Energy Resilient Dining

Sparking discussion about everyday energy resilience through design

Master's thesis in Industrial Design Engineering

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CHALMERS UNIVERSITY OF TECHNOLOGY

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Cover: Illustration by Karin Nilsson, the future cooking scenario

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Abstract

To reach the sustainability goal of the Paris agreement a sustainability transition in the Swedish energy system towards renewable resources is required. However, a renewable energy system brings with it challenges where electricity is more variable. *Designing everyday energy resilience* is a research project looking into ways of meeting this challenge.

The purpose of this master's thesis is to complement the research project by investigating how a variable power system affects the dining activity and explore ways to enable energy resilient dining in the future.

The purpose was fulfilled through four objectives. First, to map out the dining activity today and in the future and secondly to identify what qualities are important for a dining experience. The third objective was to challenge today's idea of the dining activity. Finally, the fourth objective was to through design communicate ways of enabling energy resilient and meaningful dining in a variable energy system.

The dining activity that we have focused on can be described as several *people*, a household or friends for example, consuming *food* in a specific *context* to achieve *a meal* which fulfills the need of a *meaningful dining experience*. Within this dining activity exists three main actions, *preparing*, *cooking* and *consuming* a meal. There are three main qualities achieved through this activity, all of which contribute to a meaningful dining experience, the meal fulfills *basic needs*, *social and cultural values* and *meeting infrastructure expectations*. These qualities provide value that is deeply rooted in human behaviour and changes in values over the considered time span are likely incremental if any.

The dining activity of today was challenged through the critical design provotype *Pluggen*, a smart branch outlet that varies the available electricity in the kitchen and challenges the status quo of *always available electricity*. The provotype was deployed as a part of the user research in this master's thesis and provided insights into important values and strategies of being more energy resilient today.

The result of the user studies and ideation in this master's thesis is *Thermo*, a product that bridges the mismatches in the dining activity of today and communicates an energy resilient dining activity of the future. It supports the user in separating the actions of the activity and allows each action to be performed when most suitable.

Keywords: *energy resilience, critical design, provotype, activity oriented design, dining, cooking, user studies, technology probe*

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Finally, we would like to thank all of those who participated in the different user studies within this master's thesis. Thanks for your engagement and enthusiasm, even though participation was provocative at times!

Gothenburg, June 2021

Karin Nilsson

Sofie Groth

Contents

1

Introduction

In this chapter the master's thesis is introduced by presenting its background, purpose, objectives and project scope.

1.1 Background

The average Swedish energy consumption over a year is 556 TWh (Swedish Energy Agency, 2020). In order to reach the sustainability goal of the Paris agreement (UNFCCC, 2015), which aims at keeping global warming below 1,5 degrees Celsius, a sustainability transition must occur towards renewable energy. This goal of becoming more sustainable with renewable resources, combined with a Swedish energy system in need of an upgrade motivated the Swedish Energy System to perform a future scenario study with the aims of being better prepared for whatever energy future is to come. As described in the report from the scenario study *Four Futures - the energy system beyond 2020* the Swedish Energy Agency identifies a future scenario *Legato* as one potential energy scenario which would reach the goal of the Paris agreement (Swedish Energy Agency, 2016).

The scenario Legato is in addition to the Paris agreement created in lines with two of UN:s 17 global sustainable development goals; *Goal 10 – reduced inequalities* and *Goal 12 – responsible consumption and production*. The driving forces of the scenario are therefore *ecological sustainability* and *global justice*.

Legato is a potential energy future where a rapid transition to renewable energy resources and an energy consumption below 243 TWh in the year 2050, half of what is currently used in 2020, has met the goals of the Paris agreement and slowed down global warming. The move to near all renewable energy sources has resulted in less reliant energy supply and temporary power shortages due to a lack of capacity in production and distribution of sufficient energy to all of society. This means that people will have had to adapt to a more flexible energy consumption but also a lowered general use of energy in their everyday life.

The issue of adapting to a more flexible everyday energy consumption is currently being researched by RISE and Chalmers in the research project *Designing everyday energy resilience*. This research project explores barriers and ways for people to adapt to this more energy resilient future scenario. This is done through exploring solutions of how everyday life could be more resilient to energy disturbances but be experienced as equally good.

In the project *Designing everyday energy resilience* one activity found to be affected by the future scenario's preconditions is the activity of dining at home and from their studies it was found to be something people worry would be affected by variable electricity supply. Tellström (2015a) explains that meals are an organised behaviour that we repeat throughout the day and in order for us to actually eat the food we need this social gathering where we take a break, sit down and eat. As the dining is an organised behaviour that occurs regularly in our everyday life and as many worried that their dining would be affected by the future scenario the dining activity, with all its associated activities, in the preconditions from the Legato scenario an interesting area for further research.

1.2 Purpose

As a complement to the research project *Designing everyday energy resilience* this master's thesis looks further into everyday products or services related to the activity of meaningful dining at home. With emphasis on what constitutes meaningful dining, today and in the future scenario Legato, this thesis aims to contribute with knowledge on how the activity can become more energy resilient and to a general discussion on norms and habits in relation to energy usage in the dining activity.

1.3 Objectives

This master's thesis will:

- Map out the dining activity of today and in the future scenario Legato.
- Identify what qualities are important for a meaningful dining experience, as well as how this could change in the future.
- Create an artefact that provokes and challenges today's idea of what a dining activity is and can be.
- Explore and ideate on ways to enable an energy resilient dining activity in the future scenario Legato.

1.4 Project scope

The master's thesis takes its starting point in the research previously made in the project *Designing everyday energy resilience* and narrows down to only one of their identified themes; the at-home dining activity. The dining activity includes all supporting actions that a person takes to create meaningful dining at home.

The target group of the research is people living in cities, mainly in multi-dwelling houses, such as apartments or townhouses. These are people who can be considered dependent on a continuous access to electricity due to the lack of alternative sources of energy or ways of adapting. This group is viewed as critical users as their living conditions today are considered by the writers to be most vulnerable in the future scenario Legato.

The results will mainly focus on the experience of the artefact and will not take the technical feasibility into direct consideration. However, in order to spark provocation within the viewers the artefacts created within this thesis should not come across as impossible given the circumstances, but rather as a plausible future product which challenges today's status quo (Boer & Donovan, 2012).

2

Related work

In this chapter related works relevant to understanding the project is presented. This includes a description of the energy system in Sweden, the future scenario Legato, a definition of energy resilience, some theory on food culture as well as an insight into residential electricity demand for cooking.

2.1 The Swedish Energy System

According to the Swedish Energy Agency's report *Energiläget 2020* (2020) the Swedish electricity production is at large based on hydro power and nuclear power, they note that there is an increase in wind power as well as in the use of bio fuels for electricity and heat-production.

The Swedish Energy Markets Inspectorate is a Swedish organisation that oversees the Swedish energy providers to make sure that laws and regulations are followed. One of their tasks is to promote energy demand flexibility, which is defined as a flexibility in energy demand from customers. In the report from the Swedish Energy Markets Inspectorate (2017) suggest that the electricity market of the future will consist of more variable sources of electricity production. According to the report this will make it more important to utilise flexible resources within the power system, the report exemplifies these flexible resources as *production* of electricity, *storage* of produced electricity and *demand side flexibility*.

The Swedish Energy Markets Inspectorate (2017) suggest that a demand that is adapted and adjusted after the available electricity production reduces the risk of power deficits. Additionally, the flexible demand could decrease the use of high-emission production resources which are often utilised during peak hours or when the sustainable electricity production is low. This report defines demand side flexibility as a voluntary change in the demand for electricity for the grid caused by an incentive.

The Swedish Energy Markets Inspectorate (2017) have identified four prerequisites that they consider important in order to achieve demand side flexibility, which are the following:

- Smart meters for hourly electricity metering
- Feedback of hourly values for controlling electricity use
- Technology and solutions for flexible use and power reduction
- Electricity market-linked usage/automation/devices for energy flexibility

2.1.1 The future scenario Legato

In the report *Four Futures - the energy system beyond 2020*, the Swedish Energy Agency present four different future scenarios for the Swedish energy system (Swedish Energy Agency, 2016). The scenarios are based on an analysis of factors affecting the development of energy systems and paints the picture of the years 2035 and 2050. The factors include global warming, digitalisation and social aspects.

Legato was chosen as a relevant scenario to work towards as it is the chosen scenario in the research project *designing everyday energy resilience* but also since it was found to be the only scenario out of the four presented in the report (Swedish Energy Agency, 2016) that could meet the 1,5 degree global warming goal from a consumption perspective according to the report *User centered images of future energy transition* (KTH, Green Leap, 2017).

The Legato scenario takes its starting point in a mentality of global justice and ecological sustainability being a global issue that we face and solve together. In Legato a rapid transition to renewable energy resources and energy consumption below 243 TWh, this is half of what was used in 2018 (Swedish Energy Agency, 2020), has met the goals of the Paris agreement and slowed down global warming.

The move to near all renewable energy sources such as wind, solar and water power has resulted in a varied electricity price and increased interest in storing energy but also to a less reliant energy supply and temporary power shortages. This is because weather conditions will not always allow wind and solar power to generate enough electricity and any stored electricity will not be enough to distribute sufficient energy. Increased energy efficiency, the ability to store excess energy and opportunities to import power will compensate for the insufficient capacity in the power system most of the time. However, some days, primarily during the cold winters in Sweden, when for example more electricity is needed for heating in households, this will not be enough to provide electricity for all customers. Especially not at times during the day when many use electricity at the same time.

People will therefore have adapted to a more flexible energy consumption but also a lowered general use of energy in their everyday life. In the Legato scenario some have even chosen to temporarily opt out from electricity supply at times in solidarity in order to lower the burden on the power system. In general the public has made a move toward simple living where people spend less time working and more time tending to the household, family, hobbies and non-profit activities. The strive to adapt their ecological footprint to match a globally sustainable level is now shared among most Swedes which is why they are more flexible and do not mind planning their electricity use according to a varied availability (Swedish Energy Agency, 2020).

According to the Swedish Energy Agency (2016) Sweden's potential to produce electricity with low emissions at low costs is good due to access to natural resources. Additionally it is stated that in order to reach a sustainable future it is essential that research and innovation lead the way forward. The transition to a globally sustainable future will require economic investments and measures to create a society that differs hugely from today.

2.1.2 Residential electricity demand for cooking

Meals are part of our everyday and they take up a lot of our spare time each day. According to *Matrapport 2018* by Food & Friends (2018) the Swedish household spends 36 minutes on cooking during a normal weekday and 45 minutes per day during the weekend. Cooking is not only an important part of our day it is also an interest for many, *Matrapport 2020* (Food & Friends, 2020) notes that 74% of Swedes have an interest in food and cooking.

Apart from spending a lot of time on cooking each day the cooking activity requires quite a lot of energy. As seen in figure 2.1 which portrays estimated load curves in the kitchen adapted from Vesteberg & Kiran's report *Residential end-use electricity demand and the implications for real time pricing in Sweden* (2015) the time of day when most electricity is consumed in the kitchen is between 4 pm and 8 pm, which correlates to when people generally get home from work or school.

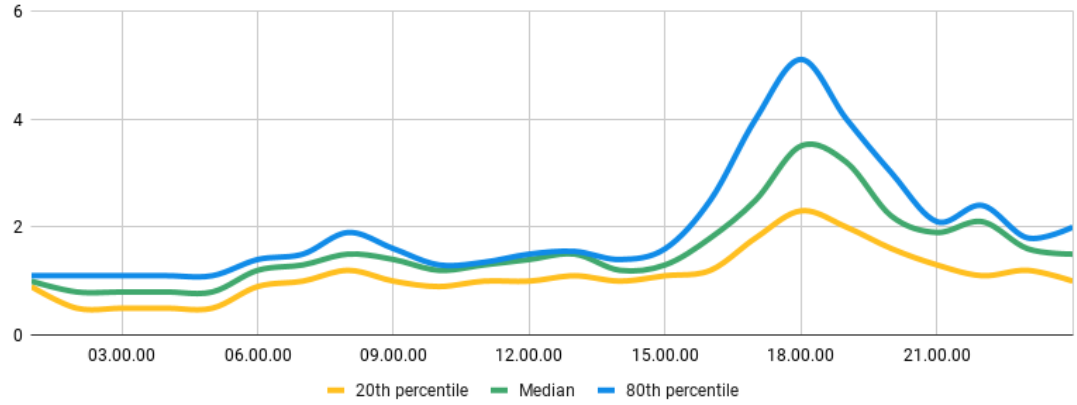


Figure 2.1: Kitchen electricity consumption by hour (kWh), adapted from Vesteberg & Kiran (2015)

A noticeable factor in figure 2.1 is that the morning peak is low, meaning that most people do not use a large amount of electricity when preparing their breakfast. Vesteberg and Kiran (2015) argue that this is because the Swedish breakfast by tradition is cold. Whatever electricity is used for say brewing coffee is small compared to electricity used for cooking dinner. The change during lunch is not large either, likely due to the fact that most people eat their lunch at their place of work where the energy used for heating the lunch is not accounted for.

2.1.3 Energy resilience

The research project *Designing everyday energy resilience* defines energy resilience in households as an interwoven part of everyday life, where the households are able to adapt **what** activities are performed, **when** they are performed and **how** they are performed in the face of **expected and unexpected variations in availability of electricity** (including power cuts) as well as to **be prepared for** and **to prepare for** future adaptations of activities. To be able to adapt activities, households need to have knowledge about and experience of how adaptations can be made, to have possibilities to make these adaptations, and to accept/create new meanings of what a good life is (Hasselqvist et al., 2021)

Based on the Legato scenario (Swedish Energy Agency, 2016), the definition of *demand side flexibility* from the Energy Markets Inspectorate (2017) and the definition from the research project *Designing everyday energy resilience* we will be working towards **energy resilience** as an adaptation in everyday activities based on available electricity in the power system.

2.2 Food related culture

Meal researcher Richard Tellström describes in his book *Hunger och Törst: Svensk måltidshistoria överlevnad till statusmarkör* (2015a) that food culture is a symbolic system that humans use to connect with each other. We eat our meals as a ritual, utilising porcelain, cutlery and textiles to mark the occasion. However, a meal could be as special as a three course dinner, as simple as a cup of coffee with friends or be eaten using just our hands.

Tellström (2015a) explains that meals are an organised behaviour that we repeat throughout the day and in order for us to actually eat the food we need this social gathering where we take a break, sit down and eat. We eat some dishes at weekdays, and others at weekends or parties so as to mark difference in importance.

Food can be closely related to our childhood and bring back fond memories from the past according to Tellström (2015a). This nostalgia is what carries the local food tradition forward. By gathering around food we recognise, with people we love the meal becomes more valuable. The food on our plate shows our culture, values and opinions both to ourselves and others; it becomes a social marker.

Finally, cooking and social meals are lifesaving, if we are excluded from the food community Tellström (2015a) argues that we reduce our chance of survival. Even today when we eat alone we employ strategies to not *feel* alone. We eat similar food to those we identify with, for example choosing the same meal as those in the TV advertisement creates a connection to the people on the screen. In conclusion, to eat *by* ourselves can be tolerable but to be *lonely* while eating is much more painful.

2.2.1 Food related habits

In the article *Keys to open the household 'black box' for a greener society* Shanahan (2015) argues that research into everyday practices is required to gain understanding of how to support households in the transition towards sustainable food-consumption. In the article Shanahan argues that minor choices in our everyday life often develop into habits and routines guided by previous experiences and that these habitual behaviours are hard to break.

In the article by van't Riet et al. (2011) the writers argue that a significant part of our eating behaviour is habitual and guided by cues in the context or environment. Habits are defined as a *learned response to situational cues* where the behaviour has provided a satisfactory result in previous experiences. Van't Riet et al. (2011) propose that more research is needed in intervention strategies aimed at changing unhealthy eating habits and they suggest that in order to change existing habits we need to employ interventions that inhibit the habitual response when cued.

Both van't Riet (2011) and Shanahan (2015) argue that *our eating behaviours* respectively *our food purchasing behaviours* are habitual behaviours that become habits through previous satisfactory results when performing the behaviour in question. We believe that the dining activity that is inquired into in this master's thesis can be considered a habitual behaviour similar to the exemplified behaviours in van't Riet (2011) and Shanahan (2015) due to it being an everyday practice that is performed time and time again within similar situational cues. From Shanahan (2015) we conclude that we need to open the *black box* that is the everyday life of the target group in order to understand how to support them in changing their habitual behaviour. As we are inquiring into ways of challenging the dining activity of today and finding ways to enable a more energy resilient dining we will likely need to adapt some sort of interventions in order to achieve the desired results as the activity is largely habitual.

2.3 Summary of related work

In previous research we have found that there is research focused on energy resilience and the effects of moving towards a sustainable electricity production. However, much of this research (Swedish Energy Agency, 2016; Swedish energy markets inspectorate, 2017) is focused on society in general and not on households or individuals. There is also previous research on food culture and eating, we have found research in food and dining that focuses on sustainability transitions in the way that we eat or shop, but no research that connects our dining activity to potential energy futures and electricity use. This leads us to believe that research in how future energy scenarios affect food culture and our dining activity, on household level, is an area of interest.

From the mentioned previous research we can see that the Swedish energy system will have to adapt to a system of higher demand side flexibility to account for a shift toward renewable energy resources (Swedish Energy Markets Inspectorate, 2017) similar to what is predicted in Legato. Legato also tells us that the new energy system will move the general public toward accepting and thriving in a life with less reliability in their electricity supply (Swedish Energy Agency, 2016). A varied electricity supply will affect people mostly when the need for residential electricity demand is the highest (Vesteberg & Kiran, 2015) which many times coincides with and will likely influence the dinner. Previous research finds that food carries a lot of significance for people (Tellström, 2015a) and that our food-related behaviours are much habitual (van't Riet, 2011; Shanahan, 2015). With previous research in mind and that in Legato there is a potential lack of capacity at the specific times when people want to perform a dining activity that requires electricity, the activity of dining proves to be an interesting area to explore ways of being more energy resilient in.

3

Research approach

In this chapter theory relevant to understanding the research approach of this master's thesis is presented. The chapter introduces activity-oriented design and critical design, which are the two main design theories that have influenced the choice of methods and overall approach of the project as well as its results.

3.1 Inquiring into the unknown

In *convivial toolbox* four levels of knowledge are presented and the levels of knowledge are often presented as a pyramid, see figure 5.7. In the pyramid *explicit* and *observable* knowledge make up what is referred to as the top of the iceberg while *tacit* and *latent* knowledge are below the surface, indicating that this knowledge is more difficult to access (Sanders & Stappers, 2018). *Tacit knowledge* is described as things we know yet can not explain and *latent knowledge* is thoughts and ideas not yet experienced. Sanders and Stappers (2018) argue that our needs and values are often found within these levels of knowledge.

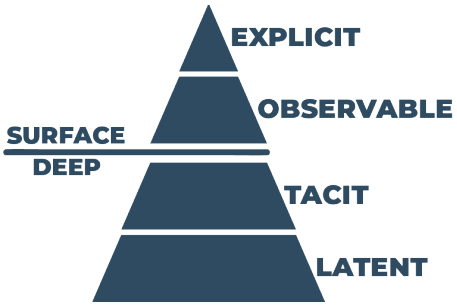


Figure 3.1: Pyramid of knowledge, adapted from Sanders & Stappers (2018)

In this master's thesis we will need to inquire into both *tacit* and *latent* knowledge as we are working with habitual behaviours, where the participant likely has little awareness of their actions, and as we will look into a future scenario, which the participant has not yet experienced. In the choice of approach and method, the knowledge we aim to find must be taken into consideration.

Apart from the dining activity being habitual it is also a subject where answers can depend on a variety of things as well as over time in the interview, according to Tellström (2015b). Questions regarding food can be discussed from the perspective of cultural values such as social status, identity or gender. Answers can reflect what the interviewee remembers or chooses to remember, or how they want it to be rather than what it actually was. To manage these factors Tellström (2015b) argues that food interviews need to be well prepared, slow and careful in their procedure if the purpose of the interview is to inquire into values. Tellström (2015b) notes that research into food and dining needs to extend interviews and that a triangulated research approach is necessary to reach a deeper understanding of values in food culture. The subject in question, dining, will dictate the choice of method in the user research as longer interviews and a triangulated approach is required to gain insights about food culture values with interviewees today.

3.2 Activity-oriented design

According to activity theory as presented by Selvefors et al. (2020) one must inspect the overarching activity of the actions people take in their everyday life to further understand why they behave in certain ways. The actions we perform are formed by the goals of the activity, and to which degree we can satisfy our needs through the activity. If we can understand why people behave in certain ways we can also design for a shift of behaviour where the overarching activity reaches the same degree of need satisfaction but is performed with actions that are for example more sustainable or energy efficient. We believe that activity oriented design would benefit this thesis as we will be looking into the dining activity and ways to implement changes in the activity that can make it more energy resilient.

Within activity-oriented design the system of interest is thought to consist of a subject, *in the dining activity this could be an individual*, an object to be acted upon, *to cook a meal*, and a mediating tool, *for example an oven or stove*, all of which contribute to achieving a satisfactory outcome within its context (Selvefors et al., 2020). This system visualisation can be broken down further into actions and operations performed to achieve sub-goals of the overall activity, see figure 3.2.

Figure 3.2: Activity-oriented Design broken down into activity, action and operation adapted from Selvefors et al. (2020)

A mapping of a current behaviour allows the designer to identify where there are mismatches between the current activity and the desired object, see figure 3.3.

We believe that activity oriented design would support the creation of an artefact that reaches the aims of this thesis as this design theory builds on implementing new artefacts into an activity to shape the activity in order to reach new objects and goals. This theory will be used to define the dining activity of today and identify mismatches with performing the activity in an energy resilient manner. It also provides us with a method to design for the future artefact and activity.

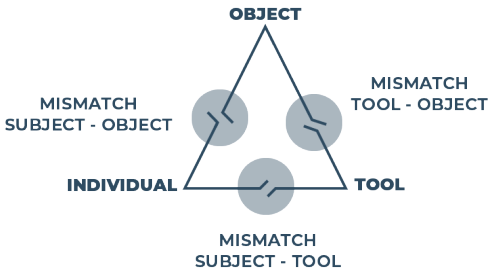


Figure 3.3: Activity-oriented Design mismatches adapted from Selvefors et al. (2020)

3.3 Critical Design

According to Dunne and Raby (n.d.) critical design can be considered as a position rather than a method, which uses speculative design proposals that can challenge the role that products play in the everyday. Critical designs critique and challenge the status quo and thus challenge a user's assumptions preconceptions. Critical design can help visualise our activities, create awareness and give rise to discussions about *the way things are*. In *What is "Critical" about Critical Design* (Bardzell & Bardzell, 2013) the authors define critical design as a research through design methodology that can help gain insights into hidden agendas, values as well as explore alternative design values. We believe that this theory will be a benefit for this thesis as we aim to inquire into habitual and automated behaviours and to challenge the preconceived notion that electricity is constantly available.

In *Critical Design and Critical Theory* (Bardzell et al., 2012) the authors consider the core of the critical design process as identifying which aspects of the current situation that is to be provoked. In the paper the process of two critical design concepts that were part of a larger project are presented. The general process of these two projects was the following:

- Identify aspect to critique
- Ideate & conceptualise
- Prototype
- User testing
- Exit interviews

The authors identified some lessons from the projects that they argue to be useful for critical design. It was found that the provocativeness of the critical design is important to assess prior to deployment with the user. They also note that a deep relationship with the participant can help the researcher in gaining insights from the participant and understanding their reactions to the critical design. Finally they note that the research plan and researchers' expectations should be flexible to move based on the reactions of the participants (Bardzell et al., 2012).

3.4 A combined research approach

In this master's thesis the choice of research approach must reflect and meet the challenges with the subject of interest and the aim. There is a need to triangulate the research approach and use complementing methods to gain deeper knowledge and understanding of the dining activity, today and in the future.

One theory that would complement the research is *critical design* which we believe will support us in gaining insights in both tacit and latent knowledge as it provides us with tools to visualise activities and discuss *the way things are* and to challenge the status quo and look into the future scenario. We believe that critical design theory will support *activity oriented design* as it visualises the activity as is but also supports us in identifying mismatches and barriers in the activity when we move towards the future scenario.

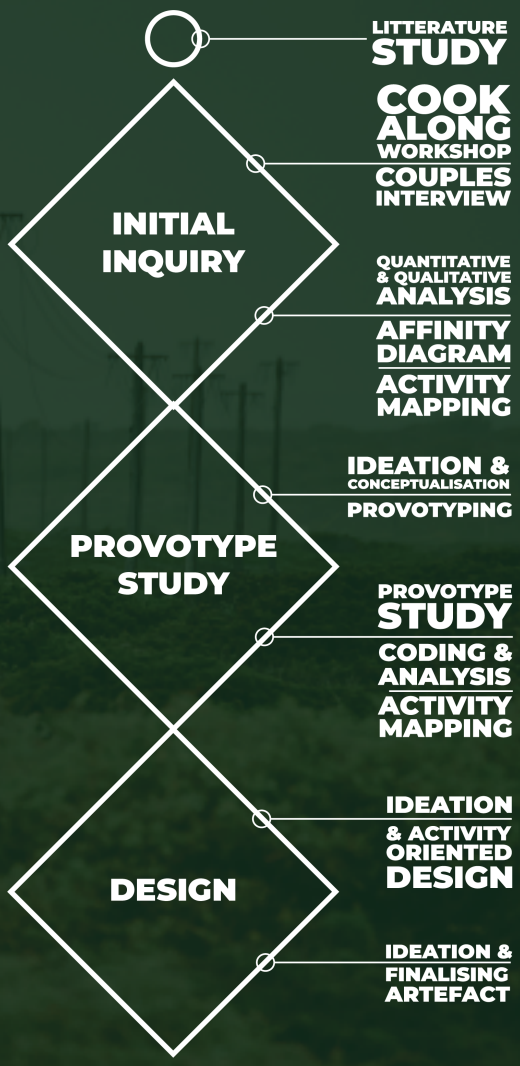
4

Process and method

In this chapter the process of the project is presented and explained. The chapter looks into both the flow of the process, and the implementation of methods as well as how they were adapted to better suit their intended purpose.

As we are looking into a subject that is habitual, and that we aim to inquire into tacit and latent knowledge, our varied choice of methods aim to triangulate the subject in order to gain a deeper understanding of the dining activity.

The project started off with initial user research aimed at identifying and understanding the activity today and its related qualities and preconditions. From this insight we applied critical design methodology to create a provotype that was distributed to users in order to explore future scenarios, attitudes, related qualities, and preconditions. Based on the insights gained from the initial inquiry and user testing an artefact was created that embodied the qualities found in the research and communicates a future scenario and meaningful dining experience.



4.1 Initial inquiry

The initial inquiry aimed to map out and gain an understanding of the experiences and activity of at-home dining. Utilising a cook-along workshop, where participants attempted cooking under future preconditions, and couples interviews as methods to gain these insights by looking into both what challenges would need to be met with the new preconditions from the Legato scenario, see section 2.1.1, and what qualities are associated with and valued in the activity today.

As the behaviours of the activity could now be mapped out we were able to identify matches and mismatches with the activity today in relation to the Legato scenario.

4.1.1 Cook-along Workshops

The intended purpose of the digital cook-along workshop was to get real-time, real-life reactions to the scenario we were inquiring into and designing for. The cook-along exposed the participants to the future scenario to some extent and allowed us to observe and gain insights about possible barriers and strategies to overcome these when cooking with a variable access to electricity.

The cook-along workshops were constructed as semi-participatory observations, a method which helps to map out what constitutes a good user experience by visualising concepts that would be difficult to mediate verbally (Wikberg Nilsson et al., 2015). The workshop had one designated observer, taking notes on any interesting strategies, comments or behaviours during the interview. It also had one facilitator, who had direct contact with the participants to keep them informed of changes in the scenario and asked questions throughout the cook-along.

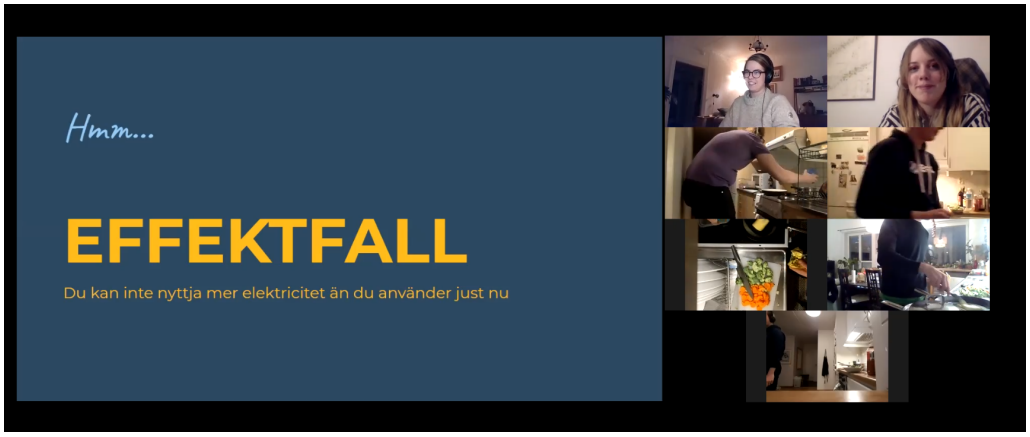


Figure 4.1: A screenshot taken during the second cook-along workshop when the participants acted out a capacity loss scenario.

Two workshops were set up with three participants in each group, according to table 4.1. The participants in the cook-along were recruited based on the target group criteria and on them being acquainted prior to the workshop, this was an important criteria as it would enhance the communication and discussion during

the workshops. The participants were given ingredients beforehand and provided with information about the time and general procedure of the workshop as well as a link to the digital meeting in which the workshop took place. They were not informed that the workshop would expose them to different energy-supply scenarios beforehand.

During the workshop the participants were asked to cook their meal in their own kitchen according to the provided recipe (chicken steak with rice and veggies) as they normally would. However they were to follow whatever instructions were given to them throughout the workshop. The participants set up one or more cameras to show their procedures as seen in figure 4.1. As the participants began cooking we interrupted them with instructions that they had a power shortage, lack of water and load deficiency for different periods, an example of this can be seen in figure 4.1. The participants acted out these scenarios and commented on their actions as well as interacted with each other, sharing their thoughts and ideas on how to handle the situation. The workshop was recorded and later transcribed.

Table 4.1: Workshop Participants

Group	Participant	Age	Cooking Experience
Group 1	G1a	21	High
	G1b	23	High
	G1c	30	Medium
Group 2	G2a	25	Medium - Low
	G2b	27	High
	G2c	26	Low

4.1.2 Couples interviews

To reach a greater understanding of the user groups relationship with food and the social practices surrounding it we interviewed eight participants, see table 4.2. The interviews were conducted online over one hour with one interviewer and two participants, who were in a relationship. Three out of four couples lived together and the fourth spent most weekends together.

Table 4.2: Couples Interview Participants

Couple	Participant	Age	Gender
Couple 1	C1a	25	M
	C1b	24	F
Couple 2	C2a	32	F
	C2b	30	F
Couple 3	C3a	26	M
	C3b	25	F
Couple 4	C4a	28	F
	C4b	28	M

With the aim of collecting more relevant data from the planned interviews a sensitising pamphlet was designed and sent out to the interview participants prior to the interview, see figure 4.2 and 4.3, for complete pamphlet see appendix A.1. The purpose of this pamphlet was twofold, gaining deeper insights from the interviews through sensitising the participants and gaining quantitative data on the topics from the interview.

To sensitise is to give a person a series of exercises which will prepare them for future activities within the user study by making them pay extra attention to something in their everyday life or spark memories of past experiences (Sleeswijk Visser et al., 2005). A sensitised participant will provide both more qualitative and quantitative contributions when participating in user study sessions which motivated the use of this method.

Figure 4.2: Pamphlet page 2

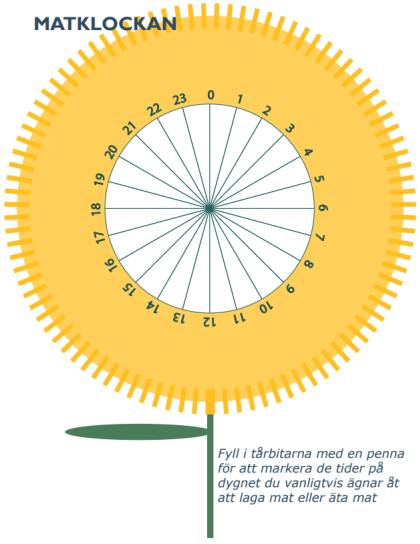


Figure 4.3: Pamphlet page 6

Within the pamphlet were several tasks related to food and energy consumption for the participants to fill out before the interviews as a means to get the participants to reflect on their behaviour prior to the interview, see appendix A.1. The tasks involved filling in different data related to their cooking or dining behaviour but also to think back on certain experiences related to energy and dining. After the interviews all participants were asked to send back their pamphlets in order to collect the quantitative data provided.

The following interviews were built up with questions focused on three different themes; *meals*, *cooking* and *energy*, see appendix A.2.1 for the complete interview guide. The process followed the basic methodology of an interview which is used to gather insights from the users in the form of self-reflections on

the interviewee's experiences, attitudes, behaviours and more (Wikberg Nilsson et al., 2018). The data collected is subjective and only on an explicit level which the interviewee can share verbally (Sanders & Stappers, 2018). The interview started with a few questions that were directly related to the sensitising pamphlet, and then moved on to deeper questions within each of the three themes. As a means to gain deeper knowledge and understanding of the participants probing techniques (Moerman, 2014) were used in the interviews, as a means to push the participant to expand on more simple answers and gain insight to deeper values and motives.

The aim of conducting the interviews with the participants together as a couple rather than alone was to get as true information as possible about the participants *actual* behaviour, as we assumed that the couples would correct each other and point out or highlight their *true* dining-related behaviours.

4.1.3 Analysis

The insights and understanding about the dining experience gained in the previous stages of the initial inquiry were mapped out as an *activity* with actions and operations following the basic structure presented in activity oriented design, as presented in 3.2. The purpose with mapping the activity was to structure the insights and gain an understanding and overview of the subjects, objects and mediating tools that affect the activity. As well as to identify underlying actions and operations and to understand the needs and goals associated with them. By mapping out the dining-activity we were also able to identify specific mismatches in the current activity with the added goal of conducting the activity in an energy resilient manner.

The data from the sensitising pamphlet was both quantitative and qualitative as it contained more objective data points as well as subjective experiences. The quantitative data was compiled and and structured into different graphs to visualise the data. Some of the quantitative data-sets was compared to the graph with electricity use in the Swedish kitchen, i.e. figure 2.1.

The transcripts from the couples interviews and cook-along were both coded separately using NVivo12. A code in qualitative data analysis is considered to be a construct which symbolises an interpreted meaning. The code is given to certain passages of the data to convey the meaning that the passage carries according to Saldaña (2013). Saldaña refers to coding as a *heuristic*, as a way to discover or an exploratory problem-solving technique that is crucial to analysis. Coding is described as a cyclical process where the data is coded and re-coded. It is often divided into *first cycle coding* and *second cycle coding*. During these phases codes can be connected and placed into larger categories that in turn can build up themes and concepts leading to a theory (Saldaña, 2013).

Our coding process contained one iteration and the results were multiple codes relating to topics on energy, meals and cooking. The codes related to the main themes of the interview questions but the overall coding process was organic where descriptive codes were identified in the material spontaneously. Each category of codes was worked through and mapped out in a mind map as an adaptation of a basic KJ-analysis using the online resource Miro.

The KJ analysis, or *Affinity Diagram* as it is also called, is a method used to analyse big amounts of data (Scupin, 1997). By sorting the data into groups with a shared theme in common the researcher can find patterns and new understandings of the data. The method is with advantage done in a group to better categorise and find patterns. In the KJ analysis the codes from the coding phase were grouped into larger categories that became main themes from which we could draw conclusions about the user groups behaviours, knowledge, qualities and attitudes. The result of this phase was an overall understanding of the topics of interest, the dining activity and energy resilience. It provided us with a basis for further inquiry and answered to the second objective of this thesis.

4.2 Research through a provotype

This phase aimed at implementing critical design and provotyping as methods to gain deeper knowledge and understanding of the dining activity in the future and its meaningful qualities. The development of the provotype build on previous insights on the activity. Ideation, conceptualisation and prototyping followed a traditional, iterative, design process. Such as the one described by Wikberg Nilsson et al. (2015) where the design process is a series of activities which are performed with the aims of reaching the goal of a project, in this case a provocative design.

The choice of methods within this phase was motivated by the opportunities that we found the methods to provide. Critical design provided us with an opportunity to challenge the status quo according to Dunne and Raby (n.d.) of the *always available electricity* in the grid as the future preconditions will be more variable and as we had found little acceptance of varying electricity. Critical design also allows us to explore alternative values according to Bardzell and Bardzell (2013) that could be found through different behaviours and activities in the dining activity. Provotypes were found to be a suitable method as it enables the use of provocation in design research. Implementing a provotype in the user testing would allow us to provoke the users current values and behaviour and visualise and support reflection on their behaviour.

Provotypes are defined as a prototype that works with provocation to visualise contradictions within a practice and explore new ways of performing said practice (Boer & Donovan, 2012). Boer and Donovan argue that provotypes provoke on three levels; in first encounters, in use, and upon reflection.

With the deployment of the provotype we aimed to gain insights and understanding of the experience through semi-structured interviews, focused on the specific interaction with the provotype but also on how they experienced taking part of the research in this way, as well as through user experience evaluations conducted over time during the user testing.

4.2.1 Ideation and Conceptualisation

This phase aimed to produce a concept for a provotype which embodied alternative qualities in the cooking- and dining experience. Based on the insights about the activity and the identified mismatches in the *initial inquiry* we ideated on a design that achieved the desired critique to the concept of *electricity always being available*.

The provotype intended to challenge the users existing behaviours and preconceptions and provoke a prioritisation in the users cooking and dining experience. Pushing the user to reflect upon their habits and behaviours as well as understand what parts of the activity are *truly valuable* to them.

In the paper by Ozkaramanli and Desmet (2016) the authors name and exemplify several related design methods focused on provoking the user. The authors argue that designing for provocation can be supported by strategies for triggering dilemmas and propose design strategies that can be utilised to trigger dilemmas as a way of provocation. Ozkaramanli and Desmet (2016) present three categories of products that can trigger dilemmas:

- Embodied Symbols
- Forced Choice
- Behaviour Barrier

Based on these categories the authors describe strategies for ideation where the designer brainstorms about symbols, possible choices and ways to alternate between choices or provide a barrier for the choice. These strategies were applied in the ideation of the provotype.

From the analysis of the initial inquiry two different ideation leads were identified, *how we choose to eat* and *what we choose to eat*. These two leads were ideated upon using a brainwriting matrix.

In brainwriting each participant write down ideas for a predetermined time period, when the time is up the participants switch papers and continue ideating on the newly received paper with a new timer going (Wikberg Nilsson et al., 2015). This switching process continues until desired amount of iterations has been achieved. The strength of this method is that all ideas are available to be modified by all participants and therefore everyone can feel a combined ownership of the final ideas.

In our adapted version the strategies for triggering dilemmas were included and each category was ideated on in a brainwriting matrix for both of the leads. The time and amount of papers were adapted to suit two participants which resulted in a total of six ideas per category and ideation lead.

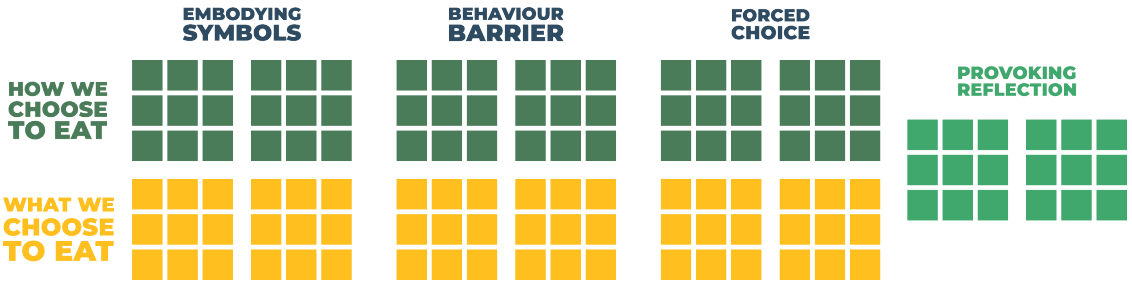


Figure 4.4: Brainwriting 6-3-5 on leads in Miro

To complement the two ideation leads we continued on with a brainwriting session where we focused on how to create a provocation that does not only provoke the user but rather creates a reflection upon ones behaviour. The objective was to make sure that there were ideas in the mix that could work as *enablers* to reflection rather than only putting up barriers to certain behaviours within the interaction.

After the brainwriting sessions the work continued by sorting through all ideas and narrowing down to 24 ideas that were found to achieve the desired provocation. These ideas were defined to the extent where all ideas were on a similar level of execution and could be compared fairly.

The final step of the provotype ideation and conceptualisation was to rank all design concepts and finally choose a concept to develop further. This was done using a Pugh Selection Matrix.

A Pugh Selection Matrix is used to rank design concepts against each other by measuring to what extent they fit a set of predetermined requirements (Wikberg Nilsson et al., 2015). Each predetermined requirement is weighted according to their importance meaning that the final score of each concept is based on which concepts fit the most important requirements.

All 24 ideas were ranked from 0 to 5 on six weighted criteria, where 0 is a criteria not fulfilled and 5 marks a well fulfilled criteria. The following criteria with corresponding weighting was used in the concept selection, see table 4.3. Three criteria were found to be especially important for the success of the concept; the prototype-ability, test-ability, and topic relevance. The concept had to provoke the specific topic and behaviour we were inquiring into and a good representation that achieved a *real product interaction* was found necessary as we wanted the product functionality and concept to provoke the users rather than its aesthetics.

Table 4.3: Pugh Selection Matrix criteria weighting and description

Weight	Criteria	Description
5	Prototype-ability	How possible is it for us to achieve a good representation that can be interacted with in the proper way?
5	Test-ability	How possible is it for our users to test and experience a "real" product interaction with the artefact?
5	Topic relevance	Does the artefact provoke the right topic and behaviour?
4	Provocability	How provocative is the artefact?
3	User relevance	How relevant is the artefact for our specific target audience?
2	Wow-factor	How excited are we about the specific concept?

Based on the ranking of each idea the ideas were sorted from the highest to the lowest and the top ten concepts were picked out for further work and selection. The ten concepts were grouped together based on the type of provocation they provided and what type of behaviour they critiqued. The three main groups provoked the user through *prioritisation* and providing information, *reminding* the user of their behaviour, and through making the user *feel the weight* of their behaviour. The concepts were discussed with the research project and a selection was made based on the scoring from the Pugh matrix and the concepts topic relevance. The chosen concept was iterated further and refined into a provotype.

The chosen idea, *Pluggen*, is a branch outlet which communicates the available electricity in the power grid to the user through a built in LED-system and hinders the user to use electricity during peak hours by turning off the outlets that are inactive.The provotype is built on a 3D-printed base, which was painted and lacquered. A LED-strip which was programmed using Arduino was mounted on the base construction. The design and construction is presented further in 5.3.1.

4.2.2 Deploying the provotype

Prior to deploying Pluggen with the actual users, a pilot study was conducted over a weekend with a four-person family. Pluggen was introduced to the family and interacted with, but the main focus of the pilot study was to control that all software was functioning as intended prior to deploying the provotype.

Four couples participated in the user study in total, and had the provotype in their home for approximately a week. All of whom were young adults living with a partner in apartment buildings in central Göteborg, Sweden. Six out of the seven participants were working from home every day or almost every day due to the current pandemic. For more data on the participants see table 4.4.

Table 4.4: Provotype study participants

Couple	Participant	Ages	Days in use	Energy Dependence
1	P1a & P1b	25 & 27	7	Moderate to high dependency
2	P2a & P2b	25 & 24	6	High dependency
3	P3	23	5	Moderate dependency
4	P4a & P4b	26 & 23	4	High dependency

The participants had varying experiences related to energy resilience. Some of the participants viewed themselves as *preppers*, that they were prepared with canned foods or batteries for possible power shortages for example, where others had little experience of being without electricity for longer periods of time. This variation of experience was found to be positive as it would provide varying experiences as the participants were assumed to have different strategies of managing the situations that they would experience in the study.

The provotypes were set up in the participants' kitchens, the provotype was placed near an existing power outlet to provide access to electricity but also near a kitchen surface where the use of kitchen appliances was assumed to be suitable, as seen in figure 4.5. Before leaving the household the provotypes were set up to the participants WiFi and tested. Together with the provotype each couple received additional material for the study in the form of a punch ticket, three plugs, and a manual. The punch ticket could be used by the participants if they chose to override the system to use more electricity, and thereby opt out of the study. The plugs represented larger kitchen appliances, such as fridge/freezer, stove, dishwasher or speaker systems that were difficult to connect to the provotype. Finally, the manual provided the participants with information about the product.

Figure 4.5: Pluggen placed out in one of the participants kitchen

4.2.2.1 Gathering data from the users

Before the participants were handed the provotype they were interviewed in a *"pre-interview"*. The interviews aimed mainly at sensitising the participants into reflecting on their own behaviours today, without revealing what the provotype was, see full interview guide in appendix A.10.1. The interviews were conducted as a semi-structured interview with one interviewer and one interviewee. The interviews took around 30 minutes and were held remotely. The interviews were later transcribed and coded to better organise the data and later be able to compare it to the forthcoming exit-interviews.

Throughout the user study the participants were also sent out another evaluation form which they filled out three times over the week of usage, spaced evenly and at different times of the day, the form can be found in A.11. The aim was to evaluate their experience over time. This was done by evaluating their emotions connected to the provotype and how they changed over time using the methods Hesselgren's Emotional Scales and Self-Assessment Manikin as a base for the evaluation form.

Hesselgren's emotional scales can be considered as a non-continuous, subjective and verbal method for evaluating emotional response (Karlsson, 2020). The method falls under the subjective feeling approaches and is an assessment focused on the conscious awareness. In the evaluation the user is asked to rate the level to which they experience each of the emotions on a scale from zero to five. The rated emotions are; *expectation, surprise, joy, sorrow, disgust, fear, anger* and *liking*.

Self-Assessment Manikin is a non-verbal method of assessing the emotional response in the shape of pleasure, arousal and dominance associated with an event or an object (Bradley & Lang, 1994). The method is non-continuous and best categorised as a method for evaluating subjective feeling as it is a self-evaluation of the users conscious experience. In the evaluation the user is asked to use a scale which is enhanced with images to mark to which degree they experience the three emotional responses, as can be seen in figures 4.6, 4.7 and 4.8.

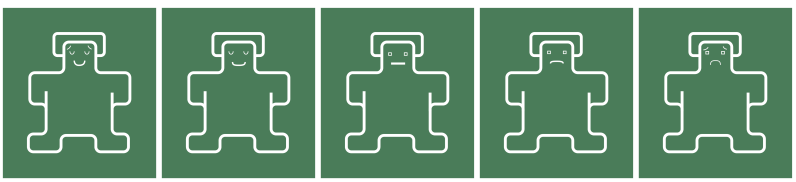


Figure 4.6: SAM valence images, adapted from Bradley & Lang (1994)

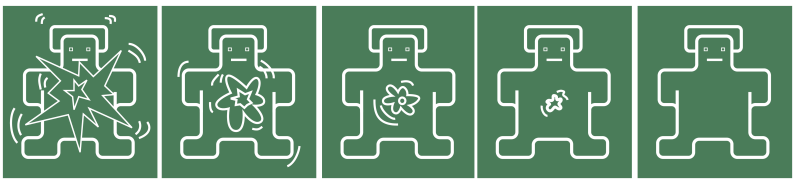


Figure 4.7: SAM arousal images, adapted from Bradley & Lang (1994)

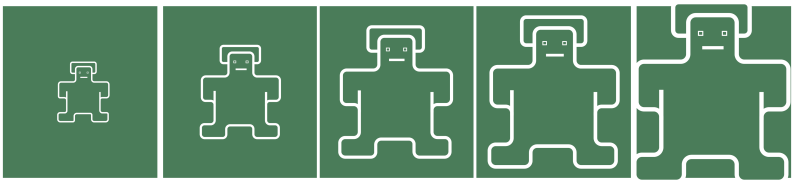


Figure 4.8: SAM dominance images, adapted from Bradley & Lang (1994)

After having used to provotype during the test period the participants were interviewed again, see full interview guide in appendix A.10.2. The aim of this *"exit-interview"* was to gain a deeper understanding of their cumulative experience over time and to identify any changes in the participants dining activity or newly adapted strategies.

4.2.3 Analysis

The data provided from the form evaluation and user experience evaluations were compiled as quantitative data. The evaluations aimed at the experience were compared with Pluggens status at the time of the evaluation as it was assumed that the availability of electricity affected the user experience.

The interviews were transcribed and coded in NVivo12 based on the principles presented by Saldaña (2013) using descriptive coding to structure the qualitative data. The introduction interviews were compared with the exit interviews for each participant to see if they had changed in the way they view their energy resilience and overall energy usage.

4.3 The final artefact

In the final stages of the master's thesis we aimed to use all insights gained in the project for the creation of a design that enables a more energy resilient dining activity, conveying the insights and the future activity, to be displayed in an exhibition as a part of the research project *Designing everyday energy resilience*.

The insights from the previous activities, which revolved around the dining activity and its related meaningful qualities, as well as barriers of resilience and resilient strategies, were summarised and defined in a mind-map to structure the insights

and define the context and preconditions we were designing for as well as the needs which the final artefact would have to meet.

With an activity oriented design approach as a basis for this phase we utilised the previously defined *dining activity of today* and the preconditions and context from the define phase as a base to envision a design that would enable a more *energy resilient* dining activity of the future. By introducing a new artefact to the dining activity of today together with the additional goal of being energy resilient we would achieve a more energy resilient activity.

The next phase of the ideation was to ideate on an artefact that would enable this change in the dining activity. This was done through an adapted session of brainwriting 6-3-5, similar to previous brainwriting activities (Wikberg Nilsson, et al. 2015). In this session we only had two participants, as opposed to six or above, three sheets with three ideas on each and five minutes to ideate. We filled out one sheet with some of the enabling ideas taken from the provotype ideation in chapter 4.2 prior to this brainwriting activity. The ideas from the brainwriting session were combined and iterated on again in order to come up with concepts that would enable a more flexible and energy resilient dining activity.

The refined ideas revolved around solutions ranging from a new type of refrigerator, stove or oven, ways of keeping the food warm, and ways of reheating the food. One shared aspect that the most enabling ideas had was that they provided the possibility to *divide the dining activity*. This main concept of dividing the activity was developed further using *activity oriented design* as an approach to design an artefact that would shape the activity and enable the user to perform their dining activity in a more energy resilient manner by dividing its actions.

The final concept was a concept aimed at keeping the food warm or cold between the three actions in the dining activity. The concept was developed further through mock-ups and CAD-software. In this phase a *user experience story* was also created to communicate the use of the artefact within the future scenario Legato.

5

Results

This chapter aims at answering the objectives of this master thesis. With a basis in the research and design work performed we will present the *dining activity today and in the future, with its associated values*. We will then present ways of *challenging the dining activity of today* and finally our proposal for *enabling energy resilient dining experiences in the future*.

5.1 The dining activity; today and in the future

One of the objectives of this master's thesis was to map out the dining activity of today and in the future. From the initial inquiry, with the cook-along workshop and couples interviews, as well as the provotype study we have been able to identify and define the dining activity of today as a meal consisting of food which is consumed within the household or with others in order to achieve a meaningful dining experience, see figure 5.1. This activity however can be broken down into smaller actions and operations, see appendix A.8 for a complete mapping of the activity.

Figure 5.1: Mapping of the dining activity of today

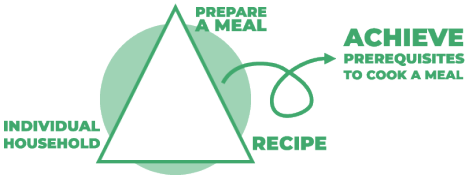


Figure 5.2: Preparing action

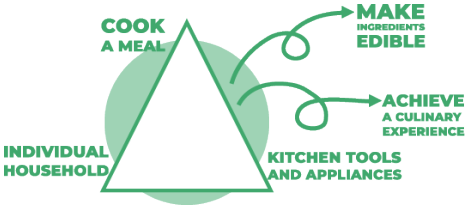


Figure 5.3: Cooking action

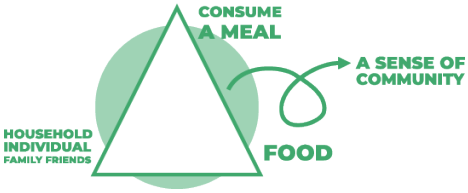


Figure 5.4: Consuming action

Within the dining activity three main actions can be identified; to prepare for a meal; to cook a meal; and to consume a meal. All of these can, in different ways, affect or be affected by an individual's energy resilience. The planning action affects the way in which we can be resilient today as the choice of recipe and ingredients influence the later stages of the activity that are more directly affected by variations in the power system. The main mismatch in this action is between the individual and their object, deciding what to cook. What we choose to cook is not always possible to cook and is dependent on the available electricity capacity at the moment the cooking activity takes place.

What we found in the cook-along as well as in the provotype study is that the cooking action today is the one that is mainly affected by variations in the power system. When there is a lack of electricity we are no longer able to perform the cooking action in the same way as it is done today while maintaining energy resilience. This is due to the activity today being dependent on constantly available electricity to be performed.

If we want to perform the same sub-actions and actions as we do today in the cooking activity, but in a more energy resilient manner, several mismatches arise, mainly between the subject and goal, but many times the tool proves to be an issue as well, see Figure 5.5. If we look closer at the activity of *heating the ingredients* we find several mismatches caused by the dependency of electricity. First is the mismatch between subject and goal, where the individuals desire to heat/cook the ingredients makes the individual less energy resilient. There is also a mismatch between the goal and mediating tool as the stove or oven of today cannot achieve the object in an energy resilient manner. Additionally, one could argue that there is a mismatch between the subject and mediating tool as the individual is not very aware of the amount of electricity used by the tool. This is due to a lack of feedback and and user control.

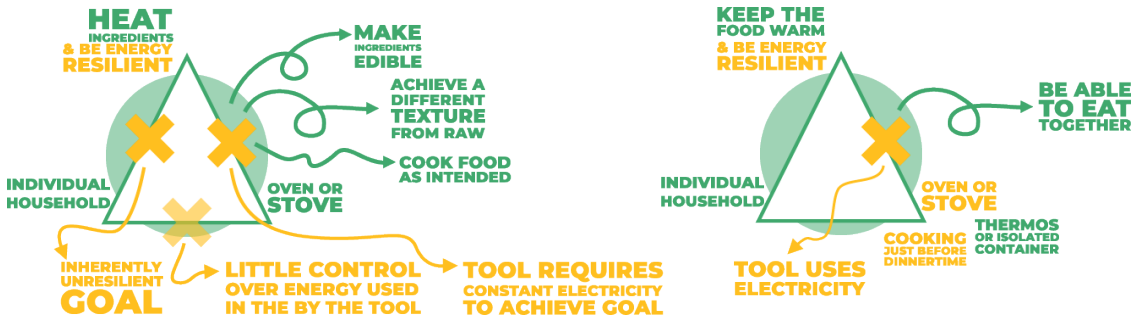


Figure 5.5: Mapping of the main sub-actions in the cooking action

In the cooking activity we can identify two additional operations that affect the energy resilience of the cooking activity today, *how the ingredients are prepared* and *keeping the food and tools warm*. How the ingredients are prepared affects the energy required in the heating process that often follows, for example a thinly sliced ingredient requires less heat for cooking than the ingredient as a whole. In the cook-along this was found to be utilised as a strategy to increase energy resilience during the cooking activity.

> "I chose to cut up the chicken to consume less energy because it is generally ineffective to fry large parts and there was a capacity decrease at the moment. It felt like a reasonable thing to do because you want to fry the chicken the whole way through and I didn't know if I would lose power again."
>
> - GS1a

> "You can put [the frying pan] in the [already warm] oven so it gets hot." [To manage capacity loss]
>
> - GS1b

5.1.1 When we eat

From the quantitative data gathered in the sensitising pamphlet we found that the participants' dining habits much confirmed what we previously expected. The participants cooking and eating habits responded well to the expected main meals of a day; breakfast, lunch, and dinner. Where the time for the dinner activity varies most, ranging from as early as 15:00 to later in the evening around 21:00, as seen in figure 5.6. The participants from this study appear to be cooking, and thus using electricity in the kitchen, at similar times as was found in Vesteberg and Kiran's (2015) more general model of energy usage in an average Swedish kitchen as presented in chapter 2.1.2, where the more energy demanding hours are found to be near dinner time.

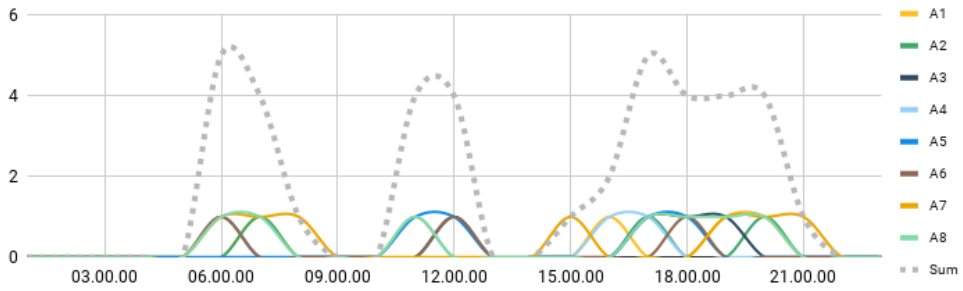


Figure 5.6: The times that we cook and eat, divided by participant

The provotype was programmed to simulate a cut the participants' electricity supply in the kitchen based on the peak hours according to Vesteberg and Kiran (2015) and the data from the initial inquiry. This was done in order to enact a realistic loss of capacity scenario. From the provotype study we then found that many of the participants quickly started to look for patterns in the available capacity and most who did identified a pattern that followed the times we usually eat. For some participants it was only natural that there would be a lot of pressure on the energy system during the peak hours that occur during our meals. And for some it was a bit surprising that they were cooking during the exact same hours as everyone else.

> "Because I knew or suspected that [there was a pattern], it is the highest pressure on the energy system when everyone uses it at those times when people are at home and cooking it increases, so it is about cooking your food when everyone else isn't. . . . I think my pattern is pretty standard. . . . I am like everyone else. *Laughs* "
>
> - P4b

> "Eeeeh, yes dear lord what we used electricity when everyone else was using it. That was the spontaneous reaction."
>
> - P1a

What we found during the provotype study was that many of the participants utilised the same strategy to manage the lack of electricity over the peak hours; *waiting it out*. So even though we have set times for eating we are able and willing to adapt the times that we eat after the availability of electricity to some extent. This type of flexibility varied a bit depending on the affected meal and the context surrounding it. Many participants found that they could quite easily make their breakfast and lunch earlier or later, the same goes for the regular morning coffee which many pushed forward to later in the morning. But sometimes the context surrounding the affected meal would not allow for this type of flexibility. One reason could be that the participant had a hectic schedule during the afternoon and deemed it necessary to eat during a specific lunch hour or else they would not have the time to eat at all until evening. Other factors affecting the ability to be flexible in terms of time could be that it suited their company to eat the meal at that specific time.

5.1.2 Managing future preconditions

The cook-along and the provotype study aimed at gaining insights in how resilient the dining activity of today is with the future preconditions. From these insights we could identify strategies for being energy resilient in the dining activity.

When looking into the strategies that were implemented by the participants in the provotype study we find two that are of interest for this study, often applied together, *adapting to new times* and *snacking*.

During the provotype study many of the participants' dinners were moved to later in the evening, and rather than changing their ingredients and recipe or the tools used in the activity the participants waited it out to gain access to enough electricity to be able to run their stove or oven. Some participants even prioritised their stove/oven above their fridge for some time in the evening to ensure that they could actually cook the food they intended to cook. We describe these behaviours as reactive strategies in which the participant waits for the problem to solve itself and employs smaller "life-lines" such as eating small snacks just to keep the hunger away and not get *hangry*.

The participants also describe a difference in urgency in certain situations. Some days the coffee could wait an hour as the activity they planned to be doing at that time did not require focus, while other days the coffee was a crucial factor in waking up and getting an effective start to the working day.

Waiting for the coffee would be the reactive strategy of waiting out the problem. Also making yourself a cup of coffee even though there was not enough capacity, thereby *opting out* from the study, can be seen as another reactive strategy. This strategy is essentially circumventing the problem the provotype gives you and would not necessarily work in a real life situation. However, it provides an understanding of a situation where the threshold of patience is reached and the strategy of waiting out is not enough.

Some of the participants ventured into the territory of proactive strategies. A proactive strategy would be a behaviour that ensures all values of a food/drink activity are maintained regardless of capacity level at that time. One example was a couple who were expecting guests and decided to start cooking earlier to make sure the food was cooked and ready before the daily drop off in capacity. They had analysed the pattern of capacity throughout the day and identified a safe zone between 13 PM and 16:30 PM. Their strategy thereby avoided the capacity drop off by gambling that the capacity would remain high enough during cooking based on the assumption that the capacity followed the identified pattern that day as well.

Another example of participants trying out proactive strategies is one participant who would cast an eye on Pluggen anytime they were in the kitchen, regardless of whether or not they had planned to cook something. This meant they could take the opportunity to use electricity to cook if they wanted. However, a problem occurs when these opportunities do not match up well enough with when they actually want or need to cook.

One strategy the participants employed in the cook-along was to shift the focus from *cooking time* to *temperature*. When the energy supply varied during the cook-along one of the more challenging tasks was to ensure that the chicken was properly cooked. In most recipes today the cooking method for most ingredients is provided in a time and oven temperature, as was the case during the cook-along. But as the energy supply varies the temperature in the oven will vary too, making time an incorrect measure for how well cooked the ingredient actually is. The participants who had an oven thermometer to use in this case appeared to be more certain of how well cooked the chicken was in comparison to those without who appeared to experience uncertainty about their cooking. One participant noted that what they required was extra time rather than more heat when their oven was turned off during the cook-along. When cooking on a lower heat than defined in the recipe the participant still felt certain that they could achieve a correctly cooked meal even without the correct oven temperature, as they were able to measure how cooked their meal was with a thermometer rather than time.

> "You don’t need temperature, you only need time" - G1b

For the cooking activity in a future with less reliable energy supply the focus during cooking needs to shift from measuring in cooking time to the actual temperature one needs to achieve. We could see that this shift in focus brings more certainty and control over the cooking activity, as in the cook-along, and this will likely be desirable in the future scenario.

One proactive strategy that the participants did not adapt to was the idea of preparing cold food. However, one household told us that they had planned to do a dish that could be served cold only to realise on the night of making the meal that it actually required toasting bread which they had not taken into account when planning. Upon realising this they were stomped for solutions without using electricity as they did not want to consume the dish without toasted bread.

> "We had a plan to make toast skagen which is really good but the toaster is a kitchen tool that requires electricity so that didn't work either! It could have been done without toasting the bread but that just isn't as good." - P4a

In conclusion, the participants were mostly reactive in their behaviour, feeling like it was worth the wait to be able to cook normally rather than implementing new, resilient behaviours. However, some participants showed proof of trying to adapt to the system over time, foreseeing problems and to a small extent trying to deflect them, thereby employing more proactive strategies. An area of interest is therefore to explore design opportunities that enable proactive strategies to handle energy deficiencies.

5.2 Important qualities; today and in the future

The dinner activity is considered to be a very important activity, as the participants waited out the low capacity during the evenings to be able to cook the meal that they had intended to cook and consume the meal together.

A dinner activity can be summarized with a number of qualities that interplay to create an satisfactory experience. From our study we can see that the qualities are prioritised in the order presented in figure 5.7. Completing the steps of the pyramid becomes increasingly difficult as they become more context dependant.

The following chapter describes the three identified qualities of the pyramid, how they interplay and how they add up to create a meaningful dining experience.

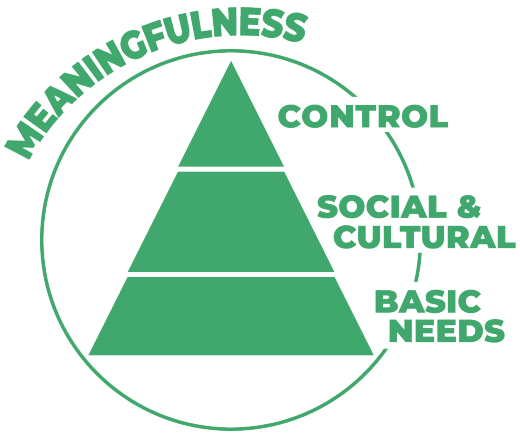
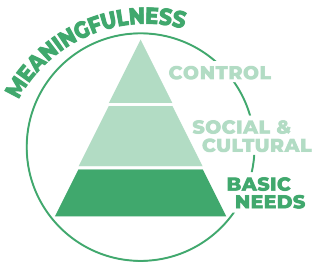


Figure 5.7: The pyramid of dining related qualities

5.2.1 Basic needs



In it's most essential part the dinner activity is something we do in order to give energy, nutrients and fluid to our bodies. We consume food that we can chew, digest and draw energy and fluid from. We can achieve this through consuming different ingredients, a portion of which require cooking in order to be consumed safely, easily and give energy. However, after having cooked an ingredient there is no need to heat it up again in order to be able to digest it, still our study found that reheating the food creates additional value.

Our participants chose to eat a warm, cooked meal for dinner, to the extent that was possible. The lunch was found to be yesterday's left-overs which were heated. Porridge for breakfast was frequently mentioned as well as some cold alternatives. In conclusion, most of the cooking activities utilised heating. From our study we identified three main qualities as to why this is; to *enable and enhance consumption*, to *temper our bodies* and to give a *higher perceived fullness*.

Enable and enhance consumption

Our participants identified the need to heat their ingredients as they regularly use ingredients that require cooking in order for it to be consumed, as well as heating's ability to enhance the flavour and texture of the ingredients. Apart from enabling us to consume the food, a warm meal is also "more of a meal" - or as one participant puts it; has more love in it.

> "Many of the ingredients we use to achieve fullness is for example red lentils or lots of beans. Beans and chickpeas can to some extent be consumed cold but red lentils needs boiling and sometimes frying"
>
> - P2a

> "It tastes better and it adds to the raw produce, many times it changes the texture and adds flavour."
>
> - P4a

To temper the body

Some participants thought that they could find equivalent ways of achieving the same result as their routines prior to the study, for example changing out the porridge cooked on the stove or in the micro to overnight oats that are prepared and placed to swell in the fridge. These participants noted in the study that some things are not consumed solely due to hunger or taste but rather to fill the need of tempering the body as this makes one feel better. As life in Sweden during springtime more often than not is cold the participants only identified the need to warm the body. One participant also said that cold food can be used to chill the body when it is warm outside.

> "I thought that it would be easier to switch out the porridge and I ate yoghurt instead and it was a bit like I want my porridge... That little warmth helps kind of, apparently you want something warm in the morning, I didn't know that so I was a bit surprised by it."
>
> - P1b

> "[The biggest challenge with the study was] to get warm food when I wanted it... Especially after having been outside, if I had been at the stables and came home cold and just feel like I want to heat my food and realise I can even heat up a cup of tea... When you're cold you want to be heated from the inside... Instead I ate something cold and pulled a blanket around me so I always managed but I just didn't get exactly what I wanted"
>
> - P1a

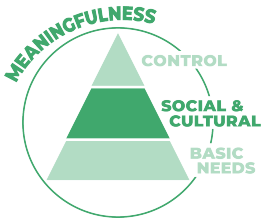
> “Mostly cooked food, it happens occasionally that we eat a sandwich or so, but then we try to include some warm element because in these cold latitudes it is nice to have warm food.”
>
> - P2b

Higher perceived fullness

A few participants were of the opinion that food needed to be warm in order to allow them to achieve fullness. Switching out the morning porridge to something cold was not perceived as equally filling and the participants foresaw the need to have an extra snack in between meals due to a substandard previous meal.

> “Well, when you don’t have access to electricity in the morning for example it was difficult when you had to brew a cup of coffee or use the stove to cook the porridge. Then you had to get away with doing other things instead to eat that don’t require that amount of electricity which is like sandwiches, cereal. ... I had to compensate for my forthcoming hunger by bringing “fika” to the office. ... Yes, that [I didn’t feel full without the porridge] is correct. I ate as much as I felt would suffice, but it didn’t keep me full for as long a time.”
>
> - P2a

5.2.2 Social and cultural values



Food provides another level of value above the basic needs, what we have chosen to call *social and cultural value*. These are part of what differentiates food from a meal and they are an important quality in the dining experience.

> "Yes... Yes food is just something that makes you full, a meal is a bit more..."
>
> -C4a

Tellström (2015a) describes food culture as a symbolic system used to connect people and the meal provides us with a social break from the everyday activities in our life, as previously stated in 2.2. In the initial inquiry we were able to identify social aspects directly related to the dining activity. We wait for others in our household to get home so that we can eat together and we use the dinner as an activity to gather around with others. Tellström also notes that food plays an important role for our culture and the way that we as people take part in it and identify through it.

Culture

As Tellström (2015a) notes food plays a big role in our culture, it is something we identify with and our food culture is at the core of what we eat, when we eat, and how we eat. From the initial inquiry we found that meals are very much a social and cultural construct, where it was described as a ritual. Many noted that the food that they eat and their relation to food is influenced by their parents and that it is part of a heritage.

> "You have a lot of ideas about food and dinner, and it comes from home" - C2b

From the initial inquiry and the provotype study we could see that food culture influenced what we eat and what we consider to be a meal and not. We found that a dish can be described as an archetype, including requirements on how the dish should be prepared, how it should look, taste and feel. How long it should take to cook, how much of it one should eat and how filling it should be. These requirements are much based on our food culture and tradition. When the archetype is not achieved, there is simply something wrong with the dish and we could see that participants in the provotype study would go to great lengths to achieve their planned dish and not some alternative.

> “We have not been able to use the stuff in the kitchen to the same extent but we have by and large just waited to get access to an outlet rather than finding new solutions. The times we have had to use something which needs electricity it’s been a specific machine, for example a food processor or similar to make soup. That means that if the dinner is soup or stew that needs mixing, it simply has to wait. It is not possible to mash a soup by hand” - P2a

It was noted by some participants that there are dishes that are supposed to be warm and other dishes that are better served cold, and there is likely a reluctance in eating something that is supposed to be warm cold or the opposite.

When the participants talked about food that is better cold they could not come up with many cold alternatives that can compare to the regular warm dinner. Most mentioned yoghurt, cold sandwiches, salad or hummus. From this we assume that warm food is at the core of the food culture of the participants involved in this study.

Social

From the initial inquiry we could find that the meal fills several functions when it comes to providing social value. Meals provide us with a *sense of community*, we use *meals as an activity* to socialise with others and even when we *eat alone* we are often doing that with others in our community around us.

> "I see it as an extremely important part of life. Food is like ... it is like togetherness. To meet people, tastes and experiences." -C2a

Eating together was a very important aspect to many participants, both in the initial inquiry and the provotype study, as this is likely due to us seeking a sense of community through our meals. In the initial inquiry many participants waited for their partner to get home before eating. Some would cook the food by themselves and then wait until their partner arrived before they ate. Many used snacks as a way of keeping their hunger at bay until their dinner together with their partner.

> "When you are cooking you want it to be one way and when you are eating you want it in another way. Maybe you want to cook alone but eat with others." - C3b

> "I would rather take that extra sandwich before so that I can await [my partner] and eat with them later." - C2a

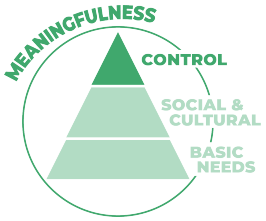
The dinner was most frequently mentioned when discussing the social aspects of meals, it was the meal where people gather to eat together and have a social exchange. But lunch and breakfast were not necessarily meals we eat alone. In a couple or larger household these meals are often consumed in company, however there is less focus on the social aspects during these meals. Many of the participants in the initial inquiry would eat together with their partner but in silence.

> "In the mornings we don't talk. It is awful to talk in the morning so we are quiet during our breakfast" - C2b

From the initial inquiry it was also found that eating in front of the TV was not unusual, either alone or with company. Tellström (2015a) found this behaviour to be a strategy of coping with eating alone, to gain a social quality from a meal where the social exchange doesn't necessarily come from the company.

> "It becomes like a thing that we cook together or alone and then we sit together and watch something on the TV" - C4a

5.2.3 Control



When asking the participants about their experience of lacking sufficient capacity to cook what they wanted it became clear that the participants experienced a mismatch between their intentions and expectations. Due to the capacity being different from what they expect, which is constant access at all times, they struggled with shifting their intentions.

The participants would walk into the kitchen with the intention of performing a cooking action and they expected it to be possible, because why would there not be electricity in their outlet? The knowledge that they can take electricity for granted means they have essentially already made the food in their head because in their mental model they can see no reason for it not to be possible. The disappointment comes when realising it is not possible to do what they intended in the manner that they intended. Had there not been an expectation of being able to perform the intended activity at all times, the disappointment would be lowered. If the resulting activity is not like you imagined, it is simply something wrong with the activity.

> “...when you have expected something or think in a certain way and it’s not possible to think that way there is an automatic frustration” - P2b

> “Now it was more that I had thought that I wanted coffee, and I had brewed the coffee in my head and then I had to brew coffee.” - P3

The problem is not that we have intentions of eating certain foods in certain ways, it is that we expect it to always be possible. Having the privilege of being able to expect there to be electricity in our outlets has eliminated the middle hand of having to evaluate whether or not our intentions are possible to achieve. People become disappointed that they can not cook because they expected to be able to do so. Had they not expected it they would have been happily surprised by a functioning power outlet.

An expectation of electricity being constantly available could be found in the couples interviews as well, where we found a general opinion that energy resilience and variable electricity supply would be a societal problem rather than something that would affect them individually.

> "I don’t think we would be so affected but I think that it would affect society" - C4a

> "That there is a vulnerability in society that you don’t think about. If you look at healthcare where the system of journals need electricity and everything that is digital. That is vulnerable if everything goes down. As an individual no, but society at large." - C3b

In city apartments we think we have the right to have electricity, however, when visiting a vacation home in the countryside we might expect lack of capacity but also do not see it as our right to have constant access. In conclusion, we create our reality with expectations about what our access to electricity should look like. When the outcome is lower access to electricity than we expected we think something is amiss.

Expectations on a meal are a driving force for actions related to it and expectations dictate the compromises people are willing to make and not. When people do change their actions and achieve a different experience that fills the same purpose the experience is incongruent in comparison to the expectations which in this case appears to have a more negative effect on the experience. When our expectations do not meet our intentions within the dining activity the user experiences this as a lack of control. Which leads us to believe that there is a need to enable the users to feel in control.

Looking forward to the future scenario of Legato, the assumption that we have constant access to electricity and be in control will not be beneficial as it will set the user up for disappointment. This highlights the importance of exploring design solutions that avoid disappointment by shifting expectations away from a constant access to electricity.

5.2.4 The most important qualities

The list of qualities vary between dining activities as different dining activities differ in goals. This means that fulfilling all qualities is increasingly difficult with growing amounts of intentions. On the one hand, a snack is consumed to combat the feeling of hunger or perhaps boredom. It might therefore only have one or a few qualities. A weekend dinner on the other hand, begins with the intention of creating additional value, such as creating a pause in the daily activities, matching the rhythm of society, achieving social interaction and so forth. Achieving fullness is often part of this activity but it is not the sole purpose of it. This being said, from the previous discussion we can extract three main qualities that were identified as important in today's dining activity. These were:

- Warm food
- Eating together
- Control

Today's dining activity qualities

Achieving the three previously mentioned qualities is essential to today's dining experience and especially achieving all of them in combination to some degree.

Having satisfied parts of these qualities is not as satisfactory as completing all of the qualities at once. This means that satisfying one quality is possible but the other qualities are still not satisfied and will need to be attended separately, which decreases the overall satisfaction. Quintessentially, the sum is greater than the qualities value alone.

The future's dining activity qualities

As food tradition goes, it is unlikely that huge changes in cuisine will have occurred by 2030. However, as the Swedish Energy Agency anticipates in their description of Legato (Swedish Energy Agency, 2016) it is likely that a higher degree of self-sufficiency will allow for other food choices. More people will have the time and interest to grow their own food. This in combination with a movement toward resource efficiency might shift potential ingredient choices toward a more plant based diet. Still, the overall food culture can be expected to include similar ideals when it comes to cooking and warm food will continue to be desirable to some extent in the near future as well.

Another aspect of the transition toward a future in lines with the Legato scenario, we can expect a shift toward a stronger sense of community (Swedish Energy Agency, 2016). People seek to find value within living a simpler life both for themselves but also as an act of solidarity for people around the world. Engaging in non-profit associations, hobbies and societal development is much more common, as well as spending quality time with friends and family (Swedish Energy Agency, 2016). This description predict the continued value of eating together in the future and highlights the importance of sustaining the ability to gather around the dining activity no matter electrical capacity at the time.

Lastly, the future scenario Legato explains that people are likely to have a more flexible attitude in general (Swedish Energy Agency, 2016). The expectations that power is variable rather than constant will be more commonly accepted. We expect that this shift in attitudes will have a positive effect on the general public's acceptance of adapting to more flexible and proactive strategies in their dining activity. Our expectations on what a *real meal* is and can be in the future will not necessarily change but as there is a will to be more flexible and energy resilient in this future scenario we expect that there will be an increased desire to adapt the way our dining activity is performed.

In conclusion, the previously mentioned qualities; warm food, eating together, and control, will be sought-after in the future as well, although to varying degrees and with other underlying reasons. Therefore the need to provide all of these qualities in the dining activity is essential, even in a future with less reliant capacity.

5.3 Challenging the dining experience of today

One of the objectives of this master's thesis was to challenge the dining experience of today, this was done through a critical design provotype. The provotype challenged the users' preconceptions of always available electricity and the participants in the provotype study were able to, through the provotype, try out strategies of managing a dining activity with the Legato preconditions.

5.3.1 Pluggen

The provotype *Pluggen* was produced as a result of previous ideation activities. Pluggen is a smart, interactive branch outlet that communicates available energy capacity in the local electricity grid to the user. As the capacity varies the user is prohibited to use more electricity than available.

Pluggen is designed to provoke the users' assumed preconceptions of continuously available electricity and to challenge the users into adapting new actions - *strategies* - that make their activity more energy-resilient. Pluggen should be viewed as a research tool designed to spark discussion and critique on this activity rather than a consumer product.

The Provocation

According to Conceptual Provocation in Research Through Design (Raptis et al., 2017) a functional provocation is facilitated by imposing a dilemma to the user. A provocative dilemma could be triggered by embodying symbols, forcing the user to make a choice or through a behavioural barrier as seen in the texts by Ozkaramanli and Desmet (2016) as well as Raptis et al. (2017) Pluggen was designed to trigger the user using all of the methods above to some extent.

Pluggen is designed according to the archetype of most branch outlets and can be considered as a symbol for available electricity in the eye of the user. The LED that is incorporated in the branch outlet symbolises the availability of electricity as it varies over time to communicate a variability in the energy system to the user.

Forced choice is implemented in the interactions with Pluggen where the user is confined to four or fewer available power outlets and is therefore forced to prioritise their electricity needs in relation to their meals and cooking activity as they cannot use more than what is available. As the available electricity varies over time the user will be forced to choose between mutually exclusive actions and different tools in their cooking activity. The user is required to actively make a choice of what objects in their kitchen and the cooking environment will be given electricity and not.

Finally Pluggen triggers dilemmas for the user through the principle of behaviour barriers through the varying electricity provided to the user in Pluggen. Throughout the day the available electricity will vary and this becomes a behaviour barrier as the lack of electricity in the branch outlet stops the automated or habitual behaviour that the user may have. The interactions with Pluggen will likely be provocative because of the barrier it poses to the user as they can no longer carry on as usual. Hopefully this will also have a reflective effect on the user as they may become more aware of their habits in regards to energy use as well as gain new strategies to become more energy resilient as they are forced to act outside of their usual comfort.

Pluggen uses conceptual and functional provocation, as described in the paper by Raptis et al.(2017), to provoke the user. The key for the provocation lies mainly in how it stops the user in their automated behaviour and forces the user to make an active decision on what is to be prioritised in their dining activity. Our hope is that the active prioritisation will cause the user to reflect on what is valuable for them and what strategies they can adapt to as a step to become more energy resilient. The provotype allowed us to expose the users to a future scenario and gain insights and understanding of what barriers need to be met in the future scenario and what qualities would be important to support.

Creating Pluggen

Pluggen consists of a smart branch outlet placed inside a 3D-printed shell in three pieces (5.8). The shell is 3D-printed in PLA and treated with spray paint and lacquer to achieve a glossy and light green finish. Apart from the branch outlet the shell also contains LED and hardware.

Figure 5.8: The components of Pluggen; Pluggen turned off and Pluggen lit

The LED's in Pluggen are individually controllable RGB LED's with approximately 144 LED's/m. The hardware in Pluggen consists of a Pro Micro Atmega 32U4 (5V and 16 MHz) and a real time clock (RTC). These components are connected with each other and with the LED's using a 47 kΩ resistor and copper wires that have been soldered together with the LED's. Details about how the hardware is connected can be found in appendix A.6.

The micro-controller is programmed in Arduino and controls the LEDs as they vary over time. The variations were predefined based on data on energy usage in the average Swedish kitchen and cooking times found in the couple's interview. The smart branch outlet was controlled wirelessly using an app for scheduling each of the power outlets individually following the same schedule as the LED's.

Together with Pluggen additional material was created to be sent out as a part of the provotype study; one manual, one punch ticket which the participants could use to opt out of the study, and three plugs that could be used as an alternative for larger appliances that the participants would not be able to plug in to Pluggen, see appendix A.4.

Figure 5.9: Pluggen with additional material

5.3.2 Experiencing Pluggen

When describing their experience with Pluggen many of the participants expressed a feeling of *being controlled*, either explicitly or implicitly in the way they described their interactions.

> "What I feel for it, oh this is so hard.. For me it conveys that it has control and I don't." -P4b

> "Other than that it is made to control your life you know." -P1b

Throughout the provotype study the participants evaluated their experience using SAM, for extensive results see appendix A.7. There was no apparent pattern in how they evaluated their experience over time or by the available capacity. However, we can see that there is a great variation between how the participants rated their experience as it comes to their experienced control during the study. As can be seen in figure 5.10 three participants found themselves in control as opposed to the other four who found themselves controlled. This overlapped with participants who implicitly and explicitly expressed a feeling of being controlled by Pluggen.

Those who did not use the word *control* directly when describing Pluggen described their interactions with a focus on Pluggen *allowing them to use electricity* or *telling them when they could cook or not*. We have interpreted this as an implicit expression of experienced control. The participants all expressed some kind of dependency of Pluggen even though all did not directly feel controlled by it, this experience is likely caused by Pluggens function of withholding a vital resource from the participants. This experience was anticipated as Pluggen is designed after critical design principles like *behaviour barrier* and the barrier provided by Pluggen was in all cases experienced as Pluggen being in control of when the participant could use electricity or not. This was a desired effect as it made the user aware of their behaviours, dependencies and overall use of electricity through hindering their subconscious and automated behaviour.

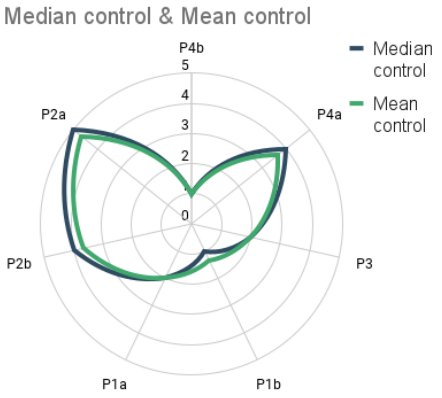


Figure 5.10: Experienced control with each participant. 5 represents being in control and 1 being controlled.

From the exit interview we could see that participants made a connection between the available electricity and electricity demand in society at large. As can be seen in the quotes below many participants reflected on not only the connection between demand and what electricity was available to them but also on the reason behind it. Drawing conclusions that their dining habits followed a similar pattern to the rest of society.

> "[The provotype has communicated] if the electricity grid has a high load or not. . . . I guess that it's my routines, breakfast, lunch and dinner are like the rest of Sweden that is when most electricity is used." - P4b

> "Eh, well, I seem to be cooking at the same time as everyone else. *laughs*" - P4a

> "More than that it has been a bit annoying I have realised how much we follow the stream, because it shows which times it peaks and so and you had to adapt to it." - P2b

One interesting attitude towards Pluggen and the overall experience of the study was that it was viewed as a game or a competition, something you could cheat on or lose. The design of the material in the provotype study may have reinforced this experience even further as the participants were all provided the possibility to opt out from the study in the form of the punch ticket, where they tore off a piece every time they used more electricity than provided from Pluggen.

> "You wanted to avoid [using the punch ticket] at any cost, as one is competition-oriented, you can't do that! Then you have failed, it doesn't feel good to tear one off, it eats up the planet, it was illustrative!" -P4b

> "[Using the punch ticket] felt like cheating, it did. And I am very competitive so I felt like "damn it", but it also made you think one extra time and we waited into the last minute." -P2a

Additionally we found that the participants who unplugged their refrigerator experienced similar feelings as the ones who used the punch ticket, they felt a bit like they had tricked the system and found a way out. Part of the reason behind the participants viewing this as cheating was due to them thinking that we the writers wanted to look at something else and that they would ruin the results of the study by doing this. However it was the participants themselves that designated the first outlet to the fridge, likely because providing electricity to the fridge was a, conscious or subconscious, priority for them. Their choice of unplugging the fridge when the capacity was low and they felt a need to cook their food further highlighted the importance of a cooked, warm meal as they made a choice to prioritise their stove over the fridge during this short period of time. This specific prioritisation was something we could not foresee prior to the provotype study, however it was something we were hoping for as the provotype employs *forced choice* as a method to provoke the users forced the participants to choose between kitchen appliances to use by limiting the available outlets.

> "We did a, I don't know if it is cheating, but we thought that... We maybe have a few more pieces to tear, but we thought that we have the outlet for the fridge so what we did was that we took out all ingredients from the fridge and then kept it closed and plugged it out so it stays cold for long enough and yeah a fridge can stand by for quite a while, to be able to use and switch between the stove and oven." -P4b

From this competitive attitude we gather that the participants were quite keen on trying Pluggen out and all were very positive about taking part and helping out with conducting the study. The choice of method and how it was applied was useful for gaining an understanding of the automated behaviours within people when it comes to the dining activity and it allowed us to visualise many expectations that people have when it comes to dining and electricity. We were also able to gain insights in what is important in the kitchen, and during what times, by forcing the participants to prioritise their kitchen tools and making a more conscious choice.

5.4 Enabling energy resilient dining in the future

The following chapter presents the final artefact and overall concept of creating a more energy resilient dining experience in the future scenario Legato. The final artefact is a product that embodies the identified qualities related to the meaningful dining activity of today and conveys the energy resilience strategy of being *proactive*.

5.4.1 Preconditions of the future scenario

When looking beyond the technical preconditions of the variable energy system presented in the future scenario Legato, see 2.1.1, we can identify several social or lifestyle values that become important preconditions for enabling energy resilient dining experiences in the future scenario. In the design of an artefact that enables energy resilient dining at home the following preconditions have been taken into consideration.

In the Legato scenario urbanisation has come to a halt, and an increased amount of people are working more locally and at shortened work hours (Swedish Energy Agency, 2016). As people are working fewer hours and closer to their homes we assume that this allows for an increased flexibility in time. From the initial inquiry and the provotype study we found that the working hours influence the times that we eat to some degree and a decrease in working hours could possibly impact the times we eat. This part of the Legato scenario appears quite similar to the working situation during the COVID-19 pandemic. We found that many participants in the provotype study who were working from home adopted some level of opportunism in their everyday regarding their energy usage, perhaps a similar behaviour would arise under the preconditions in the Legato scenario.

The scenario notes a shift in values, where ecologic sustainability is in focus and there is an increased interest from the public in this matter (Swedish Energy Agency, 2016). This change in values could have an impact on what we eat. Perhaps these changes would lead to an increase in vegetarian or vegan diets which in turn affects the shelf life of the ingredients as well as the cooking time required.

Finally the scenario exemplifies an increased demand side flexibility where people are willing to adapt their use of electricity to what is available. In the scenario this flexibility is portrayed with an example where an app is used to prioritise household equipment and to control the overall energy usage in the home (Swedish Energy Agency, 2016). Based on this we assume that there is some level of willingness to adapt to the electricity supply and that there are solutions that provide people with awareness of the available supply.

5.4.2 Enabling proactive strategies

From the initial inquiry and the provotype study it was found that the times we eat today are deeply rooted in our habits and way of life. The participants in the provotype study were able to adapt to different dining times in the study but this strategy had a negative impact on the perceived quality of the dining experience.

One strategy that enables an energy resilient dining experience that maintains the most important qualities for the user is being *proactive*. In the provotype study it was found that some participants did adapt their activity using these types of strategies but today there is little support for being proactive when it comes to the dining activity. Today the activity is performed seamlessly, see top part of figure 5.11 when all preconditions are met for the different actions; when there is *time*, when there is *electricity*, and when *everyone is home*.

In order to support this activity in a more variable power grid the user needs to be supported in performing the actions when the specific preconditions are met. If the actions of the dining activity can be split up and performed separately the user is no longer dependent on all preconditions to be met during the time they want to eat, see lower part of figure 5.11. For the future dining activity we suggest that a storage-action is incorporated into the activity to allow the user to prepare their food when there is *time*, to cook the food when there is *electricity*, and to eat when *everyone is home*. In providing an artefact that enables a seamless flow between these actions with proper storage that keeps the food at the desired temperature the user is enabled to perform the dining activity in a more energy resilient manner.

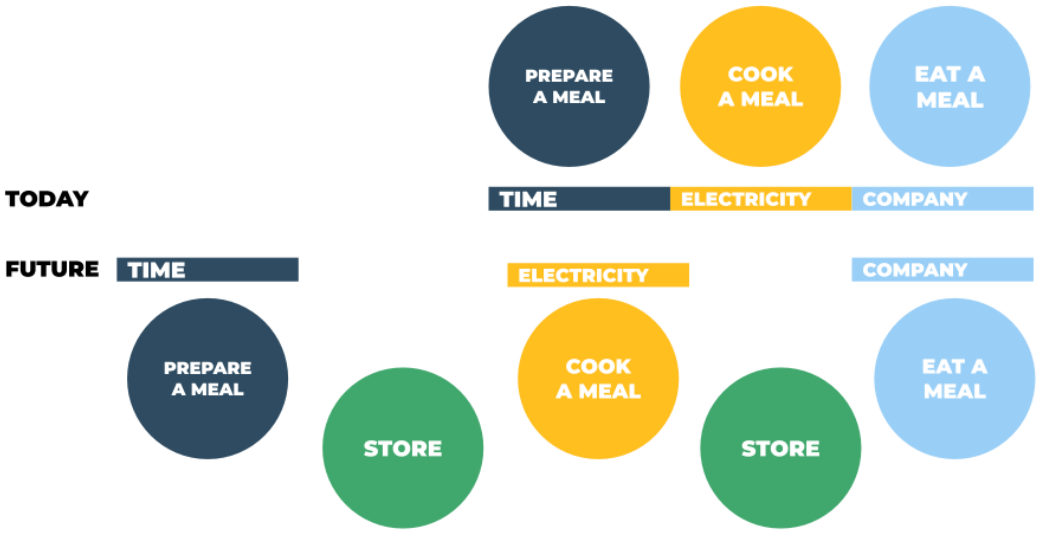


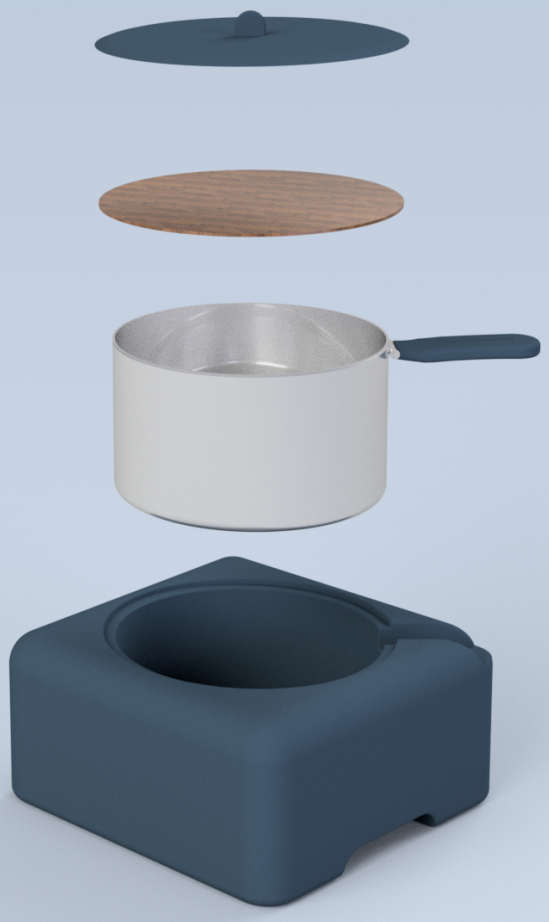
Figure 5.11: The dining activity today and in the future

5.4.3 The future artefact

The final artefact Thermo was produced through ideation activities based on the results from the Initial Inquiry and the provotype study with Pluggen. Thermo is a tool that facilitates the user in splitting their dining activity into three separate activities. It does this by providing effective storing possibilities of either cold or warm contents as well as a thermometer for temperature evaluation. The tool will allow the user to plan and execute their meals with a satisfactory result no matter the electrical capacity at the time, making sure all important qualities of the dining activity are met, albeit not through the exact same procedure and thereby creating more resilience to variability in the energy system. This final artefact aims to communicate a new way of living in the future scenario Legato. It is created as a tool to create discussion about how energy resilience may take shape and is not necessarily a future consumer product in and of itself.

5.4.3.1 Parts

Thermo consists of the five parts listed from top to bottom.



Cutting board The circular cutting board features a surface for preparing ingredients as well as a threaded groove which fits the pot and allows the cutting board to be used as a lid.

Pot The pot works just as any other pot, pan or oven pan and can be used accordingly. Additionally, it features a threaded top which allows the cutting board lid to be attached and enables storing of prepared ingredients in the fridge. The foldable handle allows the pot to be "handle-free" when needed, for example when stowing it in the fridge or using it as an oven pan.

Foldable handle The foldable handle features a silicone coating and a metal hook which connects to a fitting loop on the pot and thereby allows heat-free handling of the pot. Within the handle's metal hook is a thermometer which reads the temperature within the pot and displays it on the top of the handle. The thermometer can be utilised both during warm or cold storage as well as during cooking.

Thermos container The square base is constructed as a thermos with an outer layer of silicone, a circular slot in its center where the pot part fits as well as a slot which fits the handle if it is attached to the pot. The thermos container includes a thermos lid to be used to further insulate the heat.

5.4.3.2 Usage

The product is utilised by using the cutting board to prepare ingredients upon. The ingredients can then be placed in the pot and the cutting board is used as a lid that is screwed on the metal pot. It may now be used as a storage container for prepared food in the fridge or outside if the temperature is appropriate until it's a good time to cook it, see figure 5.12. The user can monitor the temperature on the foldable handle which now is folded down to provide more efficient storing. To cook the food the lid is taken off and the metal pot can be placed in the oven or on the stove using the foldable handle, see figure 5.13. When the food has been properly cooked the metal pot is placed in the thermos container, see figure 5.14 and 5.15. With the thermos lid on the pot can be kept warm on the kitchen counter or table until it is time to eat, while allowing the user to monitor the temperature, see figure 5.16 and 5.17.

Figure 5.12: Stored in fridge

Figure 5.13: Thermo's pot on stove

Figure 5.14: Placed in thermos container

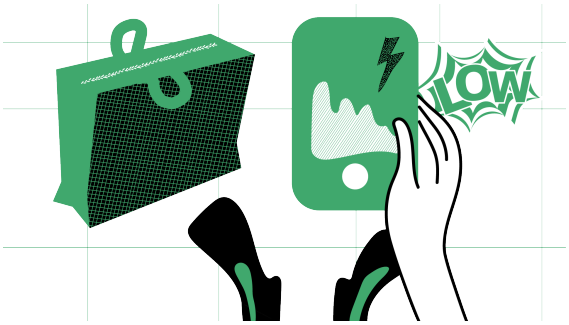
Figure 5.15: In thermos container with lid

Figure 5.16: Stored on kitchen counter

Figure 5.17: Stored on kitchen table

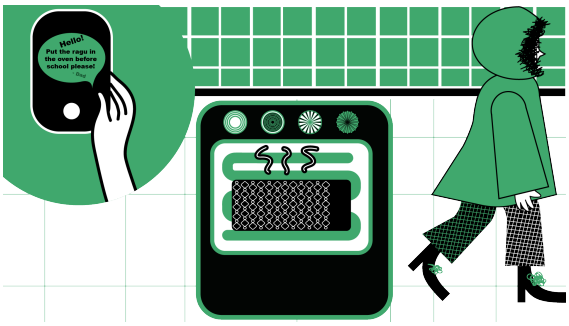
5.4.4 An everyday in the future

The following user experience story visualises what it could be like to use Thermo in a future everyday setting in the home of a family of three.

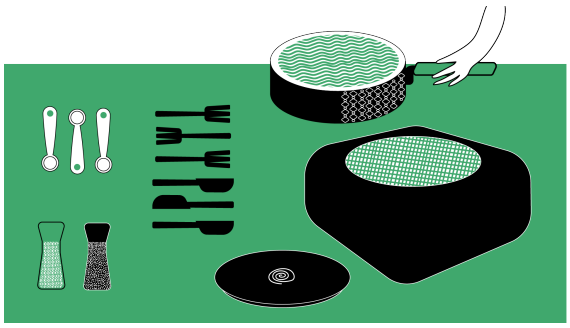


It is a Tuesday afternoon in January and Mikael just got home from the local food store. The weather is pretty mild now but the weather prognosis is expecting colder temperatures and snowfall later in the week. Mikael and his family keep dried foods at home to decrease their need to shop often, but they were in need of some fresh produce for the week. His daughter had wished that they would make her favourite stew for dinner and Mikael hopes that they will be able to cook it without any issues, but he knows that they likely need to adapt to the variable energy this time of year.

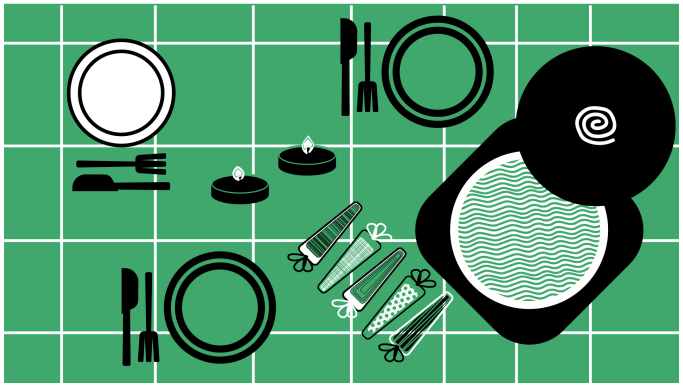
Mikael is greeted by Amanda and Milou at the door. Together the family prepares the stew as far as they can at the moment, later in the week when the energy is expected to be more variable the stew will prove to be a warming and tasty meal. Mikael is happy that the family can prepare the meal together. They chop up the vegetables and place them in the Thermo together with the other ingredients and some broth and spices. The ingredients are still quite cold so Mikael puts the lid on and places the Thermo out on the balcony. He knows that the food will be safe with the lid on and since it is quite cold it will stay fresh until it is time to cook, and if the weather changes he can always use the built in thermometer to monitor the temperature.



A day later as Milou is preparing to go to school a text from Mikael pops up on the screen with instructions to place the stew in the oven before school. The capacity is expected to decrease later in the afternoon so Mikael takes the opportunity to cook their meal earlier than expected. Milou happily places the stew in the oven and turns it on and then leaves for school. Just after lunch a notice appears on Mikaels phone, the capacity is decreasing and he turns off the stove and all other electricity used in their apartment through an app.



As Amanda walks through the door she is welcomed with a warm and homely smell of stew. The oven appears to have been turned off for a while now but the thermometer shows that the contents are still warm and the stew appears to be cooking along. There are still a few hours until dinner and the electricity will likely not be back until even later. But Amanda has a few tricks up her sleeves, she places a few rolls of tagliatelle in the still very hot stew so that the tagliatelle is cooked by dinnertime. She stirs the pot before moving it to the silicone mold that can isolate it and keep it warm until all of the family are home.



At dinnertime the family prepares some salad in the candlelit kitchen, together they plate the dinner table and get ready to eat their dinner together. Milou is excited to eat dinner as the stew is a favourite dish but also because she helped cook the dinner. On the thermometer they can see that the temperature of the stew has dropped a few degrees, but its still at a safe temperature. As they lift the lid of the pot steam rises and they are all happy to have a hot meal to warm them after a cold day in January.

6

Discussion

This chapter aims at discussing the thesis from two perspectives, the first from the viewpoint of the findings and the second on the most important methods applied.

The thesis is built around a scenario, Legato, where the energy system is less reliable than currently and the research project which this thesis is a part of focuses on design for energy resilience in the everyday.

This master's thesis set out to map the dining activity of today, find what qualities make a dining activity meaningful, and finally to challenge the activity of today in order to find ways of enabling a more energy resilient and meaningful dining activity in the future. Here follows a discussion on the main findings, their implications on the thesis and relevance for the research community. Limitations and challenges of the research approach and analysis are met and recommendations for future work within this as well as similar projects.

6.1 Bringing meaningful dining into the future

From the user research of this master's thesis we have found that a meaningful dining activity consists of three main actions; prepare, cook, and consume. These actions are occurring for most meals and can be considered to be a habitual behaviour. The identification of the activity answers to one of the objectives within this master's thesis. The mapping of the dining activity plays an important role for achieving the final objective to ideate and explore ways to enable an energy resilient and meaningful dining activity.

From this finding we could not only conclude what people do but also why people do what they do. The reason behind why people do the actions within the activity correspond to the qualities people seek to achieve through the activity. We found these qualities to be; *basic needs*, *social and cultural values* and *control*. The qualities people seek to achieve in their dining experience corresponds to the objective of identifying important qualities for a meaningful dining activity.

In the user research conducted it was found that people have mental models of what their meals are and should be. These are believed to be shaped by food culture and and social values. These mental models influence our intentions with the dining activity as well as our expectations of it. When the meal, and overall dining activity, does not fit the mental model we intended it to the expectations of the activity have not been met and this creates a less meaningful dining experience.

For our master's thesis this means that providing the user with control over the activity, to meet the expectations set by mental models, is what creates a meaningful dining experience. We as designers need to design around the users' expectations, rather than move away from the values they fulfill.

One expectation we thought to be connected to the dining activity was *when* the activity should take place. However, in the provotype study we found that there is flexibility in *when* the actions within the dining activity should be performed while there is little flexibility in adapting mental models about *how* each action is performed and what it results in. We were pleasantly surprised that time was a flexible factor within the activity as the initial user studies had suggested that the exact time of the dining activity was important, as it would allow people to eat together. As we saw that the user study participants in the provotype study cared less about when their dining activity took place than how and with whom we identified the opportunity to design for enabling a shift in the activity's timeline.

This finding meant that the dining activity of the future can be more flexible in *when* it is performed rather than *how* it is performed, as changing *how* would mean that the three identified important qualities of today; basic needs, social and cultural values and control, can not be achieved to the same extent. These findings led to the final results of this master's thesis *Thermo*, which is an artefact designed to communicate these important qualities in the dining activity and enable flexibility in *when* the dining activity is performed, which in turn enables a more energy resilient and meaningful dining activity.

An alternative to our approach would be designing for enabling and supporting a change in the important qualities themselves. However, Tellström (2015a) highlight the importance of meals as they are today, an organised behaviour that is repeated throughout the day. In order for us to actually eat the food we need social gathering where we take a break, sit down and eat. Tellström (2015a) also argues that the food we eat can be closely related to our childhood and bring back fond memories from the past. This nostalgia is what carries the local food tradition forward (Tellström, 2015a) which relates to the important quality found in this thesis of *social and cultural values*. By gathering around food we recognise, with people we love the meal becomes more valuable. The food on our plate shows our culture, values and opinions both to ourselves and others; it becomes a social marker. From Tellström (2015a) we therefore gather that keeping the qualities of today is essential in order to allow the dining activity to remain the meaningful ritual that it is for people. This is why we believe that the choice of shifting the activity in time as a strategy is less disturbing and more accepted than changing how the activity's individual actions are performed. Furthermore, we found that the shift in time is supported by the predicted scenario Legato (Swedish Energy Agency, 2016) as people are assumed to spend less time working and more time at home.

Another factor affecting our chosen approach of changing the timeline of the dining activity and its outcomes is whether or not the qualities we identified actually are the most *important* or *all* of the qualities, or indeed even the *correct* qualities. Inquiries into dining are considered to be abstract as the participants answers are influenced by a variety of factors (Tellström, 2015b) which makes us question the relevance of the important qualities in dining that we found. In answer to this we argue that the applied research approach of triangulating between many different research methods supported us in finding relevant results. Triangulating methods allowed us to identify recurring qualities in the studies and we believe that the presented qualities are relevant. However, they are most likely not all encompassing as it would require further studies to truly uncover all qualities of a dining activity. Whether or not the important qualities for a meaningful dining experience apply has implications for the design and relevance of Thermo. If the found qualities do not apply and the final design is based on this finding we will not have met the objectives of identifying important qualities and enabling a meaningful and energy resilient dining activity. But due to the chosen approach we argue that these objectives are met.

A limitation with the design of Thermo is that our focus has been to shift the norms of how the dining activity is performed in regards to its timeline but that no inquiries have been made into how this design solution affects other norms. This means that this thesis can only answer for some of the effects that Thermo will bring with it into the future dining activity. From Selvefors et al. (2020) we find that the introduction of a new artefact into a current activity will influence and change the activity but as we have not looked further into what the shift in activity timeline actually means for the future users this could be an interesting area for further work. The intent with Thermo is to push the start time of the activity back several hours. We believe that this can lead to new everyday routines where users take breaks to prepare food, cook and handle storing throughout the day. We find it interesting to reflect on what this would mean for the division of labour within a household or how it will affect what food we choose to eat as the current work has not ventured into these areas.

For further research actually testing Thermo would be one interesting approach to gain insights into its effect on the dining activity of today - does it truly change the activity and enable energy resilient and meaningful dining which fulfills the same qualities as today? What other changes does it bring? As the purpose is creating discussion around the subject rather than solving a problem, testing of the concept was excluded. If we truly are moving towards a reality close to Legato implementing Thermo will be more relevant as it could pose as a solution. Testing would be necessary to establish whether or not Thermo achieves a shift in the timeline while maintaining the important qualities of today.

6.2 Methods to identify future needs

We found that in the first meetings with the user study participants throughout all studies in this master's thesis many confused *energy resilience* with *lower energy usage*. There was little knowledge about what energy resilience is and what variable energy supply could be. Another aspect that came up when discussing the concept of energy resilience with participants in the couple's interview was that many found energy resilience as an issue for society rather than on an individual level. Participants exemplified energy issues in society but had few ideas on how a variable energy system could affect them in their everyday life.

The confusion between *energy resilience* and *lower energy usage* is believed to be caused by the current general discussion on sustainability and energy systems where *lower energy usage* is the currently accepted view on what sustainable energy consumption is. Our findings also lead us to assume that the general knowledge regarding energy supply and potential energy futures is quite low and that this poses a potential barrier when inquiring into the topic of energy resilience and variable energy supply with a human centered perspective.

We believe that it is important to be aware of the general public's knowledge of the subject in question in order to bridge this gap of knowledge and be able to communicate it effectively. If we can not communicate the subject which we are researching to the participants correctly, the performed research risks losing relevance to the subject. As the energy future we have inquired into is just that, *a future scenario*, it is of even more importance that the subject is communicated properly to the participants in order to gain insights into their future needs.

We found that the use of a critical design provotype and enactment methods enabled us to communicate the concept of energy resilience and variable energy supply more effectively to the participant. One important example of this is how the participants' insights and intended strategies varied before and after the provotype study was conducted. This variation was anticipated to some extent as we expected there to be a difference between discussing potential strategies to manage a hypothetical scenario and enacting the scenario, experiencing it first hand.

By immersing the participants into the future scenario and by breaking the status quo, which was done through the provotype, we were able to visualise their habitual behaviour, make them aware of their actions and find what was truly important for them in a meaningful dining activity. We believe that the use of the provotype led to a deeper knowledge and understanding about the users needs in a future that they had not yet fully experienced. We could see both an increased understanding of the general concept as well as a deeper understanding of the impacts a variable energy system would have on their everyday life.

Apart from the fact that a critical design provotype fulfilled the objective of *challenging the dining activity of today* by confronting the participants with their current need for always available electricity we conclude that the methods enable us as designers to discuss and explore needs within a future scenario, in this case an energy future with variable energy supply, and to truly communicate the research subject to the study participants.

One aspect that we had to consider in the analysis of the provotype study results was that the difference between the intro interview and exit interview may not necessarily be caused by the provotype. One explanation could be that the participants simply got more time to reflect between the intro and exit interview and that the first interview sensitised them and caused the additional reflection found in the exit interview. Another explanation could be that the manual in combination with how we introduced the provotype to the participants provided enough information for the participants to reflect on energy resilience in their everyday life. However, we were cautious with revealing too much information, if any, about the purpose or functionality of the provotype when deploying it and as most of the insights and discussions in the exit interview revolved around the provotypes functionality and purpose, as well as the participants experiences with it, we consider the provotype to be the main cause of the increased understanding and reflection.

In previous reports such as the ones by the Swedish energy agency (2016) and the Swedish energy markets inspectorate (2017) we find that variable energy supply and demand side flexibility are terms that are not uncommon within the area of energy. However, findings in this master's thesis lead us to believe that the subjects are less common within the general public. The article *User-centered Images of the Future Energy Transition* (KTH, 2017) support this finding. The project aimed at understanding peoples expectations on future energy scenarios and their role in an energy transitions, their empirical findings show that their respondents had difficulties envisioning the energy future or that the time frame of what participants communicated was quite short. In the article the writers find that there is a need to better form the possible energy futures and connect them to the everyday life in order to increase engagement from the general public, a statement which we agree with and we believe that one way of communicating future energy scenarios in the everyday is through critical design provotypes and enactments.

There is previous research that suggests that needs and values are more abstract and that this type of knowledge, more specifically tacit and latent knowledge, is difficult to discuss with users (Sanders & Stappers, 2018). This could be part of the reason why the participants had difficulties discussing energy resilience and variable energy supply. Which in turn explains why interviews provided a limited depth in this master's thesis whereas enactments and the critical design provotype provided the user with an enhanced understanding. These methods allowed the participant to live through the future scenario and provided the user with concrete experiences to lift when discussing their future needs.

An example of a study similar to the provotype study conducted within this master's thesis is presented in the article by Raptis et al. (2017) where a provocative, critical design probe was deployed and challenged the participants energy consumption practices. Critical and provocative design is applied in a similar fashion to this thesis with the aim to *challenge* and *make the users reflect*. Raptis et al. (2017) found that the method motivated reflection for their participants, they reflected both on their practice as well as on other aspects of their everyday life. In the provotype study we saw a similar reflection on the practice when it came to the cooking, regarding the need for electricity in every part of the cooking action. We could also see a deeper understanding of what qualities were truly important for the participants as they were forced to prioritise within the activity. The article concludes that provocation can help users better engage in a future scenario as well as to reflect on existing practices.

From our findings we have identified a difficulty in communicating energy resilience and a variable energy future to the participants and this difficulty likely impacted the results from the user research early in this master's thesis. In the beginning of this project we had a limited understanding of the future scenario and it is possible that the choice of method in the early stages of the project was not best suited for communicating the future scenario to the participants, which could lead to these findings not being completely relevant to the subject in question. However, as we had a triangulated research approach and used methods better suited for communicating the future scenario we believe that we weighed up for this later in the process and that the general insights from this master's thesis still apply to the target group and future scenario.

Prior to the study we had intended that the provotype would have some spill-over effect on other aspects of the users everyday life, similar to what was seen in Raptis et al. (2017). We hoped to see this effect to some extent. This was not observed as many participants only included what they considered to be kitchen appliances, while leaving out other electronics that were used within the dining activity context such as entertainment devices. Additionally, some participants said that they only thought about the provotype when actually confronted with it, which was within the kitchen environment. It is understandable that the participants did not allow the provotype to influence all aspects of their everyday as they where told that the provotype was focused on their dining activity and placed in their kitchen. However, the exclusion of other electronics in the kitchen environment points to a limitation with how the study was designed and could affect some of the study results. If the participants used additional electronic devices in their dining activity, when there was not *enough* electricity the participant's experience of the situation is changed. They are still provoked directly in relation to the activity but as they used other electronics for entertainment or other purposes the overall experience was likely less provocative.

Another limitation we need to consider is how the design of the provotype has affected and possibly limited the results of the provotype study. Here we have two main concerns, was the provotype *accepted by the participants* and did it *communicate energy resilience and variable energy supply correctly*? The user acceptance of the provotype is assumed to influence the results of the study as a decreased acceptance of the product would lead to the participants questioning the product rather than their behaviours and needs, which was one of the main aims of this method. And the topic relevance of the provotype is very important as the participant experiences are based on the *provotype* and not the actual scenario. We believe that these factors to some extent limited the results of the study. We could see that most participants did connect the available electricity to *the times we eat* and overall energy consumption in society, but few reflected on energy supply and production which leads us to believe that this aspect of variable energy supply was not communicated fully. This means that the provotype is somewhat limited to how well it did communicate the research topic but we argue that it is not enough to completely ignore the results. However, more work could be conducted to achieve a provotype that communicates the research topic better.

To sum it up we saw great potential in using provotypes, critical design and enactments to communicate future scenarios to users in order to gain insights into latent knowledge and the future needs of the user. We suggest that further research is conducted on how to implement these methods and how immersing the participants into future scenarios affects study participants understanding of the scenario. As we saw many benefits with these methods in the user research performed within this master's thesis we recommend that these methods are applied in projects focused on gaining insights into user needs in future scenarios and users tacit knowledge and habitual behaviour.

6.3 Summary

There are two important implications of the findings in this master's thesis. First that there is a flexibility in *when* the activity is performed and that implementing this flexibility in the activity through an artefact enables us to achieve a **meaningful** and **energy resilient** dining activity.

The second implication is that the use of critical design provotypes and enactments provides us with the tools to challenge the way things are done today and to inquire into future scenarios. Which in turn enables us as designers to achieve solutions that truly solve future problems for the user. We believe that this finding is important as these methods makes the topic more receptive to the general public and includes their perspective in the discussion and shaping of a future energy system.

A final thought about the findings in this thesis is that it does not necessarily promote the future scenario of Legato but rather communicates how it might be to live in it and provokes discussion on our habits today. Whether or not it is ethical to strive for a more sustainable future at the cost of a less reliant power grid is not within the scope of this master's thesis, which is why we make no statement about it. Instead we ask ourselves to what extent we have the right to use our knowledge to change the users behaviour through design solutions. But as the aim and employment of solutions focus on communicating this possible change to the general public and including the general public rather than achieving them we argue that the work of this thesis benefits the user.

7

Conclusions

In this chapter follows the conclusions based on the thesis' purpose which is to **contribute with knowledge** on how the meaningful dining activity can become more energy resilient and to **contribute to a general discussion** on norms and habits related to energy usage in the dining activity.

This thesis **contributes with knowledge** about the dining activity of today, both as an activity and the qualities it provides, as well as how a dining activity and its related habits and norms can be more energy resilient. This is done through a mapping of the dining activity, provocative user studies that uncovered important qualities related to the dining experience and an exploration into how these qualities can affect a future dining activity in the Legato scenario. The findings on what the dining activity is and what is important in it supported the creation of an artefact that embodies a more energy resilient dining activity of the future. The knowledge this thesis contributes with is of interest as it creates the opportunity to design for the dining activity, an activity which provides much value in peoples lives.

This thesis **contributes to a general discussion** on our norms and habits within the meaningful dining activity, related to our energy usage, by our contribution of knowledge on the subject, but also through the creation of artefacts that challenge the behaviour of today or embody a possible activity in the future. We believe that Thermo is an important tool to communicate the findings from this thesis, as it embodies them, as well as a mediating tool that can support the discussion of a possible energy future and how the dining activity in this future could be.

In this master's thesis we found that methods such as critical design, provotypes and enactments can support researchers in communicating future energy scenarios and identifying future needs within them. This finding and the provotype created within this thesis contributes further to a general discussion on how our dining behaviours relate to our energy usage as a mediating tool, communicating the future scenario to common people, in the general discussion.

We believe that the findings within this master's thesis and their implications are of relevance for the area of research within energy futures, food culture, and design and human factors. We provide an answer for how the dining activity could be affected in the future scenario, an area the Swedish energy agency (2016) has not addressed. We also provide a suggestion on what dining in the future could be. This thesis finally contributes with possible methods of how the energy future can be discussed today which previous research addressed as interesting topic for further research.

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A

Appendix

A.1 Sensitising pamphlet

Figure A.1: Pamphlet page 1

Figure A.2: Pamphlet page 2

Figure A.3: Pamphlet page 3

Figure A.4: Pamphlet page 4

Figure A.5: Pamphlet page 5

Figure A.6: Pamphlet page 6

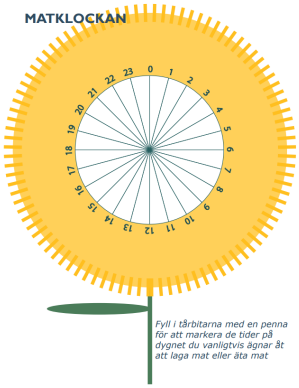


Figure A.7: Pamphlet page 7

Figure A.8: Pamphlet page 8

A.2 Interview questions

A.2.1 Couples interviews

Intro: 5 min
Välkomna till kvällens lilla diskussion! Tack för att ni tagit er tid och förhoppningsvis fyllt i häftet vi skickade ut. Det är bra om ni har det till hands när vi börjar diskutera om några minuter. Men först ska jag presentera vad vi ska göra här ikväll.

Detta är en del av våran förstudie för vårt exjobb Design för en energiresilient måltid. Exjobbet är en del av ett större projekt och energiresiliens som utförs av RISE och Chalmers. Syftet med förstudien är att skapa en förståelse för vilka vardagsaktiviteter kopplade till matlagning som skulle påverkas av återkommande strömavbrott eller lägre kapacitet i elnätet i perioder. Datan vi samlar in från dessa diskussioner och lite andra metoder i förstudien ska vi använda framöver i vårt arbete mot att designa en artefakt som uppmärksammar och skapar en diskussion om hur vi kan anpassa oss till en mindre tillförlitlig energitillförsel i framtiden. Resultatet kommer presenteras som en del av en utställning 2022.

Ikväll ska vi diskutera hur ni förhåller er till mat och matlagning och allt som är kopplat till det. Ni är utvalda för att ni är en del av vår kritiska användargrupp, unga vuxna som bor i lägenhet i en större stad, samt att ni känner varandra vilket gör att ni kan föra en avslappnad diskussion mellan er.

Vi har förberett massor med frågor och följdfrågor men det är bara bra om ni svarar uttömmande på frågor direkt så hoppar vi bara följdfrågor om svaret redan täckte dem. Tänk på eran egen inställning till frågorna men också hur ni bemöter dem ihop eller hur ni skiljer er åt. Tanken är att det ska bli en diskussion kring frågan.

Vi har planerat att detta tar en timme där vi först värmer upp med lite ämnen som ni redan fått fundera lite över när ni fyllde i häftet. Sedan kommer vi in på lite djupare tankar om hur ni ser på mat och dess betydelse för er. Slutligen rundar vi av med lite snack kring elbrist och hur det kan påverka er.

Jag undrar nu om detta låter som en okej plan och om jag får lov att spela in det ni säger idag och använda som anonymiserad data i både vårt exjobb men också föra vidare till RISE och Chalmers?

Har ni några frågor?
Annars kör vi igång!

Häftet: 15 min
Vilka tankar väcker det hos dig att göra häftet?
Hur kom det sig? Varför?

Berätta om vad du skrev på "en måltid jag minns".
Beskriv tillfället?
Varför valde du detta minne, vad var det som gjorde det viktigt? Varför?
Vad gjorde det annorlunda för dig?
Hur upplevde du det?
Varför?

Kika på din matklocka i häftet
Varför äter du på de tider du markerat?

Kika på där du markerat att du lagar mat
Skiljer era svar sig åt? Hur?
Hur skulle du beskriva ditt tillvägagångssätt vid matlagning?
Vad använder du? Hur går du tillväga?
Varför lagar du mat med de här apparaterna/verktygen och områden?

Hur flexibel skulle du säga att du är i din matlagning?
Varför?
Vem av er är mest flexibel?
På vilka sätt är du flexibel?
Varför anser du att det är flexibelt?
Hade du kunnat bli mer flexibel i din matlagning? Hur? Varför?

Kika på där du markerat att du äter din mat
Varför äter du din mat där?

Matkultur: 25 min
Vad är en måltid för dig?
Vad gör det till en måltid?
Varför?
Är det skillnad på mat och måltid, vad? (att äta? föda?)

När börjar och slutar en måltid?
Varför?

Vad är din relation till mat?
Varför?
Vad har mat för betydelse i din vardag och ditt liv?

Hur stor vikt har mat och måltider för ditt liv?
Vad är det i det som du värderar?
Varför värderar du det så?
hur tror du din syn på måltider skiljer sig från dina föräldrar eller mor-/farföräldrar?

Är det skillnad på din vardagsmiddag och helgmiddag/fest/fint?
- Hur skiljer det sig?
- Varför?
- Vad innebär det att lägga extra engagemang i din matlagning?
- Hur förbereder man för en "speciell" måltid?

Har du några preferenser i matväg? (kost/smak)
- *I så fall vad?*
- *Vad grundar sig dina preferenser i?*
- *Skiljer det sig mellan vardag och "speciella tillfällen"?*

Äter du helst ensam eller med sällskap?
- Varför?
- När föredrar du vad?
- Hur har det varit under Corona, hur har det påverkat ditt sätt att äta?
- Har du testat nya sätt att äta eller laga mat under corona?

Energiresiliens: 15 min
Dra dig till minnes och berätta om en gång då du varit utan el under en längre tid.
- (Vad är lång tid för dem?)
- Beskriv tillfället?
- Hur såg det ut och gick till?
- Hur hanterade du situationen som uppstod?
- Hur upplevde du det?
- **Mat**: Påverkades dina måltider? Hur? Vad gjorde ni? Hur upplevde du det?

Har du läst eller hört om den otillräckliga eltillförseln i södra sverige? (slarvigt kallat elbrist)
- Vad är din uppfattning av det?
- Hur ställer du dig till det?
- Upplever du att det påverkar dig? Hur?

Har du gjort något annorlunda på grund av "elbristen"?
- Har du reflekterat över hur mycket ström du nyttjar till matlagning?
- Vad har du för möjligheter att anpassa din matlagning till brist på ström?

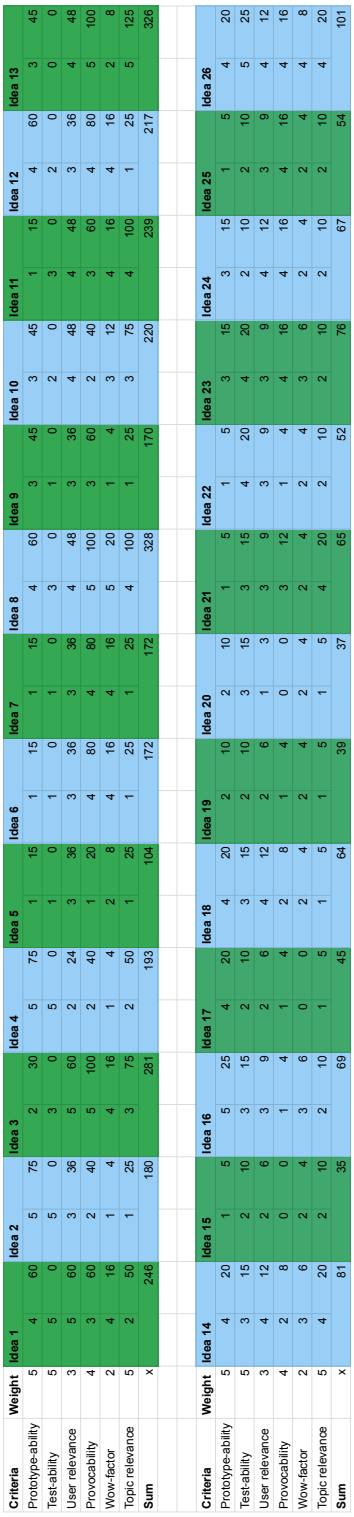
Hur känner du inför att elbrist kan drabba dig oftare i framtiden?
Hur känner du inför att elbrist kan påverka dina förutsättningar att laga och äta mat på det sätt du gör idag?

Reflektion:
Vad lämnar den här diskussionen er med för tankar?
Har ni något som ni hade tyckt var intressant att prata om kring det här eller lägga till kring det vi pratat om?
Skulle ni vilja vara med som användare i senare skeden av ex-jobbet?

Avslut:
Tack så hemskt mycket för att ni tog er tid! Det är till stor hjälp för vårt arbete, jag hoppas också att det har varit en givande diskussion för er och att ni kanske fått lite nya perspektiv på just matlagning och elförbrukning.

Jag kanske hör av mig igen framöver om något ni sagt är oklart eller om vi har något mer kul ni kan delta i.

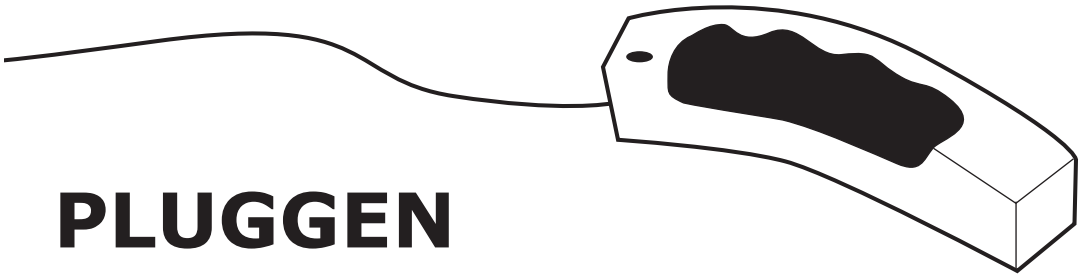
A.3 Pugh selection matrix



Criteria	Weight	Idea 1		Idea 2		Idea 3		Idea 4		Idea 5		Idea 6		Idea 7		Idea 8		Idea 9		Idea 10		Idea 11		Idea 12		Idea 13	
Prototype-ability	5	4	60	5	75	2	30	5	75	1	15	1	15	1	15	4	60	3	45	3	45	1	15	4	60	3	45
Test-ability	5	5	0	5	0	3	0	5	0	1	0	1	0	1	0	3	0	1	0	2	0	3	0	2	0	0	0
User relevance	3	5	60	3	36	5	60	2	24	3	36	3	36	3	36	4	48	3	36	4	48	4	48	3	36	4	48
Provocability	4	3	60	2	40	5	100	2	40	1	20	4	80	4	80	5	100	3	60	2	40	3	60	4	80	5	100
Wow-factor	2	4	16	1	4	4	16	1	4	2	8	4	16	4	16	5	20	1	4	3	12	4	16	4	16	2	8
Topic relevance	5	2	50	1	25	3	75	2	50	1	25	1	25	1	25	4	100	1	25	3	75	4	100	1	25	5	125
Sum	x		246		180		281		193		104		172		172		328		170		220		239		217		326

Criteria	Weight	Idea 14		Idea 15		Idea 16		Idea 17		Idea 18		Idea 19		Idea 20		Idea 21		Idea 22		Idea 23		Idea 24		Idea 25		Idea 26	
Prototype-ability	5	4	20	1	5	5	25	4	20	4	20	2	10	2	10	1	5	1	5	3	15	3	15	1	5	4	20
Test-ability	5	3	15	2	10	3	15	2	10	3	15	2	10	3	15	3	15	4	20	4	20	2	10	2	10	5	25
User relevance	3	4	12	2	6	3	9	2	6	4	12	2	6	1	3	3	9	3	9	3	9	4	12	3	9	4	12
Provocability	4	2	8	0	0	1	4	1	4	2	8	1	4	0	0	3	12	1	4	4	16	4	16	4	16	4	16
Wow-factor	2	3	6	2	4	3	6	0	0	2	4	2	4	2	4	2	4	2	4	3	6	2	4	2	4	4	8
Topic relevance	5	4	20	2	10	2	10	1	5	1	5	1	5	1	5	4	20	2	10	2	10	2	10	2	10	4	20
Sum	x		81		35		69		45		64		39		37		65		52		76		67		54		101

A.4 Pluggen instructions and punch ticket



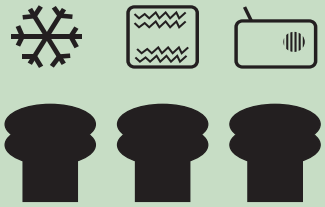
PLUGGEN

HUR FUNGERAR JAG?

Pluggen är ett interaktivt grenuttag som ger dig möjlighet att anpassa din strömförbrukning utifrån kapaciteten i just ditt elnät. Genom att anpassa din strömförbrukning efter elnätets kapacitet så kan du dra ner din elkostnad och bidra till ett mer hållbart elnät!

Koppla in Pluggen i ett vägguttag och placera den i ditt kök. Uttagen på Pluggen används till allt som är strömkrävande i och runt omkring din matlagning.

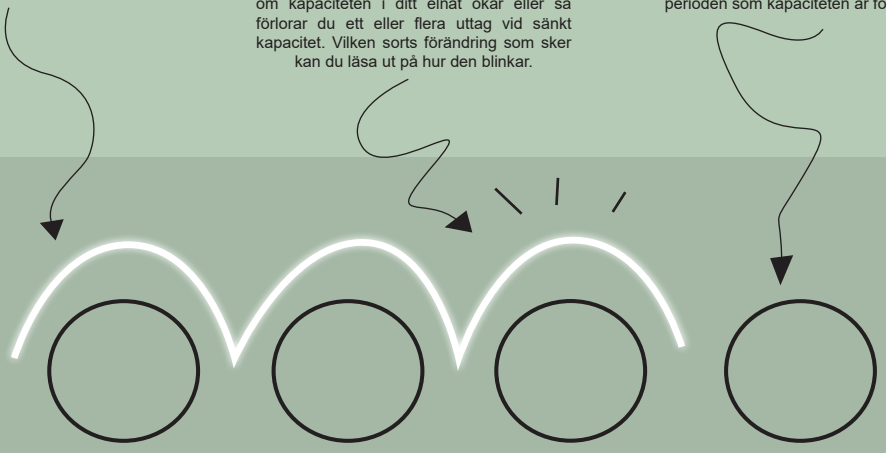
Använd de extra pluggarna för att räkna in dina större apparater till din strömförbrukning, såsom pluggen för kyl och frys, pluggen för spisen när du använder den och underhållningspluggen om du till exempel lyssnar på musik, podcast eller kanske har din TV på i bakgrunden.



När det lyser bredvid ett uttag betyder det att det är kapacitet nog för att driva den genomsnittliga köksapparaten. Du kan använda detta uttag som vanligt!

När det sker en förändring av kapacitet i elnätet indikeras det med att Pluggens LED börjar blinka bredvid de berörda uttagen. Antingen tillkommer det ett eller flera uttag om kapaciteten i ditt elnät ökar eller så förlorar du ett eller flera uttag vid sänkt kapacitet. Vilken sorts förändring som sker kan du läsa ut på hur den blinkar.

När det är släckt runt ett uttag så finns det inte tillräckligt med kapacitet i elnätet för att driva en köksapparat i uttaget, det tillförs inte heller ström till det här uttaget under perioden som kapaciteten är för låg.



DET HÄR ÄR DITT KLIPPKORT!

Om du verkligen måste använda mer ström än grendosan tillåter river du av en flik från klippkortet och kopplar din sladd till ett vanligt uttag.

Kom ihåg att bara använda klippkortet i yttersta nödfall!

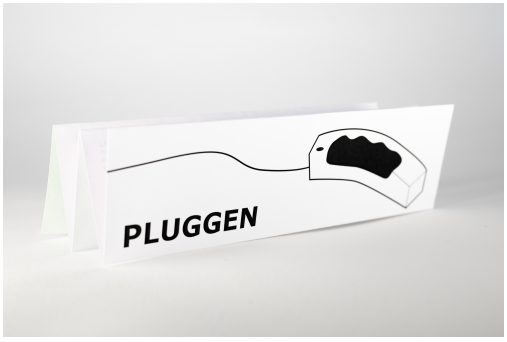


Figure A.9: Printed instructions folded

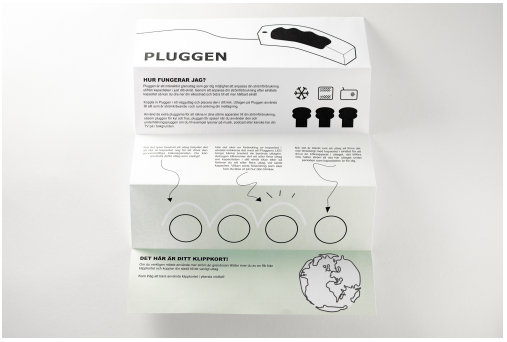


Figure A.10: Printed instructions unfolded

Figure A.11: Intact punch ticket

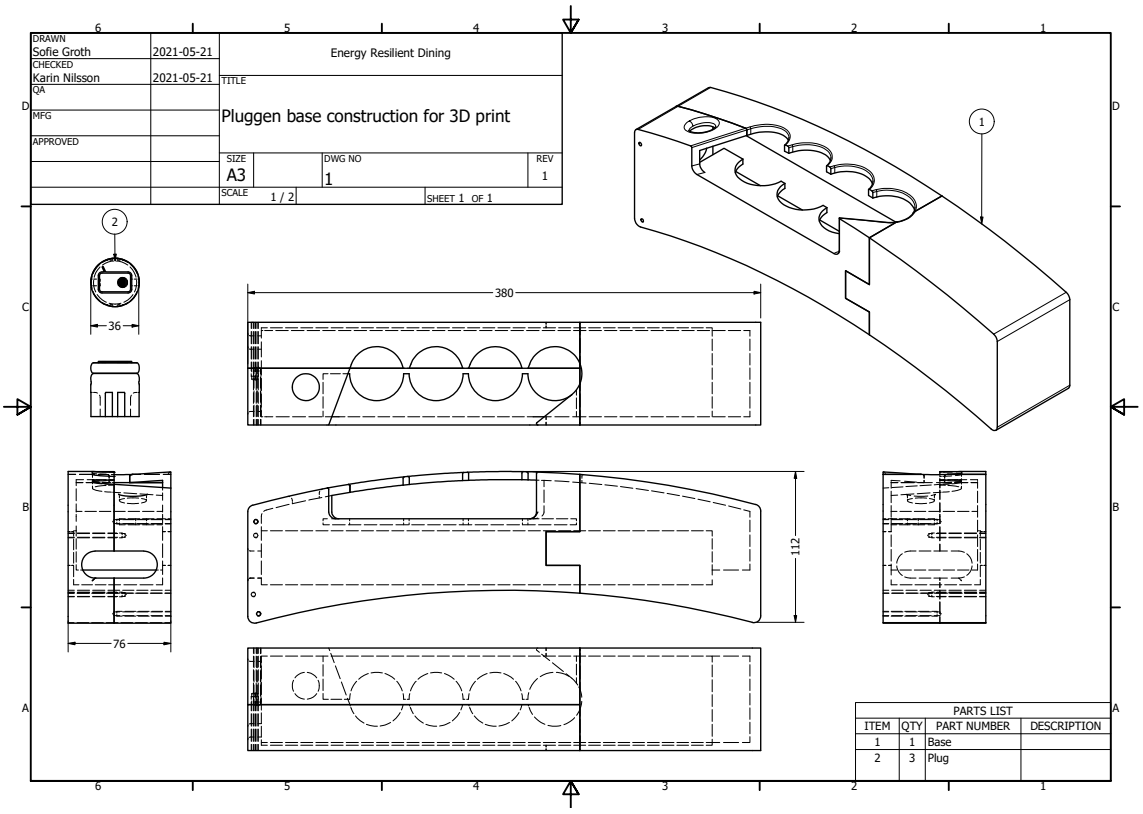
Figure A.12: Punch ticket with punched out tickets

Figure A.13: Plug

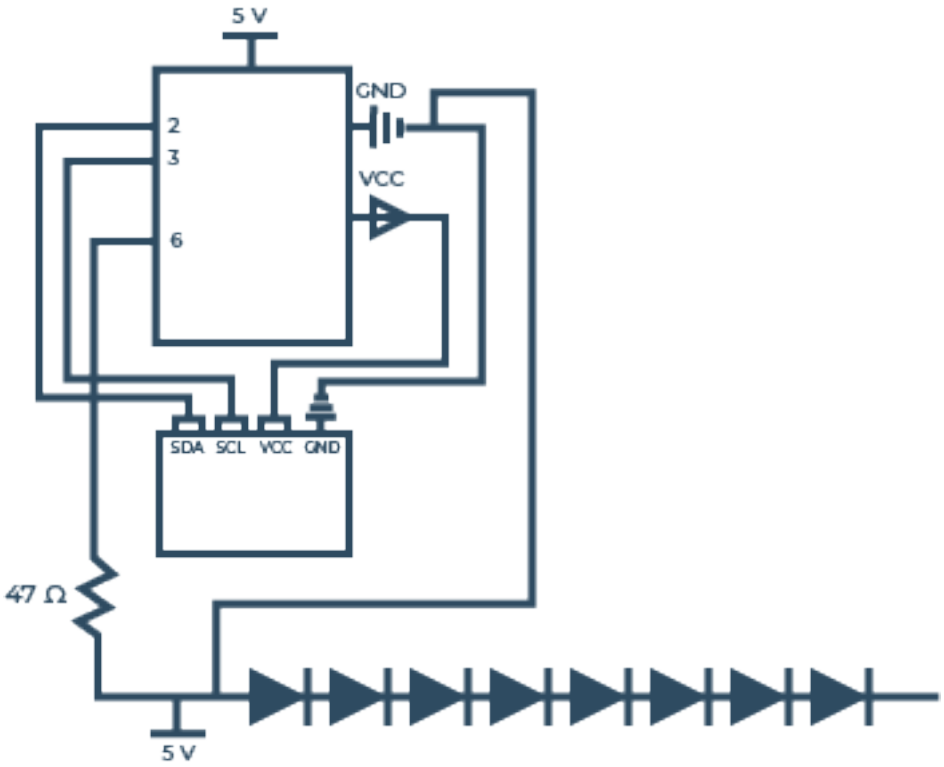
Figure A.14: Plug

Figure A.15: Plug

A.5 Pluggen Blueprints



A.6 Circuit diagram



A.7 Data from provotype study

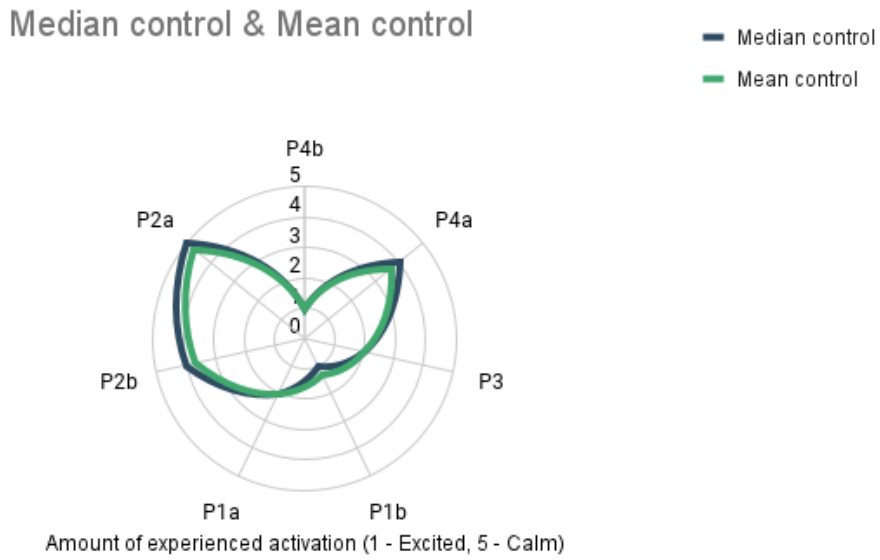


Figure A.16: SAM control results

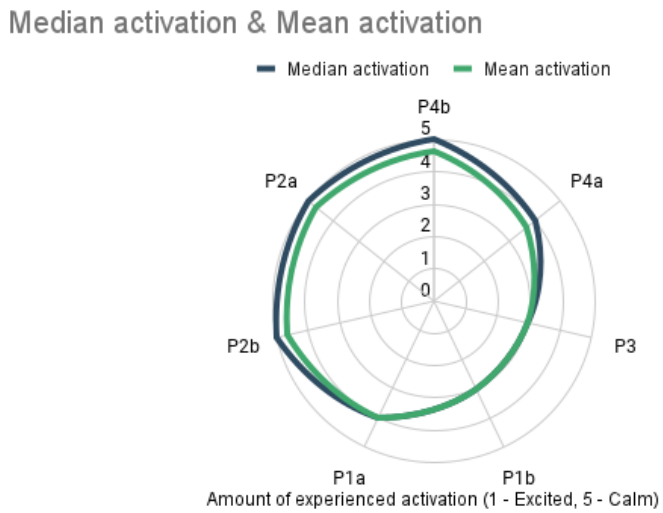


Figure A.17: SAM activation results

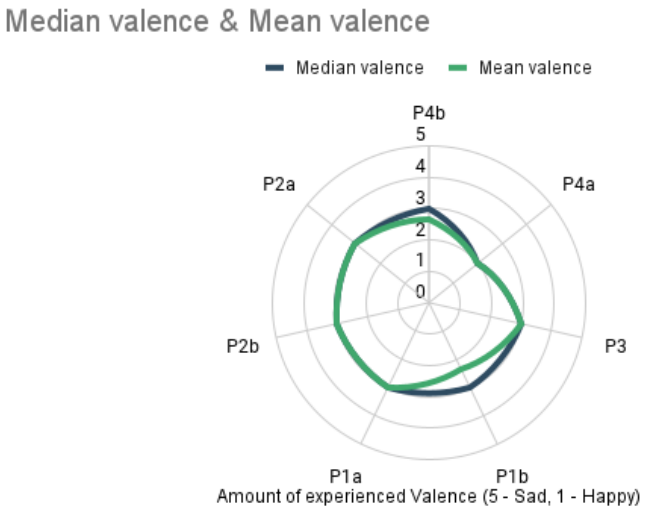
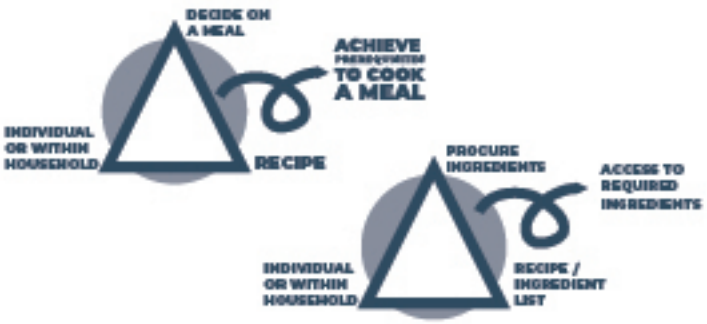
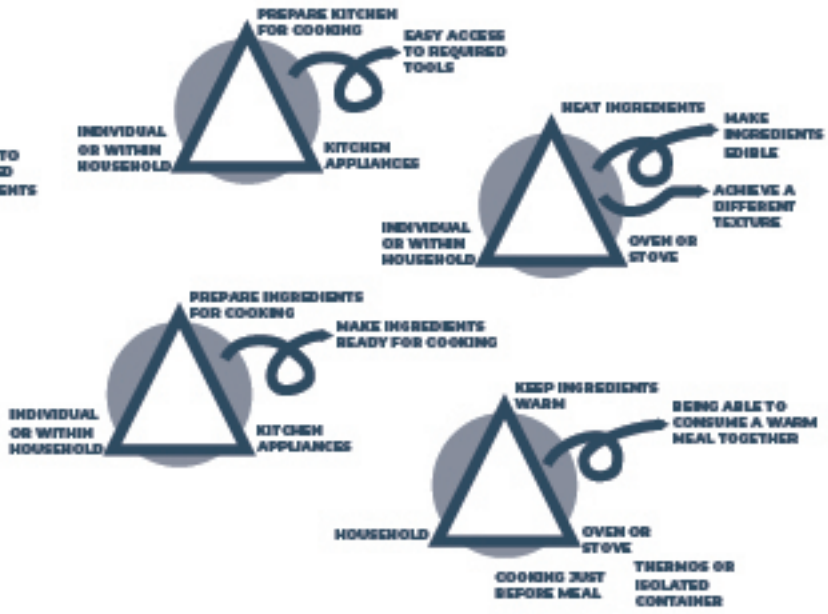


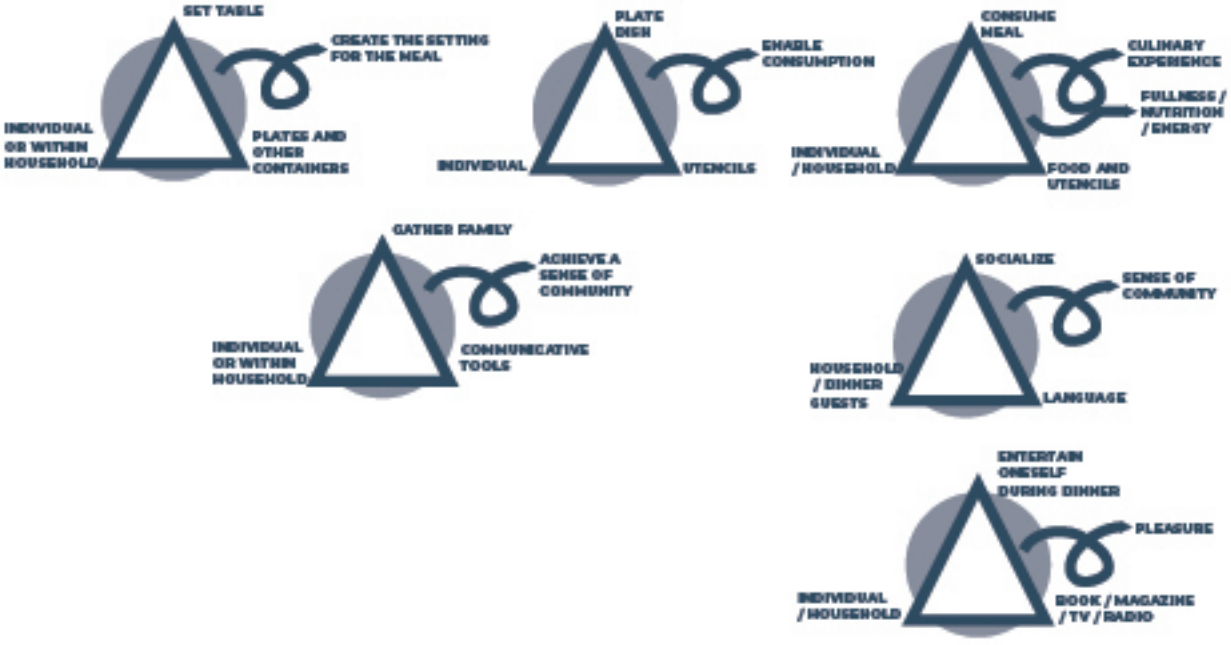
Figure A.18: SAM valence results

A.8 Activity map

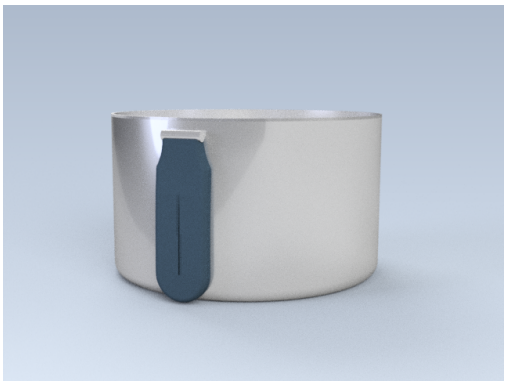
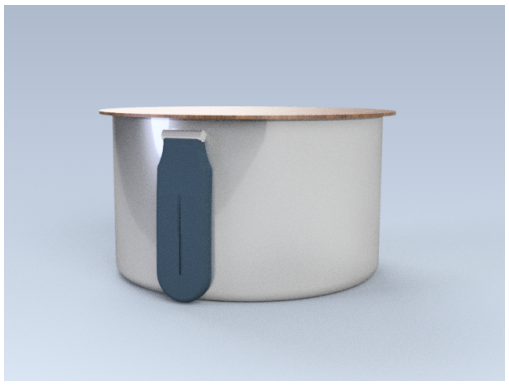


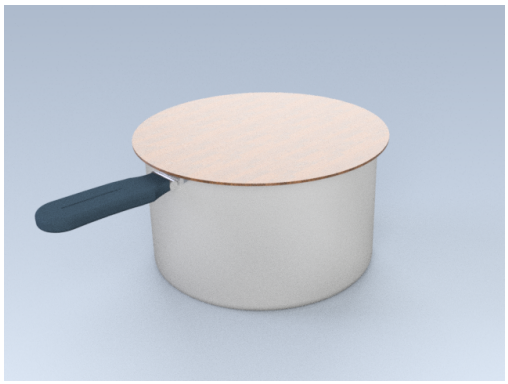
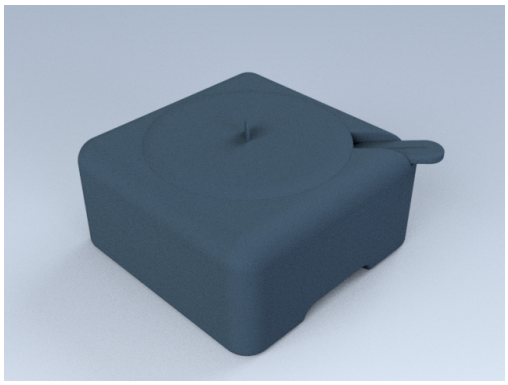
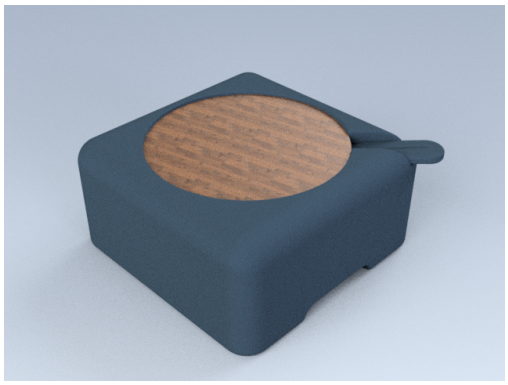
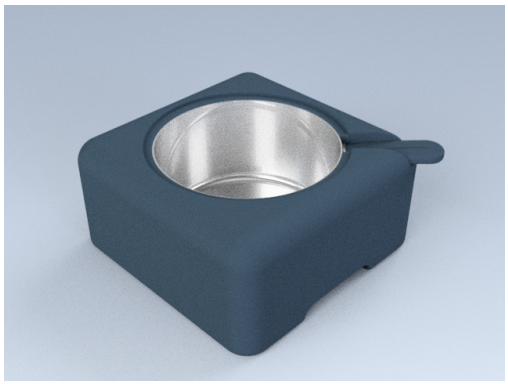
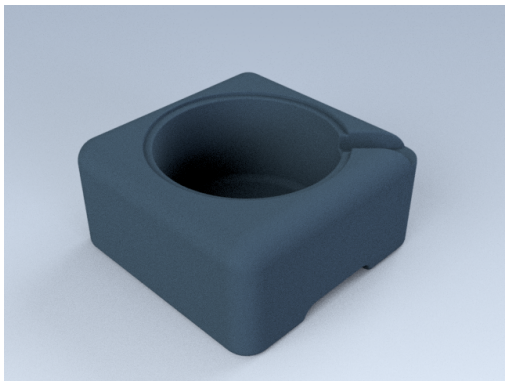



EAT A MEAL
A SENSE OF COMMUNITY
FOOD
HOUSEHOLD
INDIVIDUAL
FAMILY FRIENDS

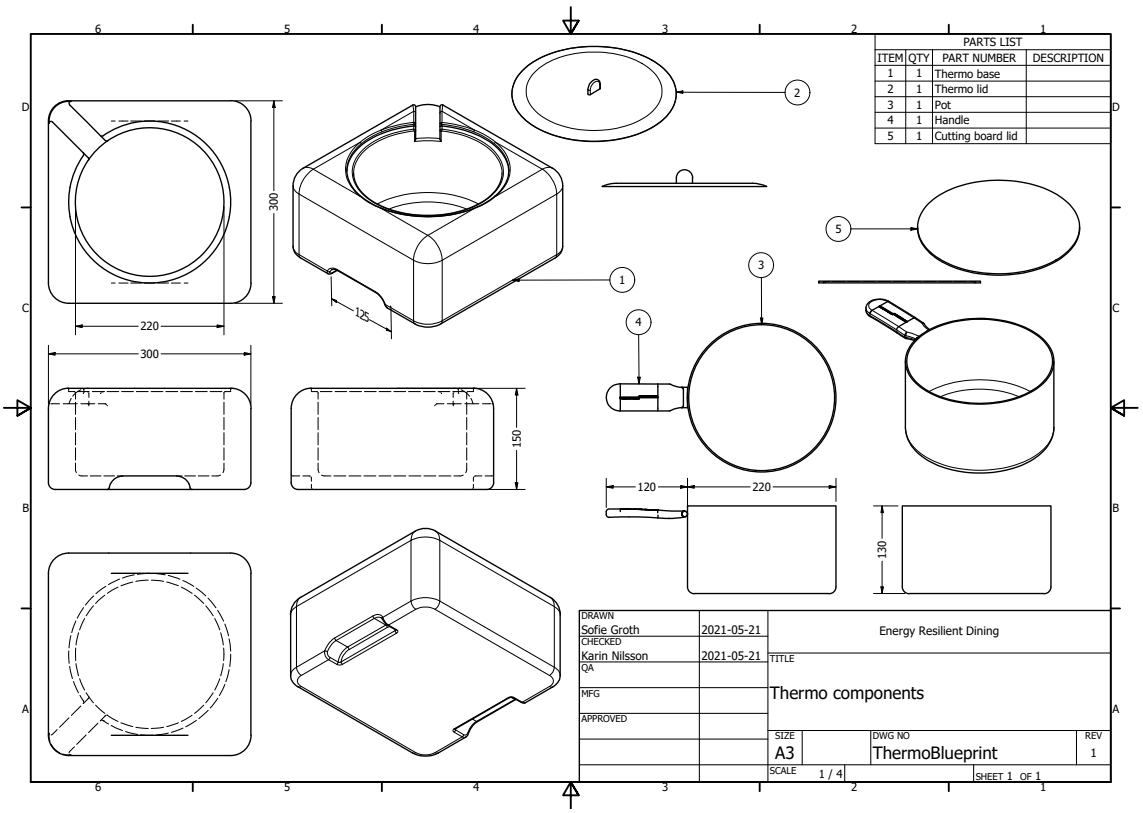

SET TABLE
CREATE THE SETTING FOR THE MEAL
PLATES AND OTHER CONTAINERS
INDIVIDUAL OR WITHIN HOUSEHOLD
PLATE DISH
ENABLE CONSUMPTION
UTENCILS
INDIVIDUAL
CONSUME MEAL
CULINARY EXPERIENCE
FULLNESS / NUTRITION / ENERGY
FOOD AND UTENCILS
INDIVIDUAL / HOUSEHOLD
GATHER FAMILY
ACHIEVE A SENSE OF COMMUNITY
COMMUNICATIVE TOOLS
INDIVIDUAL OR WITHIN HOUSEHOLD
SOCIALIZE
SENSE OF COMMUNITY
LANGUAGE
HOUSEHOLD / DINNER GUESTS
ENTERTAIN ONESELF DURING DINNER
PLEASURE
BOOK / MAGAZINE / TV / RADIO
INDIVIDUAL / HOUSEHOLD

A.9 Thermo

A.10 Thermo Blueprints



A.10.1 Pre interviews

Hej! Tack för att du har ställt upp på den här användarundersökningen!

Det här är en del av mitt och XX exjobb där vi arbetar med design för energiresiliens i vardagen, det innebär att vi vill undersöka dagens energiresiliens och identifiera möjligheter för att kunna bli mer resilient i framtiden. Vi arbetar utefter ett scenario där vi år 2050 är beroende av hållbara energikällor som är mindre pålitliga vilket leder till dippar i elnätets kapacitet. Den produkt ni kommer få hem kommer simulera hur det skulle kunna vara att laga mat år 2050. Den här första intervjun är till för att introducera dig lite till syftet bakom produkten och för att höra om dina reflektioner kring din egen resiliens och energianvändning i vardagen. Innan jag börjar ställa frågorna ska jag bara börja spela in så att vi kan transkribera intervjun i efterhand, men du kommer vara helt anonym, går det bra?

- Energi
    - Hur ser din el-användning ut idag tror du?
    - Hur jämför du dig mot andra?
    - Hur 'beroende' av el är du?
- Förväntningar
    - Hur tror du att du hade reagerat på att inte få använda så mycket ström som du brukar?
    - Hur hade det stört dina rutiner?
    - Tror du att du kommer ha lätt att ändra dina rutiner för att anpassa dig?
        - Hur tror du att du kan ändra dina rutiner?
- Mat/Måltider
    - Hur ser din vardag ut i termer av mat och måltider?
    - Hur mycket tid lägger du på matlagning?
    - Vad för sorts mat brukar du vanligtvis laga?
        - Vad för mat är värdefull för dig?
        - Finns det något i matväg du inte kan gå utan på en dag?
    - Hur lagar du mat?
    - Vilka apparater i köket brukar du använda?
    - Använder du ofta flera apparater samtidigt?
- Sensitising
    - Vad är viktigt för dig i köket?
        - Tvinga dem att prioritera!
    - Har du varit med om ett strömavbrott där du behövt laga eller äta mat på annat sätt än vanligt, berätta mer?
    - Om din tillgång till ström skulle variera idag, har du några strategier för hur du kan laga och äta mat?

Du kommer få hem produkten på XXX och med den får du även lite annat material och en manual så att du kan bekanta dig med produkten själv i ditt eget hem. Under tiden du använder produkten så kommer du att få sms med en enkät som vi gärna vill att du svarar på och du kommer även att få göra en liten utvärdering i samband med att du använder produkten för första gången.

Har du några frågor nu så får du gärna ställa dem, annars så har du våra kontaktuppgifter och det är bara att höra av sig om det dyker upp några frågor.

A.10.2 Exit interviews

Hur ser din strömförbrukning ut?
- Hur stort beroende av kontinuerlig tillgång till ström har du?

Hur skulle du beskriva produkten? (Varför?)
- Vad förmedlar produkten? Varför?

Vad är din upplevelse av produkten?
Hur skulle du beskriva dina interaktioner med produkten?
- Vad kommunicerade produkten till dig?
  - Hur hade du användning av det?
- Vad kunde du göra med produkten?
  - Hur använde du den?

Hur har Pluggen påverkat dig?
- Gjorde Pluggen att du förändrat dina vanor?
  - Hur?
  - Varför?
  - Var det förväntat eller oväntat?
  - Hur har det påverkat din vardag?
- Gav användandet av Pluggen dig några nya insikter om dig själv och/eller dina vanor? Isf vilka?

Vad har du upplevt var den största utmaningen under studien?
- Varför var det här utmanande för dig?
- Hur hanterade du den här utmaningen?
  - Hur väl fungerade det?
- Matchar det här vad du förväntade dig skulle vara svårast innan studien?

Är det något du upplevt som mindre utmanande än du förväntade dig?
- Vad?
- Varför var det inte så utmanande i verkligheten?
  - Hur kommer det sig?

Vad för sorts mat har du lagat under studien?
- Hur värdefulla har dina måltider känts under studien?
  - Har du börjat värdera nya saker när det kommer till mat och måltider under studien?
- Har du varit tvungen att kompromissa bort vissa viktiga rätter eller annat i måltidsväg?

Hur har du lagat mat under studien?
- Hur såg måltiderna ut? Hur åt ni?

Vad är viktigt för dig i köket?
- Prioritera!
- Har dina prioriteringar förändrats sen innan studien?

Är det något annat i din vardag som påverkats av att ni har använt pluggen?
- Hur har det påverkats?
- Varför tror du att det har påverkats?

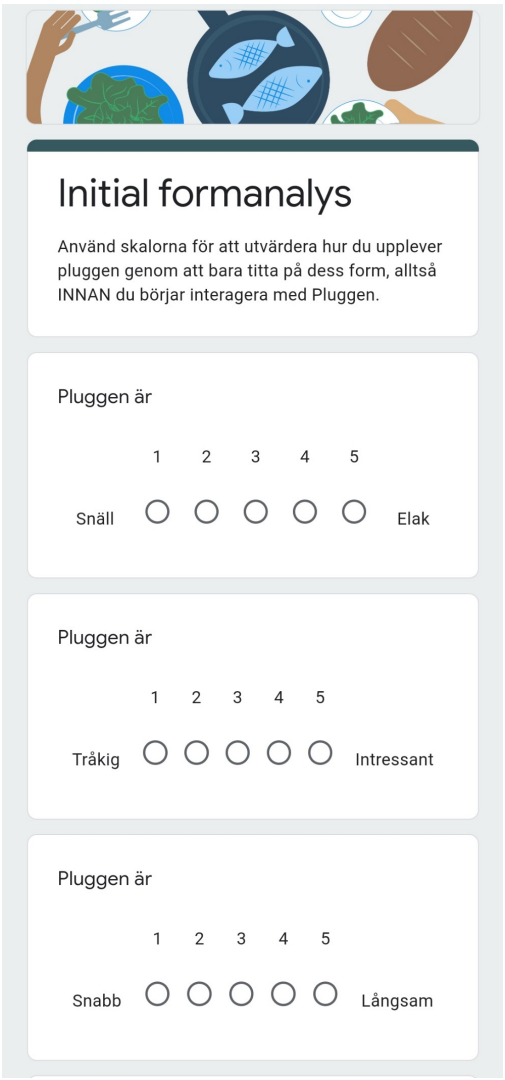
Har du blivit mer medveten om den ström du förbrukar i andra områden av vardagen än köket?

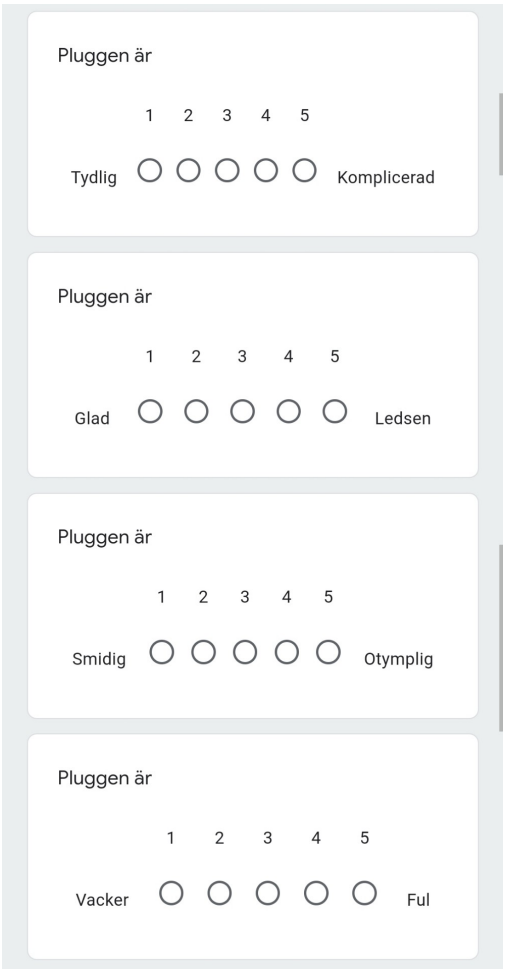
Behövde du over-rida systemet och använda en kupong på ditt klippkort?
- Varför over-rideade du? När och hur?
- Om ja, vilken dag/tid(så exakt som möjligt)?

Vilka känslor fick du av att over-ridea?

Hur tyckte du det var att vara med i studien?
- Varför?

A.11 Provotype evaluation forms






Pluggen är
1 2 3 4 5
Smart
Dum
Pluggen är
1 2 3 4 5
Modig
Feg
Pluggen är
1 2 3 4 5
Passiv
Aktiv
Pluggen är
1 2 3 4 5
Modern
Traditionell
Pluggen är
1 2 3 4 5
Inbjudande
Avskräckande
Pluggen är
1 2 3 4 5
Mjuk
Hård
Pluggen är
1 2 3 4 5
Högljudd
Lågmäld
Pluggen är
1 2 3 4 5
Ärlig
Oärlig
Nästa

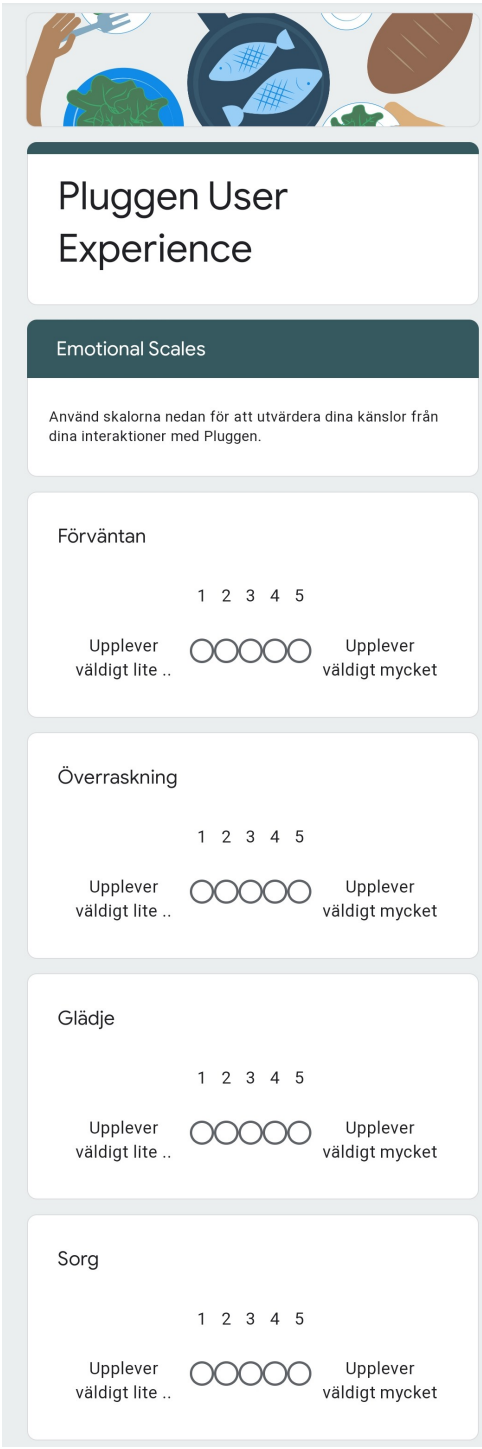
Pluggen User Experience

Hej!

Vänligen fyll i detta formulär varje gång du får länken skickad till dig under studien.
Tänk tillbaka till när du sist interagerade med Pluggen och hur du kände då eller avvakta lite tills du interagerar med pluggen igen och fyll i formuläret då istället.

Detta formulär ger oss en uppfattning av hur din upplevelse av produkten förändrar sig över tid och kommer användas för att utvärdera hur väl produkten uppnådde den önskade användarupplevelsen.

Nästa



Pluggen User Experience

Emotional Scales

Använd skalorna nedan för att utvärdera dina känslor från dina interaktioner med Pluggen.

Förväntan

1 2 3 4 5

Upplever väldigt lite .. ○○○○○ Upplever väldigt mycket

Överraskning

1 2 3 4 5

Upplever väldigt lite .. ○○○○○ Upplever väldigt mycket

Glädje

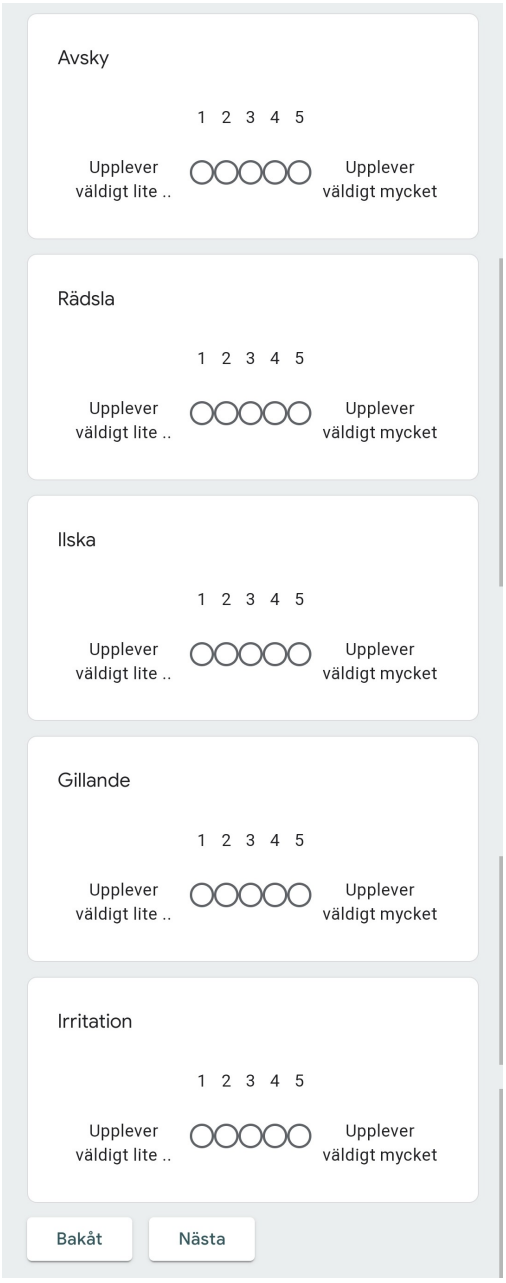
1 2 3 4 5

Upplever väldigt lite .. ○○○○○ Upplever väldigt mycket

Sorg

1 2 3 4 5

Upplever väldigt lite .. ○○○○○ Upplever väldigt mycket


Avsky
1 2 3 4 5
Upplever väldigt lite ..
Upplever väldigt mycket
Rädsla
1 2 3 4 5
Upplever väldigt lite ..
Upplever väldigt mycket
Ilska
1 2 3 4 5
Upplever väldigt lite ..
Upplever väldigt mycket
Gillande
1 2 3 4 5
Upplever väldigt lite ..
Upplever väldigt mycket
Irritation
1 2 3 4 5
Upplever väldigt lite ..
Upplever väldigt mycket
Bakåt
Nästa


Pluggen User Experience
Self Assessment Manikin
Använd skalorna nedan för att utvärdera dina känslor när du interagerar med Pluggen.
Så här känner jag mig när jag interagerar med Pluggen
1 2 3 4 5
Glad
Ledsen
Så här aktiverad känner jag mig när jag använder Pluggen
1 2 3 4 5
Exhalterad
Lugn
Så här mycket kontroll upplever jag vid interaktioner med Pluggen
1 2 3 4 5
Kontrollerad
I kontroll
Bakåt
Skicka

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