBA

Tid och hälsa

- Upplever du att du spenderar mycket tid med din dator och/eller smartphone? Varför?
- Tycker du att du spenderar FÖR mycket tid på din dator och/eller smartphone? Varför?
- Gör du någonsin aktiva val för att inte lägga så mycket tid på din smartphone/dator?
 - Kan du ge något exempel?
- Hur använder dina kompisar sina smartphones/datorer?
 - Hur tror du att det påverkar dem?
 - Hur påverkar det dig (att dina kompisar använder smartphones på det sättet)?
- Tror du att ditt smartphone/dator påverkar din hälsa negativt?
- Studier visar att fler och fler ungdomar har problem i form av sömnsvårigheter, koncentrationsproblem, depression, FOMO etc på grund av smartphone-/datoranvändning?
 - Är detta något du känt av?
 - Kan du se såna tendenser hos dina kompisar?
- Varför tror du det kan vara skadligt med smartphone-/datoranvändande?

Framtid

- Skulle du kunna leva utan din smartphone/dator? Varför?
- Hur hade det varit?
- Vad hade du saknat?
- Men om ingen hade en smartphone/dator då?
- Tror du att vi kommer använda smartphone/dator mer eller mindre i framtiden?
- Hur tror du det kommer vara?
- Hur tror du att framtiden kommer se ut? Hur kommer vi använda teknik? (se över?)
- Hur tror du det var att leva innan internet uppfanns?
- Har du tänkt på hur teknik påverkar dig och oss människor generellt tidigare?
- Pratas det om det här i skolan? / Pratas det om det här med vänner och familj?
- PROBA
- Något övrigt du vill tillägga?
- Skulle du även kunna tänka dig delta i en spännande workshop under de kommande veckorna?

A.2 Result from target group interviews

Discussion with family and friends

In general discussions on technologies impact on mental health do not seem too uncommon as some participants mention that they do have discussions with friends and family on these topics, out of those who had discussions they described a very homogeneous discussion where people agreed on the negative effects. One participant described that it can be positive to talk about common problems like these and that it can be comforting to know that others struggle with the same problems. Furthermore, some people mention that they do not talk about these topics with friends and family and some describe a less constructive discussion being had in the family, for example: “My parents tell me i use my phone too much”.

Discussion in school

Most participants have not discussed technology at school in a constructive way. Discussions in school seem very rare but a few participants mention scattered occurrences. For example one participant mentioned a lecturer visiting their school, once. Outside of these few examples discussions in schools seem to revolve around teachers having a wide array of negative opinions towards phone use, examples of phone-boxes are mentioned, the taking phones if they are used during class or a total phone bans in the classroom.

Self reflection

About half of the participants said that they have thought about these topics extensively before, in general these discussion seems to be critical and revolve around how they use technology and to what extent they feel comfortable with it being a part of their lives. However, some also stated they have never thought about the topics before.

Physical health

Even though it was not a main topic of the interview some participants highlighted physical-health consequences of technology use. Four people mentioned the fact that tech leads to too much sitting still. Furthermore, one participant told us they got extreme headaches with prolonged use.

Mental health

Many agree that tech can affect mental health and that social media can worsen the effects of mental disorders. Also several people mention concentration being negatively affected. Some mention that tech can be used as a coping mechanism and escape from reality. The connection between tech and mental health is often unclear to the users but they agree that it does affect. Two specific under-categories were identified, as we asked about other mental health issues as well it is interesting that so many subjects choose to talk only about these two specifically. They seem to be

more relatable or “top-of-mind”.

- **Sleep deprivation**

Many participants mention that they have experienced disturbed sleep due to technology use. For example many mention that using technology (usually a phone) can keep one awake too long leading to suffering sleep times. Many also mention that screens also seems to worsen sleep if applied just before going to sleep, however they can not say why.

- **Fear of missing out (FOMO)**

FOMO is widely known and understood to be a problem in the interviewees. A majority use the word unprompted to describe their feelings. A majority of people recognized the feeling and could easily give concrete situations where they felt FOMO such as: seeing pictures of an event that they where not invited to, not being able to attend an event due to other plans or not being able to contribute to a future conversation about an event that one missed. Many participants also describe conversations with friends on the subject.

Tech in social situations

Many wish for a greater presence and focus on real world interaction during social gatherings, that is: irritation towards phone usage in social situations. This problem is also a common conversation topic in some gatherings. Some feel technology and content creation can undermine the genuinity of a social situation. Content creation can control the activity at a social event, that is people choose to engage in activities that look good on social media. Some however are aware of the presence of technology in social situations but do not perceive it as a problem, it just: "is what it is". Some describe phone use as a cascading activity, if one picks up their phone others will do the same, some also confront this effect in social situations pointing out the behavior to their friends.

Motivation for using tech

Some participants had very concrete reasons for using their phone, for example: contact with a long-distance boyfriend. These where not gathered under a specific category. The rest are summed up bellow.

- **Social**

This mainly refers to social media and it being a way of socializing with friends. There is also reasoning around the width of social interactions the internet can give, having a more global social sphere. Some believe, tech makes communication easier than it was before. Social media does in some cases work as a planning tool where people easily can plan events and hangouts through the internet, leading to real world interactions in the end, this is often perceived as a positive and functional use-case. The way social media is integrated in society is also lifted in some cases, to not engage would be to commit social

suicide. Some have a hard time visualizing how one would contact friends without the internet. Some also lift the internet as a medium for finding like minded people with common interest. Important to note that some people perceive their social life as being partly “on the internet”, that is it would not exist without it. Sometimes the fun is also highlighted, that, for example, Snapchat is “a fun way of communicating”. Messenger is the most mentioned medium for communication, but also Instagram and Snapchat are often mentioned.

- **Habit**

That technology use is a habitual activity is not a secret to many participants and they easily reflect on the way tech-use has become a habit for them. In fact, the use of phones is often described in terms of “habit”. Some highlight how phone use is so integrated and normalized that it is seldom reflected upon, for example: checking a notification and answering directly is a perfunctory action. Some perceive apps as being generally negative but still use them, interpreted by us as being the effect of a habit (or peer pressure). To use one’s phone is an automated process not questioned before the phone is open and in your hand. Some easily question their own use saying things like: “I am not even interested but i still use it [social media]” furthermore many mention that they do not truly even like some apps but still use them, they can seldom answer why this is the case (speculation is that it might be because of a need to socialize, peer-pressure or a need for control). Some perceive the apps as “stealing” time from them, being used even though the user does not want to use them. Some perceive, for example, Instagram as being very uninteresting but still use the app. In some cases people describe a parallel use where two activities are carried out at the same time (one, of course, is always phone use), for example, cooking and phone, watching a series and phone, etc.

- **Peer pressure** People describe a use where the fact that others use phones or specific apps makes it important to use them. Many describe a fear of not being part of a group or taking part in plans, conversations, jokes, etc. Some are also afraid of burdening friends by *not* being on the internet and thus harder to contact. Some describe a fear of missing out on events as motivation for having a phone. One person described a fear of not being on the same level as his gaming friends when they had more time to grind in Minecraft. Social media is sometimes perceived as being the source of information, and there is fear of taking part in second hand info from, for example, friends. One person wished for social media never existing, highlighting how its existence, in a way, eliminates the possibility of it ever going away, that is, it is already integrated into culture and society.

- **Pastime / interest**

A popular use case is the phone as a simple way of passing time. Some highlight how the constant flow of new content makes some apps interesting and keeps you hooked. The phone is sometimes described as being used more if the

user has more spare time, filling out stretches of otherwise perceived “empty time”. The activities are in these cases often described as “brain-dead” or a generally mindless activity. This is also highlighted when the phone is described as used to take a break or resting during a stressful day. Video apps are often described in terms of “fun” and social media apps are more often described as being “time-wasters”. Some apps are perceived to be more giving to spend time on, for example: news-apps. Even generally disliked apps (often social media) are sometimes highlighted as being good services and have positive aspects, for example: “I like Instagram but want to limit use to just 90 percent of what I am doing today”.

- **Goal oriented use**

YouTube is often highlighted as a good app, it can be used for learning or videos of genuine interest. Instagram is argued to be a good provider of inspiration for both artistic work but also lifestyle-inspiration, for example looking at famous influencers. Some apps are also highlighted for their clear functional use-cases - apps like Banks, e-mail, etc. Some apps also facilitate music which is often perceived as positive and uncomplicated.

- **Control**

Most people describe a need to collect information on their friends and the world around them, for example knowing about a party even though you were not invited, or knowing what other people are doing in their day. Apps facilitating huge amounts of information about people and news are highlighted as positive but also lead to stress. One person describes a fear of not being updated if Instagram was removed, “Oh my god. I’m not updated!”. The word “updated” is, in fact, used a lot. Some describe a need to know what influencers are posting.

- **No other interests**

A few people described a use case with an underlying worry of not having anything to do if phones were not around. Things like: not being able to perceive what other activities they would fill their day with without their phone, saying they would have more hobbies without their phone (interpreted as them not having as many hobbies in a world with phones, ergo: phones and hobbies competing for limited time.)

- **Content creation (ghost category)**

Interesting because it is very unrepresented in the data-set. The reason for this is unclear but here are some possible explanations: (1) maybe content creation is not as common as first perceived, (2) the data set is too small and we just happened to interview people that do not actively post on social media, (3) the interview was unknowingly structured in a way that did not place content creation top-of-mind for the interviewees or (4) content creation is not perceived as the main reason for using social media.

Addiction

Some users perceive the apps as manipulating them into using them, however these users said they still use the apps even with this knowledge. Those users also draw clear drug parallels. Some also describe how they get stuck in app use, spending much more time than they initially planned. One user highlighted an interesting podcast parallel where he filled his day with listening to podcasts and this being no problem. Apps are sometimes uninstalled but then reinstalled, for example: a new interesting podcast episode makes one reinstall the podcast app, these situations often lead to further use, as one user put it, “I am susceptible to click bait” when talking about why he kept using the app after re-installation. One participant described a will to not use their phone (podcast use) in everyday situations as to leave space for personal reflection, he also described this as a struggle and that not using his phone made him feel restless.

When use?

Most describe use all through the day but mostly have a very complicated way of saying it (this might be because they are not aware that they use their phone all day, or that the interview setting creates these kind of “stream of consciousness” kinds of responses), for example: “[i use my phone] In the morning, when i go to bed and during the day”. One person described themselves gaming during the afternoon and evening as they worked during the day. Late at night seems to be a usual time for using video apps, while social media is used in bursts through the day. Once again the use of phones during other activities are highlighted, phone and cooking, phone and a lecture, phone and series, etc.

Less use ambition

Almost all participants described an ambition to use technology (often phones) less. The answers were categorized into two themes. Quotes handling active ambition, that is concrete actions to minimize use and quotes handling passive ambition, passive opinions on the interviewees own lifestyle.

- **Active**

A majority of the interviewees used tricks to keep themselves from using their phone, some common techniques include:

- Having specific apps that complicate unlocking their phone, often perceived as effective.
- Using a built in function to limit time used. One user tried this but failed. However she realized that she used her phone much more than she desired. (tried to limit to 3 hours but used it “way more” (5 hours)).
- Distracting oneself with other entertainment, for example: friends, Sudoku, coloring-books, etc.
- Simply uninstalling apps to decrease use, often just removed for a period

of time. For example a stressful study week, or just having a generally sensitive period in life. The apps are almost always reinstalled afterwards.

- Actively trying to not look at a notice, ergo: hearing your phone but not acting on it.
- Putting the phone away or flipping the phone upside down.
- Collecting the use to a limited time and place, for example: answering all backlogged messages in a single sitting limiting general use.

The most common trick is the rather draconian measure of just uninstalling the apps, Instagram is often said as an example. Once again - the app is almost always reinstalled at a later date.

- **Passive**

A substantial amount of people think they use their phones too much and express a will to lessen time spent on their phone. Some have theoretical ideas on how they want to use their phone, for example only using their phone once a day checking all feeds just once in a day rather than continuously. They do however not act on there theories.

Relative use

Many people described their use in relation to others and often said that they used their phone a lot but not as much as other people they know. We interpret this as either: (1) a defense mechanism where they motivate their extensive use by showing that someone else uses it more. (2) a way of motivating their use by showing us a broader context, that is, showing us that: “all their friends use their phone the same amount”. For example, one person used their smartphone 5 h a day but did not think it too much. When prompted why, they motivated their use by saying: “...it is common [to use ones phone that much]”).

Availability stress

One participant described a fear of not being available through their phone, fearing scenarios where their friends or work were not able to contact them. Another participant described frustration towards the fact that they were expected to always be “contactable”, that same participant also mentioned the functionality of showing when a person was last active as a contributor to this fact. The functionality led to stress and made it harder to control when one would answer and when one would not.

Distraction

People describe notifications being a problem when concentrating as it can disturb a workflow, some also highlight the uncompromising way all notifications get the same treatment and thus many notifications not being necessary, disturbing rather than helping. Notifications can lead to stress in general and many people describe them as demanding their focus in a negative way. Some people describe that extensive use of

phones can lead to worse self image and the feeling that they are not “doing anything worthwhile”. Many people describe problems with concentration in general and that a phone can work as a distraction even passively, for example: when studying, a participant had a hard time not picking up their phone. A lot of people also describe general stress from having a phone, mostly referring to notifications as the main culprit.

Upbringing

4 participants highlighted (unprompted) the negative impact of technology on younger generations and that extensive phone use in young children seems negative, they do however have a hard time saying exactly why it is negative.

Nostalgia

Many participants seem to romanticize a world without tech especially highlighting the more “genuine” social interaction such a world holds. For example a world without the internet would lead to people being happier, more thankful, less stressed, spend more time outside, etc. They also mention that such a world will have more genuine connections between people but also lead to a more local social circle, this is perceived as both positive and negative. Some also mention that removing the internet will lead to a more relaxed and "present" existence. Many have a positive view of a world without social media and express a want to “try it out”. In general digital experiences seem to not be perceived as as valuable as physical ones, however no participants can truly motivate why.

Relief

Some participants talk about a feeling of relaxation and relief when not using technology, however many often describe stresses and restlessness when they do not have their phone. One participant specifically described a period of weaning before a feeling of relief, very akin to how one would get rid of an addiction.

Integrity

Surprisingly, only one participant mentioned integrity, that person described a scenario where it would be harder to gather personal data without the internet.

Reflection unknown

Two participants showed lack of reflection when asked if technology can hurt their mental health. This is mainly interesting as, considering their extensive use of their phones (3-12h per day) it seems odd that they have never reflected on the topics.

Self image

A couple of people felt very strongly for this topic mentioning it several times during their interviews. Instagram was highlighted as the main culprit but other social media can also hurt self image. The problem has two distinct categories:

- **Lifestyle**

Comparing oneself to others (friends/influencers) beautiful lives and thus feeling bad about one's own lifestyle, feelings of "not doing enough" or "not having an interesting life", (travel, parties, gym, etc). The amount of likes or comments on a post can contribute to this effect, turning social media into a "competition".

- **Body image**

Being affected by the way people look on social media, and thus feeling bad about how one looks, ergo: people on social media being perceived as "pretty" or "skinny". Some participants also highlight the body positive movement as combating this, perceiving it as positive and that social media has become more body positive now than before.

Some participants highlight that self image problems affect specifically people that already have low self esteem (this hints at both a general opinion of some people having higher resilience towards these kinds of influences, the need to have this resilience, and the ambiguity of the causality of tech and mental health.) Self image concerns were not gender specific.

Time

Many participants describe "losing time" to apps, and negative reactions from the phenomena. The time a user plans to spend on an app seldom reflects the amount they actually spend, leading to extensive use and distress from the time spent. Some specifically describe a different experience of time when in front of a screen, describing "flow-states", or "forgetting they are using a digital device". "Explore"-functions, where the app actively shows content the user should find interesting, is often highlighted as a "time-stealer". This is sometimes seen as the app designers fault and some highlight specific functions as the culprit, for example: the removal of the clock in the YouTube app.

General opinions on technology

Many participants highlight the positive aspects of technology. The main theme of these aspects are functional in nature, for example, many highlight the bank apps, email apps or medicinal technology (diabetic aid). Many also highlight the social aspect and the ease through which one can keep in contact with friends and family. Some younger participants also specifically say that it is easier to find like minded people with common interests through the internet, and the way one can know about

a person before meeting them helps in making new social contact.

Many participants have a pragmatic analysis of technology discussing with themselves about the positives and negatives about tech. In general most people weigh the positive functional aspects of technology against - the stress, and a feeling of not being able to “live in the present”.

Some participants highlight direct negative consequences of technology. For example saying it leads to more loneliness in people and that the government should inform more about the negative aspects of technology. One participant mentioned that they think that the fact that everything can be googled leads to people not learning the same way as earlier, this was perceived as negative. Another person mentioned that the fact that one has their friends so “close” in social media, leads to less real world interactions, perceived as neutral.

Future

All participants were asked and prompted to share their thoughts on what the future hold, in general they had a hard time envisioning specifics of the future, some simply did not answer the question but most created a future with only incremental changes from today. Many specifically mentioned that it “would be like today but...” often highlighting small changes like digital schools or just “more technology”. Many mentioned concepts such as: “more stuff”, “more functions” or “more technological things”, however most does not mention specific examples. Some examples of future tech mentioned: smart housing, smart watches, digital stores, cars, “checking Instagram by closing ones eyes”, etc. Some also mentioned tech being integrated inside the human body, thus that smartphones will disappear in the future and be integrated in the human body. Some mention specifically that they believe that there will be more rules and/or laws restricting technology in the future.

Most people believed that we will be using smartphones more in the future and that it will have more functionality. However, a few also mentioned that there might be a anti-phone movement and thus less phone use. Many show examples of new apps they started using and then project this into the future, believing that the future will have more functionality in their phone. Some also mention that they think that the phone will be more common in the future and that the computer will be less common. One participant envisioned a future where we read less books, referring to a new documentary, they then argued this would lead to people in the future being worse at communicating and writing.

A.3 Result from workshops

Climate change

The workshops showed that almost all workshop participants had a focus on climate change when envisioning the future. Even in themes and subjects that do not apparently demand a climate angle they still created scenarios and solutions that had climate change in mind. This is not surprising as we live in a time where climate change is a massive issue and an aspect of both today and the future. That scenarios containing climate change aspects appear therefore seems reasonable as it should be very “top-of-mind” in the workshop participants.

Climate change solution

Many ideas had climate change as a central problem and aimed to solve it or aspects of it. One concrete example is diet, as many participants mentioned eating insects as a part of the future. Some also mentioned that the future will have more locally cultivated foods to remedy climate change. Several also mentioned vat grown meat as a mainstay of the future. One person hoped that we in the future will learn to live with nature in a more constructive way. In general the participants seemed to put their hope towards technology to solve the climate crisis, however one participant highlighted the importance of there also being motivation for deploying technology in order to save the environment.

Ideas:

- In a future where trees are dying out we will have technological trees that make up vast forests of mechanical pillars.
- Cloning an army of people that will “fix the environment” (Interesting that the participant wanted to clone an army when there is a fully functional world population that can perform the same task. Probably shows that there is a lack of trust in the world to fix this problem.)
- Cloning a plant indefinitely to give it “immortality”.
- Bio engineering plants to make them grow to full size in a day - pitched as: medicine for a plant.
- Cloning used to replant forests. (The participant seemed to believe that our current habit of cutting down vast forests can not be hindered. Instead going for a remedy to that problem with cloning.)
- Eating something that tastes like real food but is not the thing it tastes like.

Climate change scenario

Some ideas were not solutions to the climate problem but did take the scenario in mind. One participant mentioned a post-apocalyptic scenario where people were forced into a more survival based lifestyle. Two participants mentioned the big difference between different parts of the globe, very cold in some places and very hot in

others. Some also mentioned that natural disasters will be a big part of the future and that several species will die out. In one scenario the existing plants were no longer edible. One person mentioned the need of simulated forests in a future where real forests are rare or do not exist. One person mentioned having endangered animals as pets in order to save their species. Having insects as pets was also a one-time idea.

Ideas:

- A meat eating plant that is a result of our climate destruction. The plant grows huge and combats society. (Our analysis is that the participants envisioned a future where nature packs a bit more punch and fights back against society. Interestingly the idea was pitched as neutral or even positive even though the plant would eat vast amounts of people.)
- A set of dice that randomly determines what bear necessity moon-colonists needed to give up in order for others to survive. (Could show a want for people to reduce their extensive consumption of natural resources. There is not enough to go around. The introduction of randomness makes the system terrible but just in a roundabout way.)
- Two games that you win by burning down forests or producing carbon dioxide. Pitched as a game played on a lunar colony for pastime and remembrance of a wasteful lifestyle on earth before its destruction.
- Lunar toys that make people dream of former earth.
- Photo album with pictures of your ancestors but also all the destructive things they did in life.
- Reused toys from earth used on a lunar colony.
- A space elevator that leads to a platform in space where one can sit and physically distance oneself from the earth below.
- Vacation under a dome that simulates other climates in a world where travel to other countries is not possible.
- Luxurious submarines for successful people where they can live while the surface succumbs to climate disasters.

Control

Through the workshop when asked to brainstorm on the subject of state and governance many participants produced ideas that had dystopian undertones and existed in surveillance societies, these ideas were created generally unprompted showing that many fear a future with increased surveillance and dictatorial aspects of state.

Ideas:

- All devices send data on use and time schedule. The state can remove access to devices so that they can not be used outside of designated hours. For example a work-computer can only be turned on during working hours.
- An AI system that reads people's minds and catches and acts on destructive thoughts that people have.

- In a future where everyone has a “mind reading chip” in their brain one leader controls everyone’s thoughts and opinions in a global dictatorship.
- Daily well being is checked by the state, both mentally and physically.

VR

A general technology that appears through the workshops is VR technology. As the technology is relatively new and often pitched as part of the future this is not surprising. Several people created scenarios where humanity more or less lived in VR, this was often combined with climate disaster with VR being an escape from a dying and more hostile world. Some mentioned working through VR, having virtual meetings but also more physical labor being done through VR with the help of robots.

Ideas:

- A corporate VR system that encompasses every part of human life except bare necessities.
- In a world where humanity completely destroys every planet it inhabits - VR is used to plan new settlements on other planets.
- VR as an escape from a dying world, VR is described as a “vehicle” that can take a person to a better world.
- VR vacations.

Robots

Being a standard sci-fi trope, robots were to no surprise, mentioned several times. One example being that automation will make most jobs obsolete and people instead work with observing robots at work. Several mentioned robotic pets with varying degrees of personality.

Ideas:

- A robotic plant that takes care of itself

Tech development

Many ideas are projections of today’s tech being developed further. People envision a more digitalized world where all aspects of society are improved by new and more advanced technology. Some participants mentioned new school subjects like software-development and mental health in relation to social media. One person mentioned the singularity as a possible future scenario.

Efficiency

In relation to the precious category many people described today systems but effectivised by technology. For example one person mentioned that there will be no

physical stores in the future as we increasingly shop online. Instead of eating food we would also “eat” pills.

Ideas:

- A personal fast jet-pack that trivializes travel making it extremely easy to go anywhere one wants.
- In a future with no countries people can travel very quickly from place to place. This was envisioned as a climate positive idea as the creator hoped that the “closeness” of the world would motivate people to take care of the environment.

Space

Some mentioned the very common trope of space being a bigger part of the future. People mentioned that space will take increasing control over our lives, people will for example “work with space”. Finding life on other planets was also mentioned. Going on vacation to space was also mentioned.

Culture

Some ideas had to do with cultural impact in the future relating to how the future will change culture and our psychological well being and opinions. One person expresses that cultural activities, such as music and cooking, will disappear in the future. One person hoped that the future would be more spiritual as a revolt against a tech based and information dense reality. One person mentioned that the future is often presented as being more relaxed and harmonious but that this is not necessarily the case. Several people mentioned that the future will be more homogeneous and that cultures will melt together, maybe we will even talk the same language. One person also mentioned that staycations will be more popular in the future.

Living

Some ideas had specifically to do with housing and living in the future. Maybe we will live in small one-room apartments that are built very high. One person mentioned city planning and that there will be a general lack of space that forces us to build upwards. Smaller concepts were also mentioned like IoT-homes and smart city growing solutions. One person mentioned that there are two possible scenarios one where everyone moves into the cities and another where everyone moves to the countryside.

New tech hope

Some ideas showcased a hope that the future will hold more emotional technological improvements to the living experience. For example cloning deceased loved ones

back to life or cloning dead pets.

Ideas:

- An idea to create human faced plants from the DNA of deceased loved ones. The plants were capable of speech.
- An invasive plant that fills your room and thus cures depression.

Controlling data

Not a very popular category, however it hosts one very interesting idea.

Ideas:

- A system that lets you control and sell your personal data to both private companies and research. The data can also be invested, somehow, and grow in value, like a bank.

Purpose

Some ideas handle systems that help people decide important life choices. We interpret this as being an expression of a lack of meaning in life, something the participants hope the future will remedy.

Ideas:

- A system that analyses your brain at an early stage and tells you what you should work with. This idea also led to the creation of smaller societies where people with similar jobs live together.
- In a world where humanity has colonized the universe people travel on caste based rockets. The people are mentally affected in a way that they feel disgust and physical nausea towards jobs that the state has not selected for them.
- A cylinder that helps one vote in elections by analyzing ones “true” wants. Even oneself do not know what one voted for.

Feeling

In general people feel hopelessness towards the climate aspects of the future. They also described concern for the future and a fear of it going the wrong way. Some highlighted the dissonance between society and human nature saying that we do not fit into the way society is constructed. Furthermore, they argued that this dissonance will increase as society moves into a more technological future. People mentioned things like that humans need physical contact, or experience nature. There was general mentions of poor mental health in the future as we increasingly disregard basic human social needs. People will also be more lonely in the future as technology makes a lonely lifestyle more viable, something is lost along the way however. The participants mentioned that we need to learn how to live with technology to keep social interactions alive. One mentioned a lack of purpose in the future but

did not elaborate on the cause. Some mentioned that some technology can lead to unnatural feelings like for example vat grown meat being perceived as unnatural as it was never truly alive.

A.4 Result from team ideation and concretization

14 concepts

1. Data time capsule library
A service that produces data-storage-time-capsules for personal use. This unit can be filled with personal data and saved for historical prosperity.
2. Collective memory storage
A system that can externally save the sensory aspects of a memory for enjoyment at a later date. Optionally this system can encompass several different people's interpretations of an experience creating a sort of digital collective consciousness. The memories can be enjoyed through VR, holograms or some other visual media.
3. Mechanical scroller
A spinning mechanical finger scrolls your feeds for you without tiring your own muscles and mind. A way of effectivising scrolling into an even more perfunctory task. A comment on the mind numbing way we scroll and consume social media. (Maybe part of a product series)
4. Communal computers
Computers that in different ways encourage collective use. The computer can for example be a round touch-based interface or a cylindrical lap-top based design, a design resembling half a globe was also created.
5. Personality profile
By diagnosing data from digital use and questionnaire answers the system gives you a personality type that is socially necessary to include in other social media platforms.
6. Body sock for personal electricity creation
A full body suit that lets a person act as a battery, that is, charging a power bank from a person's heat and movement. A version consisting of a ring around your thumb was also proposed.
7. Dislocated supercomputer
By networking all participants' phones the system can create a dislocated supercomputer that can be used to crunch big data sets. Pitched to help the environment.
8. Smart dogs
A service that is simply a smarter dog. The dog is smart enough for basic speech, for example: one bark is "yes" and two barks are "no" and can use its intelligence to become a better pet, for example understanding the rules of a house much faster. The dogs can also perform simple jobs that are too boring or too dangerous for humans to do.
9. Meta social media platform
A social media platform that exists to analyse and visualize data about your presence on other platforms.
10. Infocoin
A digital currency consisting of your own personal data. This data can then be sold to different stakeholders for small amounts of money.

11. Internet Jammer

A signal jammer for domestic use. The stylish piece can jam any signal effectively creating a more grounded and organic space where no internet is present.

12. The VR home

Different ideas on how one can visualize technology use through the medium of home layout. Firstly the idea was to have a real-space/VR-space combo where the real space could work as a "stage" for many different rooms in VR. Other versions of the idea were later developed like a completely web based system that in different ways showcases our technology use by constructing home layouts with whole rooms dedicated to specific social media. This "social media room" idea later found its way back to the first idea of virtual living in the form of a virtual elevator that would "transport" a user through the many rooms of their house, with some rooms being wholly dedicated to social media.

13. Social media dress-up

A conglomerate of ideas that consists of different ways one can "dress in ones data" the first being transparent full body clothing that would be filled out by the users own posts covering one's naked body. The user could also dress in their own feed (other people's post) or in their followers for clearer symbolic meaning.

14. Data urn

A urn in which one can store both the ashes of a dead person but also their data.

A.5 Scenarios Imaginary Employer

- *Every second a person spends on using a product means money for the companies. You have been employed by a company to find new ways of getting people to use the companies products. Your employer wants the user to spend as much time as possible using their product, preferably multiple hours per day. How would you design a product in order to truly catch the users time and attention? The year is 2040 and you want to create products that urges constant use. Make people spend more time, gladly unhealthy amounts of time on the product.*
- *The year is 2120 and the majority of all social contact is managed via digital media. To meet up in person is simply to inflexible, risky and time consuming to resist when global social contact is only a button press away. In other words - socializing digitally is the reality both in the present and the future. You have been employed by a company to create new ways to socialize digitally, how can we mimic the old-fashioned genuine real life meeting?*

A.6 Scenario/future user journey

Sävi's dreams are interrupted by the obsessive ringing of a bedside clock. With a groan she raises a shaking hand pressing the tiny mechanical button to silence the terrible machine. It's 7:30 in the morning and it is time to start the day.

Sävi picks up her phone pressing the power button. When the phone turns on and fills the room with a cold blue light Sävi's nervous eyes dart toward the top left of the screen. How much battery does the phone have? Seems to be just around 20%. The phone needs charging but considering that it is towards the end of the month Sävi does not feel comfortable charging in the apartment's single outlet. Electricity prices are also extremely high on Mondays. Sävi is gonna have to keep her phone alive with indie electricity.

After a quick shower Sävi dresses and turns towards her PEP-device casually thrown over a chair in the living room. Struggling slightly she pulls the device over her left arm, fastening the straps over shoulder and side. Recognising the telltale warmth of a human body the device turns on with a pleasant ping and Sävi is plunged into ice cold water.

With a tiny gasp she looks down at the device cursing herself. Why does this happen so often? To simply calibrate the device to a more comfortable temperature is such an easy thing to do. Sävi, however, seemed to have forgotten this when undressing for bedtime yesterday.

With a quick rotation of the dial Sävi pulls the device back into more comfortable territory and inspects the display on the device's battery pack. Damn, only half full, all the VR:ing yesterday seems to have taken its toll on her personal electricity. Well there is nothing to it but to dial the device back into cold territory. She will need the electric input to get through the day. With a sigh and a shiver Sävi picks up her phone and hails an autonomous cab. time to get to work.

30 minutes later Sävi swipes her phone across the car's payment surface and steps out onto the pavement with 8 euros less. In front of her - the huge concrete building that is the Swedish Digital Investigation Agency. Behind her - the automated car beeps a happy digital beep and smoothly returns to the everlasting flow of identical white autonomous vehicles. Sävi checks her battery once again. Her personal storage is now up a bit, but Sävi is still not comfortable with the amount she has. Her phone pings and she checks it to find a message from one of her friends. There is a dinner planned tonight. The phone happily shows a meager 15% battery. With a sigh she increases the warmth harvesting of the PEP-device. It's gonna be a cold morning.

The work day creeps slowly along and is both chilling and uneventful. Sävi powers her work computer with personal electricity as the SDIA takes a pay cut if the employees need more electricity than their monthly quota. It's not a very fair system

as the quotas are quite low, but it beats burning alive on an ever hotter planet.

After a short meeting with her boss she at least got 20 minutes of charging from his PEP-device. Sävi dislikes her boss, he seems too shifty with his dazzling smiles and tight suits. But free electricity is free electricity, and thus she accepted the charging invitation. Even though it is clearly not the case, Sävi often feels like the “taste” of other people’s electricity lingers in her device for hours after a charge. Even though she knows it’s silly she therefore prefers charging with people she likes rather than strangers or worse, her boss.

Sävis daydreaming during lunch is interrupted by a colleague.

Sorry dear. But I notice you’re running low on juice.

Sävi looks up from scrolling her phone with its waning battery. By the side of the table stands an elderly lady in a hand knitted sweater. The picture of an ant on the front is partly hidden by her rather well-worn Personal-electricity-device. Sävi looks down towards her PEP-device and notices that the bar has gone into the red. Damn, Sävi knew that using her phone was a bad idea, but how will she manage the rest of the day without it? She has a dinner to plan!

We can charge if you want.

The lady smiles pointing towards her own battery-bar that appears full. Full?! This old grandmother must hardly use any electricity at all. Maybe she reads a lot? Sävi looks around nervously blushing but accepts the invitation. She always feels like a child when her battery runs low. Like she can not manage her own electricity without the help of others. The older woman sits down across from Sävi offering her cable. Sävi accepts and plugs it into her personal device. They talk for the rest of the lunch-break and when Sävi leaves the lunch room with over 50% battery she feels happy firstly for the electricity, but secondly because it seems like she might have made a new friend.

The evening approaches and Sävi has invited a couple of friends to dinner at her apartment. A bit stressed she arrives home worried that she wont have dinner finished in time. Because of battery constraints she walked home instead of taking a cab. This in order to increase her body heat for more electricity production. She needs her phone active or she wouldn’t be able to unlock her front door and will not know when her friends arrive. Later when the guests arrive she is still in the kitchen-corner stirring a simple but delicious soup made from roots with added insect protein. As part of greetings the gathering connects their devices into a larger network seamlessly balancing electricity between them. It is just what friends do. Sharing is caring! As they sit down at the table with wires criss-crossing in all directions Sävi plugs the network of people into the sound system through her battery pack. To hell with tomorrow, tonight they are gonna have music. Talking, eating and laughing the dinner continues late after midnight. As Sävi undresses for

bed she takes a last look at her PEP's display. Only 30%. Well that's life. It's just gonna have to be another cold day tomorrow. And maybe she can eat lunch with the nice old lady again, and charge a bit.

A.7 Evaluation result

Website comments

Some participants felt that the website was dystopian and overly corporate in language. That it mimicked a way of presenting a product that seems insincere and covert, very reminiscent of crowdfunding websites such as kick-starter or indie-gogo. The participants felt that there were problematic aspects of the product not clearly presented on the website. This capitalistic aura mostly stemmed from the language used but the color scheme was also mentioned as a contributing factor. Some participants mentioned that the troubled expressions of the models set a clear dystopian tone for the website and this was also complemented by the absurdity in language. However this was not as common as we first thought it would be. Many participants never commented on the cookie-cutter corporate style and language and instead perceived the website as 100% serious.

One participant even mentioned that the texts could have been written by a marketing bot or some similar expert role. Especially mentioning the section describing the Seebeck company as being overly corporate and very nondescript full of buzz words.

The website was highlighted as looking very professional and that the product itself looked better on the website as well as looking like the “final product” in the digital medium.

The future vision the website presented was clear to some participants and commented upon. The users used the “backstory” to construct their own consequences and speculations on how we will relate to technology in the future. It was also mentioned that this section of the website led the discussion towards environmental themes.

The website was commented as “looking sci-fi”, especially the pictures.

The picture of the dancing people charging together was liked by one participant. Another mentioned that the picture made them think that the product should be worn while being active (running, dancing, walking).

Comfort

As the participants were not able to try the physical prototype some discussions handled the topic of how comfortable the artifact was to wear. The discussion was divided between users that felt the product looked very comfortable (sometimes even calming, a reference to weight blanket for example) while others perceived the product as being heavy and cumbersome. Some worried that the product would restrain their movement too much especially when exercising also many mentioned that the product would be too heavy to exercise in referring to the weight of the battery of the box and the material. Furthermore they worried that the asymmetric shape

would lead to an unbalance in weight distribution, making the product slide to one side during use. Others, in contrast, described that they perceived the product as being light because of the “conservative use of materials”, “the light materials” and that “it was tight on the body”. This tightness is also sometimes highlighted as a negative aspect.

There was also mentioned that the plastic material might chafe when moving around especially when exercising.

Two participant specifically feared that it would be hard to sit down while wearing product mentioning it several times during the workshop.

One participant mentioned that it would be cumbersome to put the product on and off instead referring to that they “like simple things”.

Aesthetic aspects

In general the product was perceived as having a sci-fi look or being futuristic. The reasons for this futuristic expression was mentioned as being:

- Clearly visible components, referring to both the battery box and the visible patches through the plastic material
- The asymmetry of the product

Furthermore the product was often described as looking “cool” or being a fashion statement. Generally they expressed like for the look of the product.

While being perceived as futuristic the product was also perceived by some as familiar and clearly functional. The product clearly showed its content and function and thus appeared non threatening to the users. The familiarity of the wearable “looking like a shirt” also contributed to this fact. The dial was also specifically mentioned as being a non-threatening means of interacting referred to as “looking like a toaster from the 60s” and looking harmless.

While on the topic of apparel one participant mentioned specifically the arm as contributing to the product appearing more comfortable and “more like an article of clothing”. They continued with wondering if the arm had a function or was simply a fashion decision.

Furthermore one person perceived the artifact as looking “cold”, because it looked “metallic”.

One participant mentioned that the product would appear more dystopian if it would have been black.

Medtech

The product was often unprompted described as being a medicinal tool of some kind. The participants describe that the color choice was contributing to this experience as white is heavily associated with medicine or science. Other factors that led the thought to medicinal-tech was the asymmetry of the product hinting about a specific anatomical purpose, and also the “size” of the product, that is, that it covers a substantial part of the body. Some other contributing factors were how cumbersome the product appeared (creating a motivation of necessity of the product’s size), the tightness of the product (that is, the fact that it fit so tightly on the body), the plastic material.

The dial apparently also contributed towards a med-tech style being described as looking like diabetic equipment.

One person mentioned that if the product would have been “completely white” it would have appeared less as a medicinal tool and more like a fashionable piece of clothing.

Some participants observed that it was fitted over the left side of the body, that is the side where the heart is placed referring to this as hinting towards a med-tech use case.

The product was often described as looking like a “life support tool” of some kind.

Cables

Being a specific design choice included for clarity in symbolism the cables were quite correctly perceived as cumbersome and a hindrance. Many mentioned that they had a hard time perceiving charging as practical when they had to have cables running in all directions especially when exercising. Furthermore several participants mentioned that they would like the product to charge wirelessly instead. The added cable management tools however helped in remedying some worry often referred to as being practical in contrast to a cable problem.

It was perceived as limiting to be connected to another person but the cables are also sometimes highlighted as positive, for example one participant mentioned that it “is perfect to not lose one’s friends on the dancefloor”.

The cables also created some confusion as the connection between the product and the phone made the users perceive the product as being controlled by some app on the phone. It is however hard to know if this would be remedied by removing the cables.

One participant feared that the cables would lead to fear in public places as the product looked a bit similar to bomb belts.

Interface

In general participants guessed correctly when it comes to the bar on the front and that it shows battery level. When motivating their choice some referred to the fact that the bar did not change as the dial was spun.

However some guess wrong instead understanding the bar as other things, for example an indicator of speed of transfer between two phones.

Interestingly some understood the fact that the bar on the front had the purpose of showing others (not themselves) a battery level, pushing social interactions.

Furthermore, the digital interface itself appeared confusing to some participants as they had a hard time relating to the current charging network, its function and the visualization.

One participant mentioned that the screen runs the risk of having the same mesmerizing effect as a phone has, becoming an obsession where a user constantly checks their levels.

Continuing, some mention that it is weird that the product does not have a companion app. But, that, it is more inclusive to have the screen on the box instead.

Interaction

In general most people understood the interaction with the product referring to the dial as an understandable way of modifying the products main function. The interaction was often visualized through statements.

The dial was sometimes perceived as confusing in purpose even when the functionality of the product was known. For example it was understood to regulate the power output for the device leading to reasoning of how unpractical that would be. Furthermore the dial, by some, perceived as cumbersome and running the risk of being unknowingly changed during user movement.

When only shown the product some users still guessed at an early stage that it would be possible to connect PEP:s to each other. Probably because of the cables.

One thing highlighted was the safety of the user being able to stop wearing the device so easily. Highlighted as positive leading to a safer use case.

The abundance of contacts also clearly hints at the possibility of charging several devices as understood by the users. This also hinted at unknown functions creating

questions and speculation in the users.

The combination of the box and the vest often leads to users speculating at increased functionality. The cables often put their thoughts towards charging but the visible vest creates additional questions showing the importance of having a visually interesting product and also a visible wearable as a hint.

One participant mentioned the importance that a user should develop a skill to tune their to not get too cold or too hot.

Product reflections

Here are gathered general reflections on the product from the users.

- In this situation you would never go without electricity.
- The white parts are bendable. But also stabilizing.
- The box is big but also the cable management would be hard. (On if the product is worn over or under clothing)
- The product seems safe in that it has covered parts and is not inside your body.
- Some question the effectiveness of the product and why it is not worn directly in contact with the body.

Questions on efficiency

Interestingly very few discussed this at length, only one participant mused about the viability and effect of the product on a technical level.

Sci-fi references

It was not uncommon to refer to sci-fi media when describing and discussing the product. For example, the most common reference is the Stormtrooper from Star Wars when discussing the look of the product. Some other references are the Matrix that uses the same source of power. The terrible sci-fi movie In Time was also referenced in an idea of having electricity instead of money, very much like they use time in In Time.

Believability

Almost all participants perceived the product as believable and reasonable both when prompted on the subject and when having unstructured discussions. They perceived it as being a chronologically close product that is “sci-fi enough”. Furthermore it was perceived as easily being adopted by the people of a close future.

Some even got tricked into actually believing the product WAS real clearly showcasing how reasonable the product appeared.

The product was often perceived as being a prototype for a coming prototype with a clear use case in a future world.

One participant perceived it as being the “next level of power bank” continuing to reason that people in the future will not have a hard time adopting the product.

One participant showed very good analytical skills when praising the product for its good use of satire saying that it was enough to be provoking but still based enough to not be unbelievable.

However, some participants mentioned that the product lacks a clear usecase in today’s society referring to the abundance of other electrical outlets.

Function

When presented with the product the participants guessed what its function was. Many guessed correctly that the product would be used for charging, the heat transformation was often missing from these reasons. Some other guesses are that the product is some kind of armor or a “DJ-suit” powering music by movement. Many guesses surrounded the phone probably because the phone was so heavily featured in the material.

SPECULATIONS

Ideation

In many cases the product led to the users creating new scenarios or ideas based on the scenario presented. Some of these ideas where:

- A very common idea for use of the product is that of powering a tiny fan while hiking or exercising.
- A tram powered by its travelers
- A system that automates power charging presented as “Electricity communism”
- Charging when/by giving another person a hug
- Electricity as a currency in a future
- The product producing heat, “working in reverse”
- Powering a car with its passengers
- Using the same tech to create energy from the heat produced by large server halls
- Connecting the product to the internet and monitoring and regulating health aspects of the wearer
- A system where everyone had a quota of electricity that they can complement with the device

- Connecting to a personal lamp in a café to light the room
- The product can also work as protection or like armor

Use case

Many participants speculated in scenarios where the product would be most useful. The biggest category by far was hiking which was often highlighted as a scenario where the product would be very useful as electricity is hard to come by in the wilderness. Working out was also a popular scenario where many participants talked about how the product would be more efficient in work out scenarios. Furthermore, the heat removal was highlighted as positive as cooling oneself when working out is preferable. One participant speculated that people will live healthier lives with the product as more people would work out in order to produce more electricity. Working out together.

Some also highlighted the use of the product in developing countries where electricity was perceived as being sparse.

Other use cases:

- Charging ones phone but with a very hectic lifestyle thus charging on the go
- Living alone on an island but still want to socialize. Thus using the product to charge technology to socialize.
- Using it on trams, flights and trains and while doing other transportation.
- When skiing.
- When at a music festival.
- Using it for short periods of time collecting electricity.
- Using it at home when there are no outlets close.
- Survival situations.

Hard to see use cases today

Some participants had a hard time visualizing use cases today even though this was never the point. They had a hard time placing the product in a futuristic setting and thus did not clearly see why the product was needed. For example feeling that they would not use the product if not forced by for example the state.

Love it. Want it.

A surprising amount of participants really liked the product and expressed a want to have it. They highlighted the very practical aspects of having “infinite battery” describing the product as useful and “cool”. Many also described the product as a “great idea”.

Some motivated it by describing a hectic life where one could charge while transporting.

Risks

Many participants describe potential risks of using the product or int being on the market. These are summarized here.

Firstly the most common themes are political consequences mostly referring to class differences and poverty. Many participants rightly perceived the product as being a necessary tool to sustain a lifestyle and thus that rich people (who can afford electricity) do not need to use the product to that same extent. For example one participant worried that he would feel quilt towards users of the product as it highlights their economic standing. Continuing this theme many speculated on how humans as a source of electricity could lead to very classicist societies where lower class people produced energy for more powerful individuals. These ideas range from simply electricity production as a low credibility job to whole societies producing electricity for one “emperor”. These concepts were very dystopian in nature and also often described as “dystopian” by the users themselves.

Taxation in the form of electricity was also mentioned.

Other risks that where mentioned:

- Health hazards or death from hypothermia
- Disturbing natural processes of heat regulation in the body by using the device
- Using the product in dangerous situations (for example when sick)
- The batteries of the device and connected phone exploding
- Hacking someones product and killing them by making them cold
- Bullying from the fact that some people have more battery then others
- The product is a material thing contributing to a consumerist lifestyle
- The stealing of electricity stemming from the visibility of the battery level
- The product could lead to negative impacts on the environment in that the fact that it makes you cold can force people to heat their homes even more

Being cold

Naturally many participants speculated on the experience of being cold and how it would affect them and society at large. Some are scared about the health risks but others see the cooling as a positive mentioning that they can use it during the summers to cool off.

Others mused on how the interaction would feel. Spinning the dial and being cold, etc.

Many participants mentioned that they are already very cold generally and worried that the product would be even more uncomfortable due to this fact and wondered if the output would be lessened by their “natural coldness”.

Conscious use of tech/electricity

Many participants speculated on how the fact that electricity is limited and sourced from the self would affect their technology use. Generally most agreed that the lack of electricity would lead to less time spent using their phone for “menial tasks” and shifting the focus to more useful tasks, just scrolling their phone for example would be done less. Continuing, some participants discussed how the connection between self and technology(phone) would become more personal if the phone was powered with the artifact.

Another parallel topic that was discussed widely was how the artifact would lead to a greater understanding of how much power their technological activities consumed. This greater understanding could lead to respecting resources to a wider extent but also to lesser use of technological products. Continuing, the artifact would also lead to a greater understanding of where the used electricity is sourced and how it is produced.

Other environmental aspects

To no one’s surprise environmental aspects of the system were discussed in some interviews. The fact that the product produced very clean energy was highlighted as a positive. The product could also change the prominence of batteries in devices in general eliminating the need for products to have big batteries. It was presented as positive for the environment but negative for the consumer as it forced users to also buy the artifact in order to have their technology functioning.

One participant speculated that it would be a shameful task to charge from a socket in the future.

One participant felt paranoid by reading about the product as it reminded them that our resources will run out and that we are moving towards a darker future with less electricity to go around.

Privacy

Some participants feared that the product would make it easier for companies or governments to track a person as it makes it impossible to run out of electricity. Some also speculated that an internet connection could be included in the product making intrusive collection of health data possible.

Human/machine integration

Many participants discussed how the system is a first step to integration between human and machine. The fact that it was a wearable was highlighted as the reason for this hint at cyborg integration. These discussions came with some fear of what

the future holds and what affects the product would have on the body itself. Some participants also seemed positive towards the change highlighting how the body can be used in new innovative ways.

The fact that the product is “only” a wearable is often highlighted as the product being reasonable and not too frightening.

Social aspects of charging together

Many participants mused on how it would be to experience the communal charging. Generally they argued that it would be a more personal experience to charge together. Specifically, the act of “giving” electricity was highlighted as a more symbolic and personal gift.

Many expressed an ambiguous positivity towards producing electricity together and that it could be a conversation starter and a “fun” thing to do. The fact that the produced electricity could be used to power things together was also highlighted as positive assuming that it was not a forced process which of course would make it a more negative experience.

Continuing, many discussed the personal aspects of the charging. That they would not like to charge just about anyone but reserve the process for friends and family. The fact that one has to be physically close to the person one is charging was also highlighted as both a plus and minus.

One person highlighted that a power bank can be used as a way of making friends.

Conformity

Many participants discussed the effect others would have on them using the device highlighting the importance of wide-spread use in order for them themselves to feel comfortable with using the device.

Firstly some argued that there would be some early adopters of the product, people that would not care about being judged by the general public. This would in time create more widespread use.

Using the device together as a group would make it easier to try it out.

Continuing, if the majority of people used the artifact they might judge others.

It would be important to change the way people see a product like this.

One participant highlighted a problem with the product that it looks so distinct but it could also be a plus for the tech savvy of the population that might want to look

futuristic.

Availability stress

Many discussed how the fact that the phone would always be turned on would force people to be contactable all the time. There are no excuses to not charge one's phone and this could lead to stress. Continuing, the constant connectedness could lead to people being less present during physical activities. The access to electricity would lead to elimination of those few moments where one's is never contactable, this is described as uncomfortable.

The physical closeness of the phone and person in the device is highlighted as problematic as the moment where the phone is placed somewhere for charging is eliminated.

Generally many worry that the way the product promotes constant connectedness is negative. It is important to not be connected sometimes also.

Addiction

Many worried that the way the product promotes active phone use and connect-edness would lead to more destructive use of phones and technology. For example increasing technology addiction.

Others also highlight the implication of the product's existence fearing the absurdity of the lengths a user is willing to go in order to charge their phone all the time. Being cold, carrying a heavy load, paying the price of the product, etc.

Many highlighted the products used as a very reasonable but scary scenario, highlighting how extensively people use their phones. This is often argued as being a problem and negative placing phone-battery as such a basic need. Instead the participants promote more physical meetings and real social interaction.

A.8 Product website

PEP
SEEBECK

HOME
PRODUCT
VISION
ABOUT US

Power electronics with your body 🌱
Every second your body is radiating heat. This vast reserve of energy is wasted - until now. The PEP-device harvests this energy and makes it possible to power electronic devices with body heat. With it you will never go without electricity again. With PEP you don't have to - your phone will only die if you do.

Control temperature 🌡️
Take control of your body's resources. For the first time ever you are in charge of the heat you produce. The body battery lets you control how much of your body heat PEP is harvesting.

Charge together 💞
Electricity is more fun together. Connect your PEP with friends and family to charge each others power supply. Connected devices can also output more power, increasing possibilities.

Free electricity ⚡
Why pay for electricity when you are making it for free? With the PEP you become an indie electricity producer in full control of your own power supply. Share it with friends? Sell it back to the grid? You decide!

thermoelectric generators
cable management system
body battery
6 outputs for your devices/humans
twist to set body temperature and level of harvesting
screen lets you keep track of:
experienced body temperature
current charging network
body battery level

Figure A.1: The top of the web-page used for promoting the PEP. Showing use cases and interface.

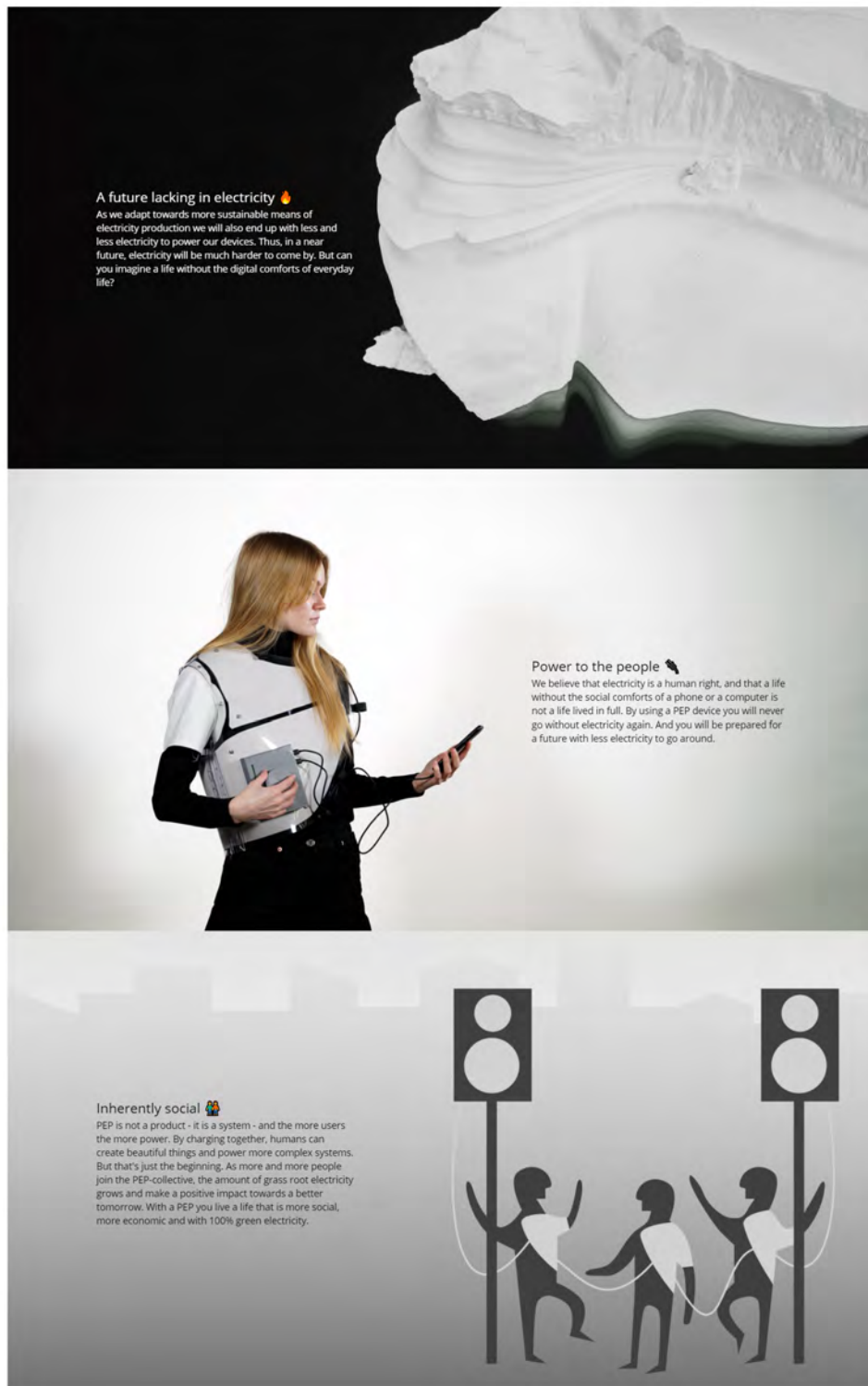
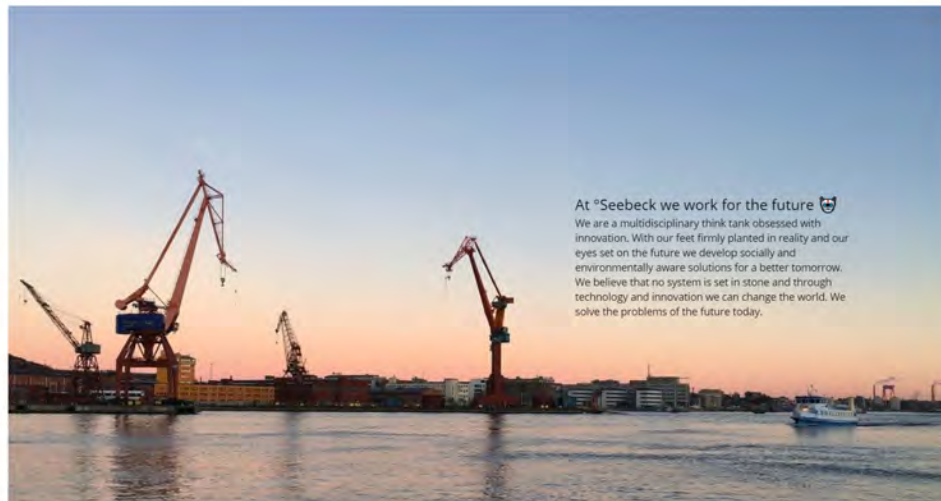


Figure A.2: Part of the web-page focusing on setting and socialization.



FAQ 💡

- Will I be cold using this device?

You may be. How cold you get is completely up to yourself, you control this by twisting the knob in the center of the body battery. A pro tip is to go for a run or do some exercises to build up extra body heat. Maybe avoid using it when you are sick.

- What devices can a PEP charge/power?

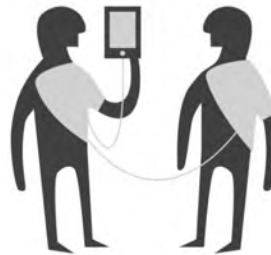
Anything that has a USB-C port. And the more people the more power!

- How many devices can I charge at the same time?

You can charge up to 6 devices/humans, its up to you how you want to distribute your electricity.

- Why do I need this product?

In the near future electricity will be much harder to find and with this product you can continue living a life with the comfort of multiple tech products such as a phone or computer.



°SEEBECK We are currently in the last stages of prototyping and will be releasing the product soon. If you would like to receive a notice when the PEP-device is on the market - do not hesitate to contact us.

Figure A.3: Part of the web-page describing the company and the FAQ.