CHALMERS
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Designer's Toolkit 2

Extending a web application into an interaction design collaborative platform

Master's thesis in Computer science and engineering

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Abstract

In the field of interaction design, design methods play an important role in designing and developing products. There are various design processes that can be applied in interaction design. Designers often collaborate in groups and while conducting interaction design processes, they also need to document their findings and structure their design process. The number of Web applications serving as tools for designers and developers have been growing in the past years. There are various web applications used by interaction designers such as Miro and Figma that support collaboration. However, there is a lack of web applications that guide the users in the interaction design process. Designer's Toolkit is a web application which is used to browse design methods and plan design sprints. The aim of this research is to extend this web application in to a collaboration platform where users can document their design processes and collaborate together on projects. Simultaneously, the work presented here answers what should be considered when designing a collaboration platform for interaction designers. The result is a set of eight guidelines on features to include in such a collaborative web application.

Keywords: Interaction Design, Web Application, Collaboration, Triple Diamond, Guidelines, Toolkit, User Experience.

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Jesper Jansson & Ibrahim Naboulsi, Gothenburg, June, 2022

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Introduction

Interaction design is the design of the interaction between users and products or services (Teo Yu Siang, 2021). It aims to increase the user experience of the product or service by appealing to users needs and demands. Within the field of interaction design, the iterative design process is used when designing or developing a product. Depending on which phase the designers find themselves in, they apply certain design methods in order to get a step closer to their final product/design. In interaction design, a common design process is the triple diamond (Google, 2022) which is a six phase process for designing a product. This is sometimes done through cross-disciplinary teamwork with other fields of work such as design leaders, product owners and developers. It can also be done between interaction designers themselves, where they work together to plan and conduct a design sprint.

A design sprint is a five day design process intended to build and prototype solutions to design problems in under a week's time. Google has their own definition of a design sprint as a six phase design process where product owners, design leaders and developers use to tackle and solve design problems (Google, 2022). The design process is structured as a triple diamond and can be seen as an extended double diamond design process (Design Council, 2004).

Previous work on web applications that aim to support designers has been done as seen in Sprinster Diandraputri & Niwanputri (2021) which is a canvas web application to support interaction designers. Their approach was to design a web application that would provide guidance through a design sprint while also giving documentation capabilities. Diandraputri & Niwanputri (2021) mention that existing web applications only provide templates and have no support for guiding the users through design sprint phases, meaning that all design phases are conducted on the same board. The goal with Sprinster was to create a design sprint application which supports documentation, provides the users with tools and materials to conduct design sprints, and gives guidance through a design sprint.

The original Designer's Toolkit is a web application designed to support interaction designers with selecting design methods for their design sprints. It provides a guide on how to perform a design sprint by showing the methodology behind the design process and how it should be done according to the triple diamond framework. It supplies the user with a small library for design methods to use for each phase of the triple diamond framework. It also allows the user to add design methods to a design sprint plan which also makes it a planning application.

This thesis will mostly focus on how the collaboration between interaction designers can be improved. This will be done by extending Designer's Toolkit into a collaborative web application. Designer's Toolkit will be used as a basis for the design of a collaborative toolkit in this project. This means that there is no need to develop a product from scratch and the focus can stay on improving the collaboration aspects of the application.

1.1 Problem

Including designers, product owners and developers alike in the start-up of a project has been proven to be an effective framework for collaboration (Sari & Tedjasaputra, 2017). Within the design sprint, the team decides on what design methods to use when forming the design project. There are many design methods to choose from, for example Crazy 8's , Paper prototyping, Interviews and Focus groups (Google, 2022). These are categorized in different phases of the design sprint such as the ideation phase, sketch phase, prototyping phase etc. When designers start a new project, choosing which of these methods to use can take some time and knowing which one to choose can become time-consuming (Christian Rohrer, 2014). Furthermore, documenting the process of each method used can result in various note/documentation files being scattered in a project folder.

To have the ability to quickly structure a design process is something that can be useful for interaction designers. A personalized design sprint tool could also be beneficial for interaction designers as it can give the opportunity to store previously used methods and explore new ones without having to browse the internet. This will save time and be a convenience for conducting a design process.

Planning an interaction design project can be about finding methods that provide the right amount of user input within the time allocated for the project (Jesmond Allen and James Chudley, 2013). Project management applications can serve as a tool for efficient time management in a team where people collaborate with each other (Stephanie Seymour, n.d.). A toolkit that is created to support interaction designers in planning their design sprints can be helpful in order to manage the project with respect to the time allocated for the project.

1.2 Aim of the Work

This thesis considers interaction designers working together to solve complex problems. The goal is to design a web application to facilitate collaborative working. While working on the web application toolkit, the following research question will be considered:

What should be considered when designing a web application to support collaboration between interaction designers when conducting a design sprint?

Part of the research will therefore include exploring guidelines for creating web applications to plan design processes in a collaborative fashion. This will involve researching different levels of collaboration.

Another aspect of the work will involve looking at the pragmatic and hedonic quality of the developed web application. Hedonic and pragmatic qualities play a valuable role in the overall user experience of a product. Tools are available online to measure these qualities. The research will explore the available tools and make use of it to evaluate the web application.

1.3 Limitations

Due to the nature of the thesis mostly consisting of literature studies and design work, it is important to consider the time used for technical development. The amount of features that will be designed and developed will be limited due to the amount of time allocated for the design process in the thesis.

This project will not follow strict in-depth theories of how to design a product. Instead it will attempt a design solution and take user feedback in order to make appropriate changes. This can be seen as limitation as it is gives a sense of uncertainty to the process. However, according to Gaver (2012), the lack of verifiable information is a part of research through design and does not stop the results from having the desired outcome.

The main validation of this project will be done through a user study which does limit the results. One limitation of the result is that the user study will have students as participants and not experts. This will lead to some different results among the participants compared to how results would look like if it would be used in a company setting. The best would be to test it on both but due to limited time and resources the decision was made to only test it on students. The amount of participants in the user study will roughly be five people which is also limiting the result.

2
Background

Before starting work on a toolkit for collaboration work, an analysis of existing work and literature surrounding the subject was conducted. This section will cover the key foundations of this project in terms of collaboration teams and existing collaborative platforms. The triple diamond design process will be looked into and explained in a general setting. Finally, we present a collaboration tool which will be used as a basis for the extended web application, Designer's Toolkit 2.

2.1 Design Sprints

A design sprint is a five day design process which is meant to build and test a prototype with a team (Knapp et al., 2016). The design process can be seen in figure 2.1. The design sprint methodology has been adopted by Google (2022) in their Design Sprint Kit and is a proven methodology to solve problems through designing, prototyping and testing with users.

The first day is dedicated to mapping the problem. The second day, the team will start sketching a solution. The third day is about deciding on the best ideas sketched in the previous day. The fourth day is dedicated to prototyping a solution. Finally on the fifth day, the team will test the prototype on the target customers.

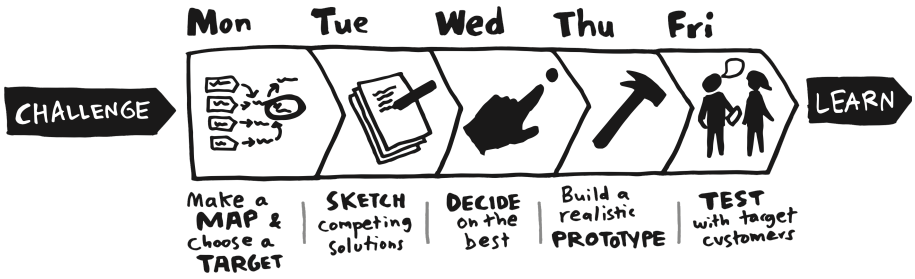

Figure 2.1: Design sprint by Jake Knapp

2.2 Cross-Disciplinary Collaboration Teams

The business market always strives for a competitive advantage over its counter parts. To get this advantage, companies need to have a way to integrate and apply new technology when it arrives (Grindley, 2018). Cross-disciplinary teams is an

efficient way to accomplish this, since knowledge integration and knowledge sharing in cross-disciplinary teams often leads to innovation (Huber, 1999). This is because the new knowledge gained by the organization mixed with already established knowledge leads to new possibilities and opportunities. Thus, there is a need for collaborative tools, for the cross-disciplinary teams to work and collaborate in.

Collaboration in teams is complicated in theory. It ranges from team dynamics to individual's interest and there is no magic formula to create the best collaboration possible (Wagerman et al., 2012). To study and understand the dynamic in the user study, the recommendations by Wagerman et al. (2012) will be considered. The reason for studying the collaboration in teams is to be aware of how it effects the result of the evaluations and how to interpret this in the analysis for a more accurate result.

2.3 Examples of Collaboration Tools

There are wide variety of online collaboration tools available for the public to use. They are used with a specific purpose in mind, e.g. designing interfaces, writing documents, creating an ideation board etc. One of the key features of these tools is that they can be used to create a collaborative environment by inviting several participants to design on the same project. These tools can come in the form of device specific application such as desktop or tablet. And they can also be accessible and used immediately on a browser of the users choice. Examples of collaboration tools are Figma and Miro.

Figma is used primarily to design user interfaces (*Transform the way your team work*, 2022). One of the key features in Figma is that users can create a canvas to design in and also invite other users to the canvas to work with. This is the collaboration aspect of the tool.

Similar to this, Miro is also a tool available online on web browsers where users can create canvases to ideate and sketch (*Collaborate anywhere with Miro on all of your devices*, 2022). And it is also used to invite other users to the canvas in order to collaborate and design together.

2.4 Triple Diamond Design Process

The triple diamond design process (Google, 2022) is a six stage design process which is used to tackle complex design problems. It consists of six phases, understand, define, sketch, decide, prototype and validate. The basis for it is to focus on understanding humans who are facing a problem. During the understand phase, a large amount of information is collected surrounding the topic at hand. This is done in order to get a better understanding of the problem instead of having the designers make presumptions about the problem. The findings in the understand phase are then used in the define phase in order to define key problems which are to be solved

for. This is also a phase intended to scope the project. Going forward to the sketch phase, everything gathered in the previous phases will be used to ideate solutions to the defined problem. Several ideation techniques are also used here. When sufficient ideas are brought forward, the team will reach the decide phase. In this phase, decisions will be made about what ideas to go forward with from the sketch phase. Once the design team has decided on their set of ideas, a prototype will be created in the prototype phase. Which will finally be tested in the validate phase.

Within each phase, there are various amounts of design methods that can be used. Google Design Sprint has collected a variety of different methods under each phase which are available on their website. Examples are Crazy 8, User Journey Mapping, etc.

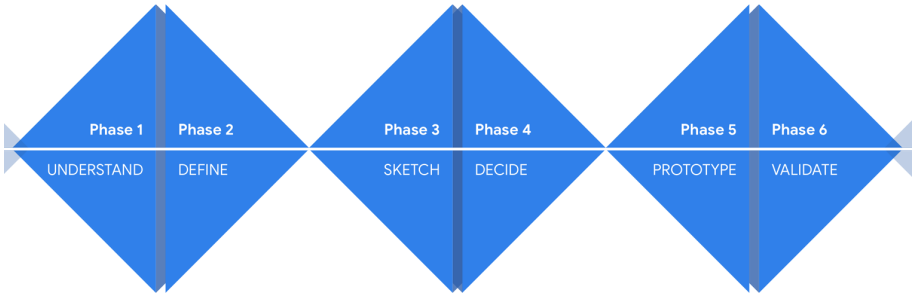

Figure 2.2: The triple diamond design process by Google Design Sprints

2.4.1 Designer's Toolkit

Designer's Toolkit is a web application used to browse design methods and create sprint plans, see figure 2.3. The main target demographic for this toolkit are interaction designers. A key feature in this web application is the ability to create design sprint plans. This is done by adding design methods under a design phase, see figure 2.4. The toolkit follows the triple diamond design process, thereby there exists six phases in a design sprint plan in the web application.
This toolkit was created as a student individual project minor at the Interaction Design and Technologies masters program at Chalmers University of Technology. The purpose of the web application is to provide the user with a variety of design methods for each phase in the triple diamond design process. The user can browse and search for design methods in this toolkit. The web application also provides various tools to help the user search and filter methods, see figure 2.8.

In the context of this thesis, this web application will be used as a starting point to further develop features to support collaboration work. This will be done by developing additional features to the web application to support teams of designers to set up design sprint plans together.

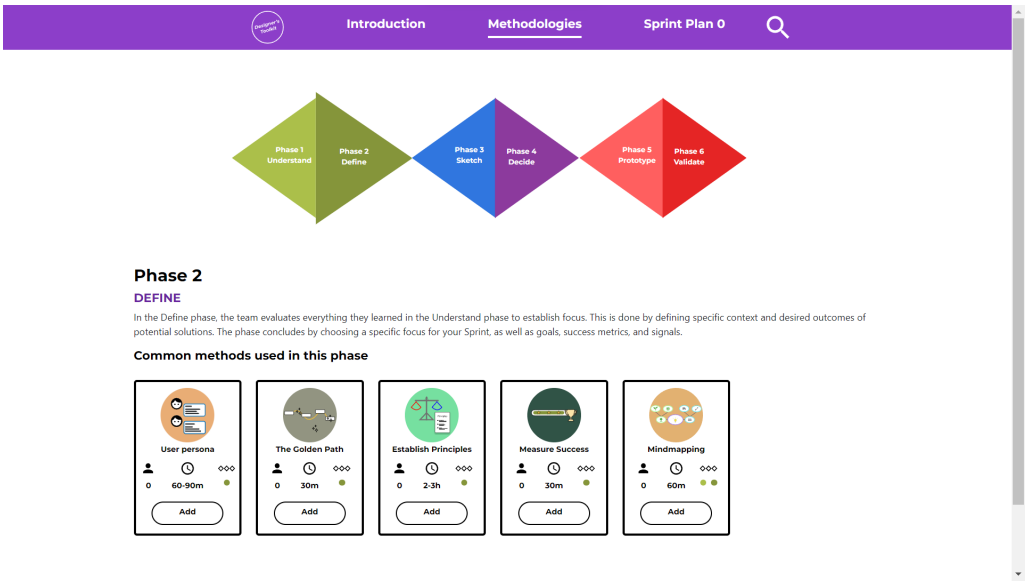

Figure 2.3: Designer's Toolkit

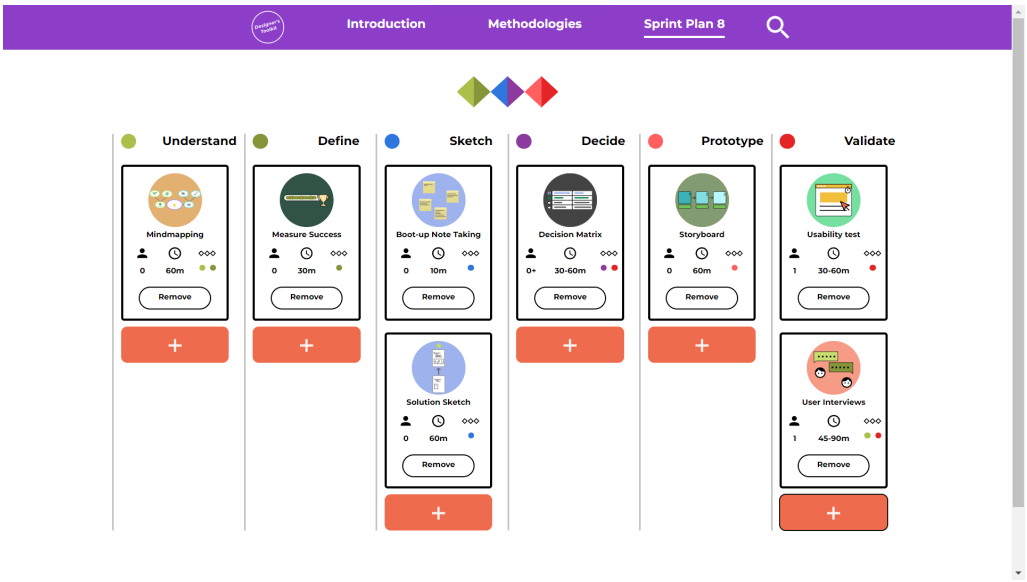

Figure 2.4: A sprint plan which a user has created in Designer's Toolkit

Method Cards

The method cards are used to present design methods in the web application, see figure 2.5. They contain an image representing the design method, a title of the method, followed by three parameters:

- Amount of participants needed
- Estimated time to conduct the method
- Applicable phases

When pressing the Add button, the user is presented with a drop down menu con-

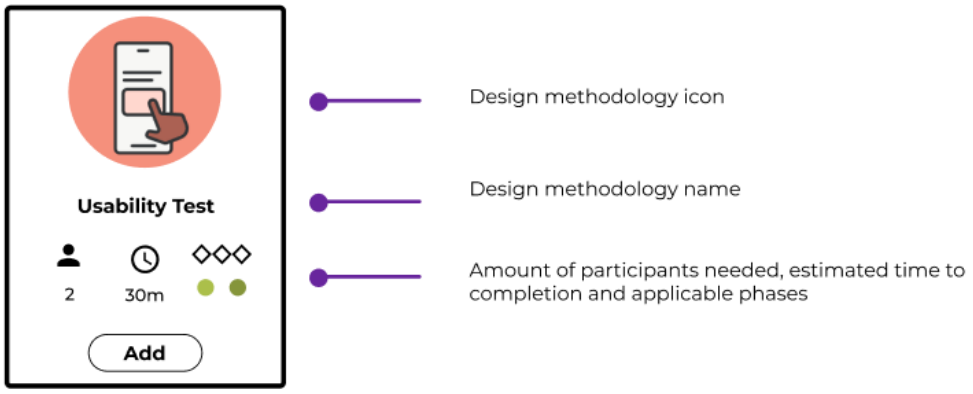

Figure 2.5: A design method card which shows the amount of participants needed, time to conduct and applicable phases

taining the applicable design phases, see figure 2.6. When clicking on one of the check boxes, the method card will be added to the sprint plan under the selected phase.

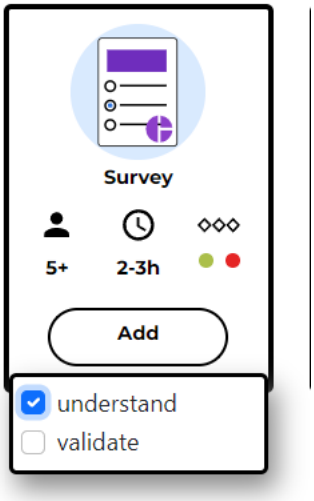

Figure 2.6: A drop down menu showing the phases that a user can select for a design method

Method Description Page

When clicking on the image on the method card, the user is taken to a description page, see figure 2.7. This page includes a description of the design method and step by step instructions on how to conduct the design method. They also contain the three parameters seen in the method cards.

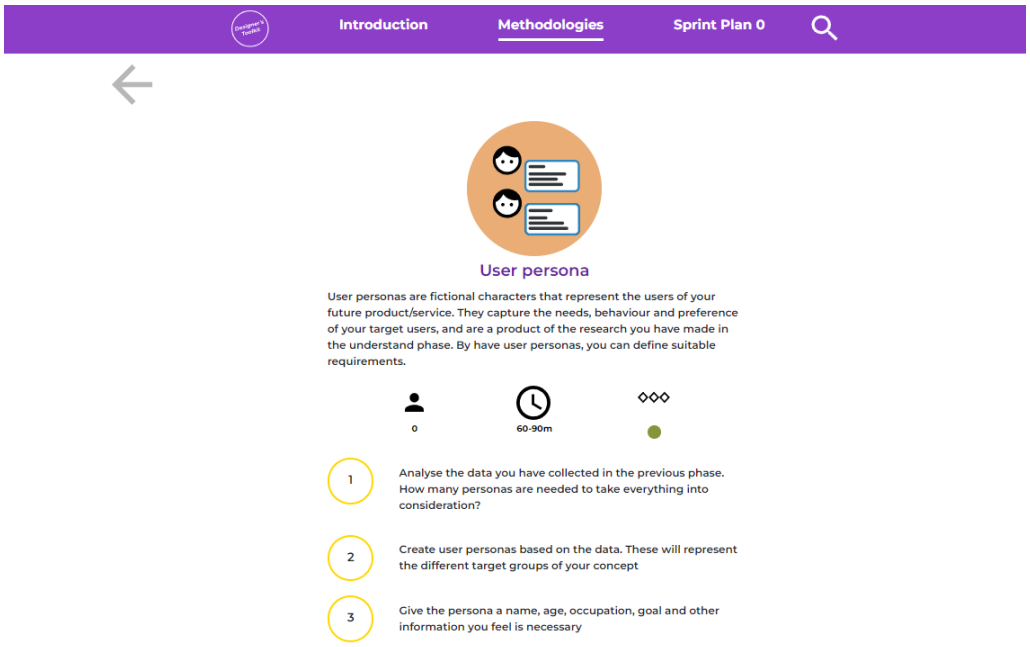

Figure 2.7: A sprint plan which a user has created in Designer's Toolkit

Search and Filter

The web application also has a tab for the user to search for and filter design methods, see figure 2.8. In this drawer, the user can search for the design method by name. The user can also filter by the three parameters that the method cards have.

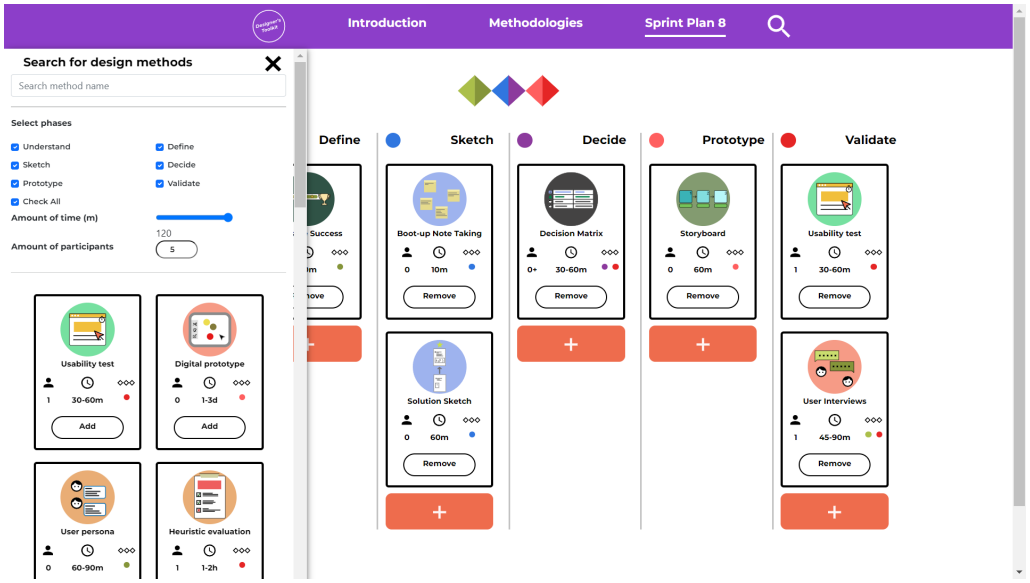

Figure 2.8: A drawer menu to the left which can be used to search and filter design methods

Technical details

The web application was built using JavaScript with the React framework. The MeteorJS platform was used to create the application. MeteorJS has a built in account system which allows for the developers to easily implement an account system in their web applications. MeteorJS also uses Galaxy Hosting which allows developers to build and deploy their web application for free on a limited storage server.

3
Theory

This section will go through the underlying theories behind this research work which will be used during the project. The chapter begins by defining user experience, which focuses on the hedonic and pragmatic qualities in UX. Furthermore, a definition of interaction design is given to understand the demographic being designed for. The chapter continues with examining research behind collaboration and a collaboration framework. Finally, the various ways of structuring a design process is presented. This is essential in our toolkit as the users will follow a specific design process when creating a design sprint plan.

3.1 User Experience

User Experience (UX) is a broad concept and has different definitions for both people who do research within UX and people who practice UX (Lallemand et al., 2015). By the ISO 9241-210 definition, User Experience is defined as "user's perceptions and responses that result from the use and/or anticipated use of a system, product or service" (ISO9241-210, 2019). A couple of notes are added to this definition. The first denotes what the users' perceptions and responses are. They are the following: emotions, beliefs, preferences, perceptions, comfort, behaviors and accomplishments. These are perceptions and responses that occur before, during and after use of a product. The second note details three aspects that result in UX. The first is the system itself (functionality, performance, brand image etc.). The second is the users physical and internal states which are a consequence of prior skills, experiences and personality. The third is the context in which the system is used.

In trying to understand how people experience products, Hassenzahl (2003) draws a model which presents user experience and its key elements. He identifies two key attributes of a product's character, the hedonic and pragmatic attributes. The pragmatic aspect is about the product's usability, which is about the products functionality and efficiency to use. The hedonic quality is about the users emotional relation to the product. Hassenzahl (2003) writes about the emotional attributes as follows:

- *Stimulation*, the products ability to invite the user to interact with it through interaction style.
- *Identification*, the products ability to let the users express themselves
- *Evocation*, the products ability to provoke memories

This chapter will further look into how designers can measure the hedonic and pragmatic qualities of a product.

User Experience encompasses many different fields, see figure 3.1 (Saffer, 2010). It overlaps with fields such as Architecture, Information Architecture, Human factors, Interaction Design etc. The particular field that the present research will focus on is Interaction Design.

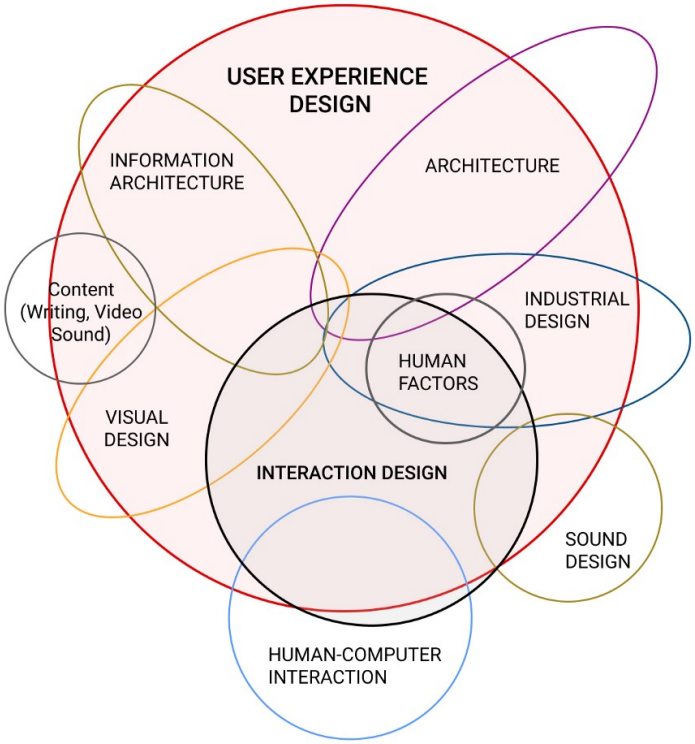

Figure 3.1: User Experience correlation with various fields

3.1.1 Interaction Design

Interaction design is a subset of User Experience as seen in figure 3.1. The target demographic of the web application being developed in this thesis are people who work within interaction design. Therefore it is important to cover what the field of interaction is. By the definition of (Sharp et al., 2019, p. 9), interaction design is "designing interactive products to support the way people communicate and interact in their everyday lives". They elaborate further by saying that interaction design is about creating user experiences with the intention of enhancing peoples communications and interactions. Thereby presenting the relation to user experience.

Similarly, (Winograd, 1997, p. 6) defines interaction design as "designing spaces for human communication and interaction". This definition also places an emphasis on communication, similar to the definition by Sharp et al. (2019). Another definition by Saffer (2010) states that interaction design is "the art of facilitating interactions between humans through products and services". Compared to Winograd (1997) this definition incorporates art into the definition of interaction design.

By the definitions above, interaction design is about facilitating interaction between humans and products. To achieve efficient interaction with the products, interaction designers look at the products usability. Hassenzahl (2001) broadly defines usability as the quality of use. However, he also argues that there is another aspect to the quality of use which is neglected, the hedonic quality of a product. He therefore looks at the pragmatic and hedonic qualities of products.

3.1.2 Hedonic and Pragmatic Qualities

When designing an interactive product, an important aspect to keep in mind is ease-of-use. The designers should aim to achieve optimal operability in their interactive products. Not only the ease-of-use is a major factor, but also the hedonic quality of the application is important to the users (Schrepp et al., 2006). A model was created to show how the pragmatic and hedonic qualities influence the users perception of an interactive application, see figure 3.2 (Hassenzahl, 2003). The model splits the interactive products aspects into the following:

- The product quality intended by the designer
- The subjective perception of quality and subjective evaluation of quality.
- The independent pragmatic and hedonic qualities.
- Behavioural and emotional consequences.

Previous research has applied the model and have shown that the pragmatic and hedonic qualities both contribute equally to an interactive products attractiveness (Hassenzahl, 2004).

Hassenzahl investigates the interplay between the pragmatic (usability), hedonic (stimulation, identification), goodness (satisfaction) and beauty attributes (Hassenzahl, 2004). He argues that the satisfaction people find in a product relies on both the pragmatic and hedonic qualities. On the other hand, the beauty aspect of a product relies on identification, which is a hedonic aspect.

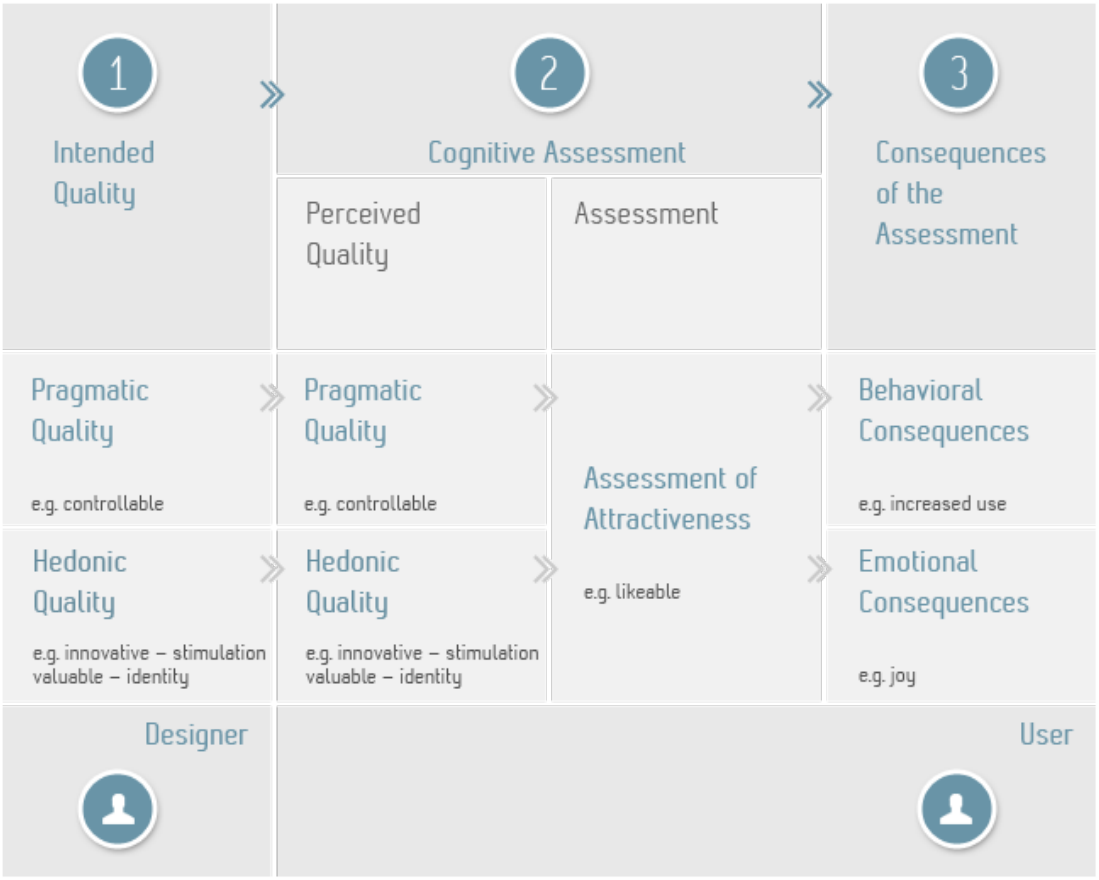

Figure 3.2: Workmodel of AttrakDiff

Hassenzahl has further stated the importance of the hedonic quality in a product for the overall user experience (Hassenzahl, 2006). However, Karapanos (2012) states that the user experience changes overtime. The beauty of a product might initially be important, but that aspect does not necessarily promote long term use of the product (Karapanos, 2012). Similarly, Minge (2008) finds that the hedonic quality is indeed important within the user experience of a product. However, the users will overtime tend to appreciate the pragmatic qualities more and neglect the hedonic qualities. Meaning that the usability should be focused on for long term use of a product. The present research will however, not focus on long term use and therefore, looking at pragmatic and hedonic qualities are equally valuable.

3.2 Collaboration

Collaboration between people can be complex and this chapter breaks down this interaction to gain a deeper understanding of how it works. First it will go through a collaborative framework to have a baseline for how collaboration appears in the context of a design application. It will later move on to investigate different levels of collaboration and how it can be defined and compared.

When collaborating in an application over the internet it can be hard to know what the rest of the team is doing. A common way to solve this is notifications and there are ways to optimize this (Powell et al., 2021). Notifications are often essential for communication in a collaborative application but they can be used too much and lead to the user losing focus and depending on what the notification is about, it can also impact the user's emotional state (Ardissono & Bosio, 2012).

3.2.1 A Collaborative Design Framework

To verify the collaborative design for the web application made in this project a collaborative framework will be used. The framework chosen is the one presented by Meroni et al. (2018) because it is relevant to interaction design and the design process. It also has a graph to visualize how the collaboration looks like, this helps to understand and later analyze it. The framework from Meroni et al. (2018) can be seen in figure 3.3.

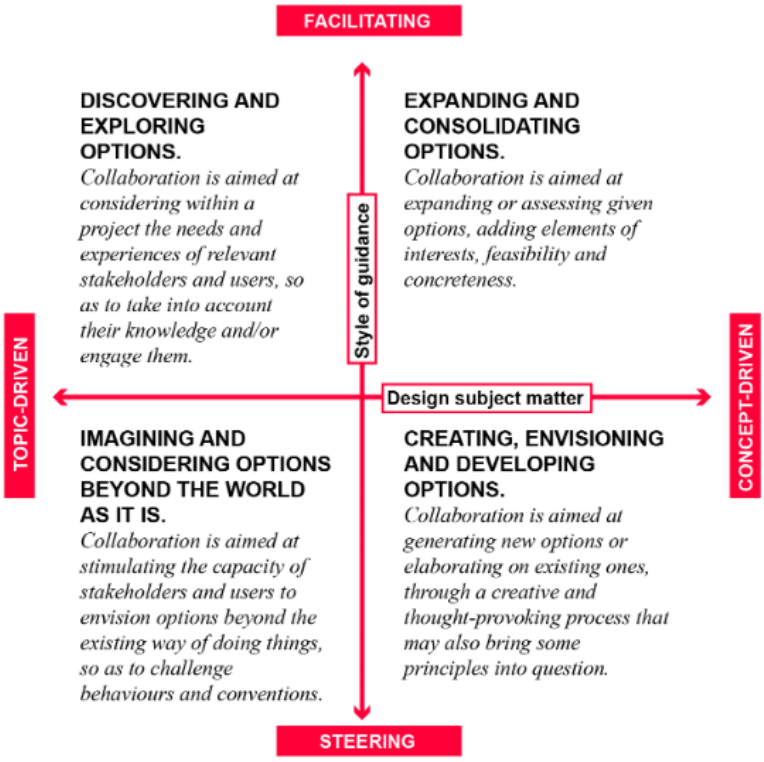

Figure 3.3: A framework for collaborative design

The idea of the framework in figure 3.3, created by Meroni et al. (2018), is that it measures the collaboration in two dimensions represented by two axes. These dimensions being *style of guidance* and *design subject matter*. The *style of guidance* axis stands for the different ways to conduct activities. In one end of the axis is the *facilitating*, which means more based on user opinions and the other is *steering*, which is more based on expert opinions. The other axis is the *design subject matter*,

where the focus of the design process will be determined. The simplest way to explain this axis in relation to this project is to compare with the triple diamond where the earlier the phase is the more *topic-driven* it is. This also means that the later a phase is in the process the more *concept-driven* it is. The reason for this is that the earlier stages are more focused on inspecting the problem and situation while the later stages are more focused on how to come up with a solution for problems and situations identified.

The two axes makes a graph with four quadrants. These quadrants are also defined by Meroni, Selloni and Rossi and can be seen in figure 3.3. The framework shows how collaboration can be used for each quadrant.

3.2.2 Levels of Collaboration

To be able to measure the success of this project it will be advantageous to be able to measure the the level of collaboration. To do this, the different levels of collaboration needs to be defined and there needs to be a change in collaboration between each step. In Aaltonen et al. (2018) they suggest a four level model for collaboration and in Frey et al. (2006) they suggest a five level model. These models are both detailed with how the different levels are defined but a few of their levels are slightly irrelevant for a model in this project. The 3C model presented in Fuks et al. (2008) presents a three level model for collaboration but has less levels. Therefore the decision is to go with the model from Coleman (2012) which is a five level model that includes the same as the previous one but one extra level for each extreme. The five level model by Coleman (2012) can be seen in figure 3.4.

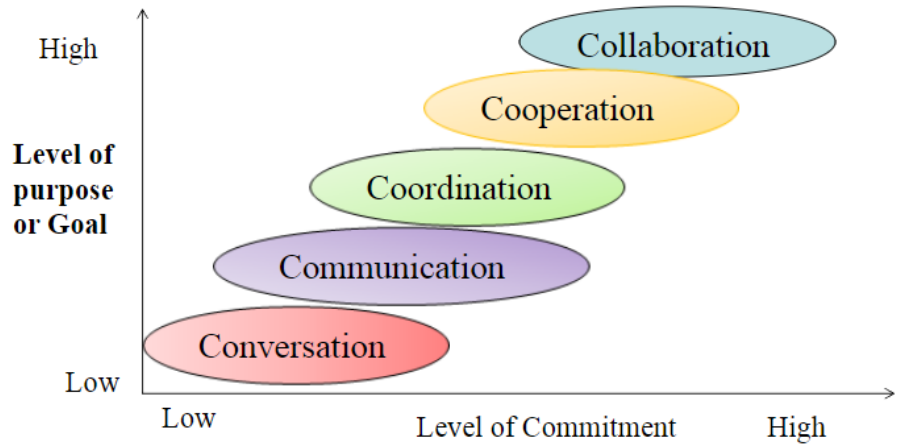

Figure 3.4: Five level model of collaboration

The five level model of collaboration seen in figure 3.4 starts with *conversation* which is the level where no work is physically done nor discussed within a team. The second level is *communication* and includes the discussion of work but nothing more. The third level of *coordination* refers to when the team is planning the dynamics of how to perform a project. *Cooperation* is about how a team is planning their physical work together to later perform the tasks. The last level is *collabora-*

tion and aims to share knowledge in order come up with integrated strategies for how to best perform a project.

This framework can be used to measure and compare the level of collaboration in products. In this project, the framework will be used to explore what level of collaboration can be reached for the user studies. This will be done through comparison with the definitions of the different levels and if they are reached or not during the user study.

3.3 Structuring a Design Process

The triple diamond design process is as the name suggests a design process containing six phases. There are various definition of the triple diamond design process. The one that will be used in this project is the one designed and used by Google Design Sprints (see figure 3.5). This is one way of structuring a design process. However there are many other different ways. For example, *design thinking* follows similar phases as the triple diamond design process however the process is non-linear (Interaction Design Foundation, 2022a).

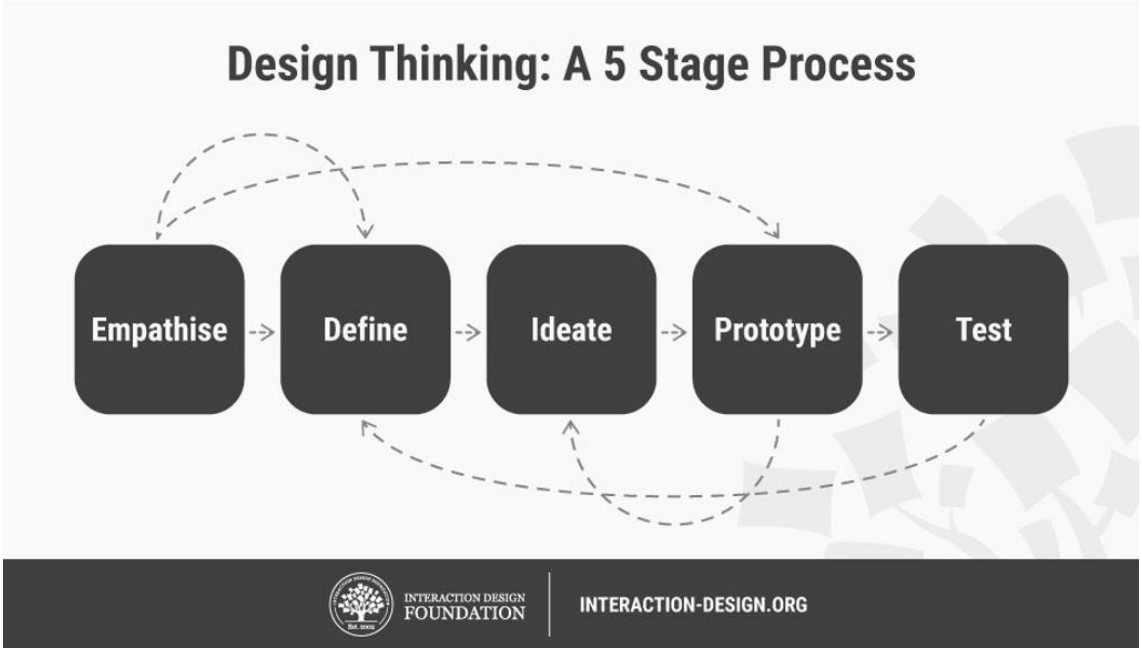

Figure 3.5: Design thinking design process

Research through design is a part of every design process that aims to research a new area. The issue with research through design is the lack of scientific verification of the theory. This can be seen as a flaw in theory, but as Gaver (2012) mentions, it can still achieve great results with the help of more qualitative approaches and not following detailed design examples.
The triple diamond process seen in figure 2.2 in section 2.4 is a design process used and created for design sprints by Google (2022). It is a framework and it helps

designers to structure their design process. In Google they refer to it as a design sprint, because they often work in sprints. The triple diamond consists of six phases that will guide the designer to more consistent results. Each phase has its own goal to make the process simpler to understand and execute.

In Marin-Garcia et al. (2020) they created their own variation of a triple diamond process based on the double diamond process, see figure 3.6. At first glance it looks similar to the one Google made. However, the triple diamond by Google is based on the five day sprint presented in Knapp et al. (2016). The idea and structure of both processes look the same, the main difference between them being the naming and definition of various phases in the process as well as the complexity.

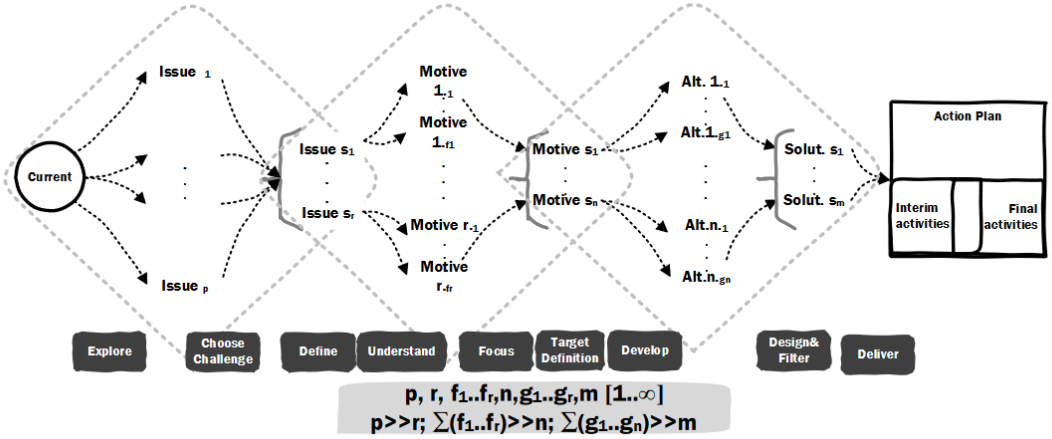

Figure 3.6: A variation of a triple diamond

4
Methodology

In this chapter, the relevant methodology behind the design process and the design methods will be brought up. It will go through each phase in the triple diamond design process and why it was chosen for this project. Then all methods corresponding to each phase will be described followed by the relevant methodology. All methods described in this chapter does not necessarily have to occur during the execution of the project, this is merely the planned methods and their methodology.

4.1 Design Process of the Project

The design process is a central part of any interaction design project and there are a few ways of structuring it, e.g., design thinking (Interaction Design Foundation, 2022a), double diamond (Design Council, 2004), triple diamond (Google, 2022) and Jones model (Jones, 1992). This project will follow the triple diamond process (Google, 2022) as it seemed natural to apply the same design process as the Designer's Toolkit 2. Another reasoning for choosing the triple diamond is that it is intuitive because it is detailed with six steps, making each phase more specified and less mixed. It was also chosen to make it simpler to explain for the user study participants how their work will contribute to our project. This is because they will use the triple diamond when working in the application. The design process will be divided into two iterations overall, meaning the triple diamond will be performed twice throughout the project.

To understand how the process will look like, Figure 4.1 was made. Here both the iterations can be seen as well as all methods performed in each phase for each iteration.

The first iteration will not be based on user feedback but instead it will function more like an expert evaluation of the product. This is done in order to give the product more ways collaborate in as Designer's Toolkit was not designed for this before. That makes it possible to let users try out the product and give feedback on how they experienced it. To do this the plan is to host a user study, where the user experience during collaborative moments looks like. The feedback gathered from this study will be the base of data for the second iteration.

The understand phase of the first iteration in this project starts by making collaboration personas, where the results is expected to give an understanding of how

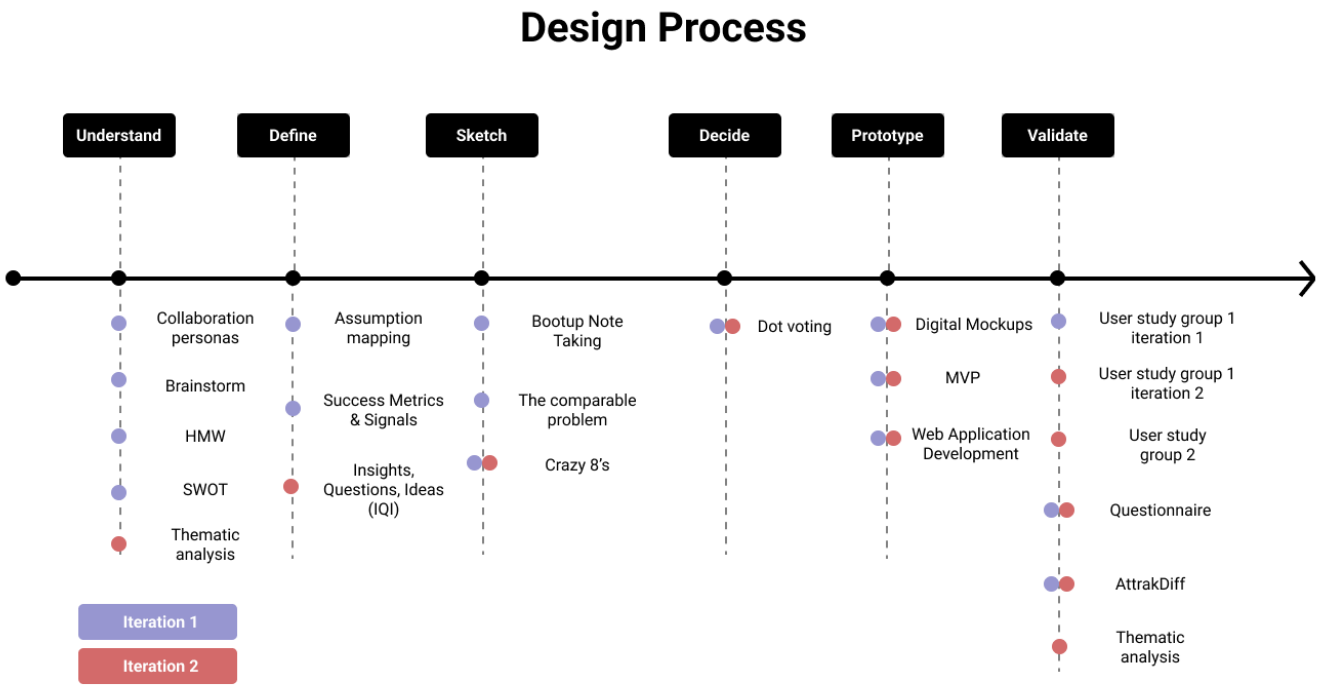

Figure 4.1: The design process

users could interact with each other in the product. This is followed by a brainstorm to increase the amount of ideas on how collaboration could look like in the product. Following this, the method of how might we will bring up pain points to consider. To finish the understand phase a common SWOT analysis will be made, this always gives a broad understanding of the product. For the define phase the method of success metrics and signals will be done based on the ideas from the brainstorm. This will lead to the ideas becoming more processed and refined. On top of this the method of assumption mapping will be done in this phase. The idea is that assumption mapping will allow the team to explore the assumptions around if the product is desirable, viable and feasible. To move on to the next phase and sketch the ideas, the method of crazy 8 was chosen as it is fast and produces a large amount of variations of an idea. To make the the crazy 8 more efficient the complementary methods of boot up note taking and the comparable problem was chosen. These methods helps in getting into the right mindset and inspire the team before conducting a crazy 8. For the decide phase dot voting will be used to pick what ideas to keep developing. To then prototype these ideas, digital mock-ups will be made. These mock-ups will illustrate how the product will look like as a MVP, minimal viable product. When the visualization of the product is done it will be developed as an web application. The last phase of validation will then start with a user study where data will be collected through questionnaires and observations. On top of this, attrakdiff will be used to collect the data it needs to visualize the usability.

The second iteration will start will a thematic analysis where the goal is to get an understanding of the data collected from the validation in the first iteration. After having understood that data better the IQI method will per conducted to structure the processed data by sorting it into the three categories insights, questions and signals. After the data have been defined into these categories they will be sketched through a crazy 8. This will produce a bunch of small concepts that needs to be finalized into a big one. This will be done through digital mock-ups. To then decide what to develop into the web application, the method of dot voting will be used again. When the chosen concepts and ideas have been developed, it will be validated with a second user study by the same group that did the first one. This is to gain an understanding of how they perceived the changes to the product. To make it even more authenticating a second user study will be done with completely new users to the web application. This way new users' experience with the new concepts can be validated as well. For both of these studies, the users will be given the same questionnaire and an attrakdiff to fill out. There will also be an observation done, to gain extra data from both the studies and to not miss any important aspects.

4.1.1 Understand

The first phase of the triple diamond is the understand phase. The goal of this phase is to build up an understanding of the topic and the circumstances around the initial project idea. It is of importance for all members of the team to not only find new knowledge but to also share knowledge found between other members.

Literature Research

Literature research is the process of identifying and reading literature relevant and essential to the topic. It aims to organize and map the collected literature in order to get a better overview of the topic (Rowley & Slack, 2004). This process is done in the start of a project, as it brings knowledge and therefore facilitates the rest of the project.

The main advantage with a literature research is the knowledge gained from it, but also the structural understanding of what has been covered (WSU, 2017). This helps in taking wiser decisions when creating something unique in the field as well as not missing out on literature in certain areas relevant to the topic. Literature reviews can be overwhelming in the amount of knowledge available and therefore it can be difficult to choose what to include and not. One way to deal with this is to start by finding a modern and relevant paper that has the same topic and go through their references as a base. This works as long as the field that is reviewed is not brand new and there would be no text to start with.

It can be a challenging task to make a literature study and without any guidelines the higher the risk is of the quality being worse. Therefore, the guidelines

presented in Snyder (2019) will be taken into consideration when conducting the literature research with the intent to increase the quality of it.

Collaboration Personas

Collaboration personas are similar to personas but with a redefined purpose to fit the a collaborative environment with multiple users (Matthews et al., 2011). As with regular personas, the intention is to capture the essence of a certain user/ user group based on research. Personas are created in order to understand the users' needs, experiences, behavior and goals (Interaction Design Foundation, 2022c). These personas are useful when evaluating interfaces with one user in mind at a time. This brings us to collaborative personas. These are employed when designing for collaborative interfaces where multiple users are involved. Collaborative personas focus more on the interrelations between group members instead of an individual user. There are three main attributes of collaborative personas which are:

- **Group goals**: Identifying the common goal between every group member
- **Group work style**: How each member in the group works with other team members. This is the interrelations aspect
- **Collaboration needs**: These are the needs for the group in order to achieve the group goals

As the research question is centered around collaboration among interaction designers, methods that focus on collaboration are highly relevant as they help in creating knowledge around the topic. The more that can be discovered about the research area, the more likely it is to gain meaningful results.

Brainstorm

Brainstorming is a common method in the ideation phase of a design project. It can be divided into seven step, as suggested by Kelly (2001). The first being sharpening of the focus by setting up a clear problem statement. The second step is to apply playful rules, meaning it is beneficial to encourage wild ideas and not allowing criticism of these ideas. The third step is to focus on the quantity of ideas produced rather than the quality of them. But it is also about bouncing between ideas, to avoid getting stuck. For the forth step flexibility is important. Pick an idea fast and continue with it. But if the flow stops, simply go back to another idea or branch out to something else. To make use of the room or virtual space your in is the fifth step. The sixth step is to make the group get familiarised and more comfortable with each other, especially if they have never worked together before. The last step is to not only use words when suggesting ideas, but to also include quick sketches.

The method of brainstorming can be used in multiple scenarios, (Wilson, 2013, p. 5) suggest five times to use the brainstorm method. These are to generate ideas, to find solutions to problems, new ways to do do old things in UI, to explore new design spaces and to make a product team be on the same level.

In this project brainstorming will be used in the understand phase, where the goal is to generate ideas and possible solutions to the collaboration problems in the application. One advantage with brainstorm is the amount of ideas that can be produced (Kelly, 2001). Although all ideas might not be valuable, some will be and they might even be the start of the final solution to a problem. It can be difficult to get started, but following the guidance from Kelly (2001) should make it simpler. Brainstorm is from the start a neutral method in the sense that it depends on an area to brainstorm over. This makes it adaptable to fit in almost any project, as long as there are areas that needs to be ideated around.

How Might We

How Might We (HMW) is a method for the understand phase as it breaks down problems to facilitate future ideation in these areas. The goal with how might we is to understand potential challenges by identifying opportunities (Gkatzidou et al., 2021b). These opportunities will expand the perspective of the group and prevent premature solutions. The method itself is performed by identifying pain points and writing ideas and opportunities on sticky notes.

A common mistake is that users directly come up with solutions instead of listing the opportunity. Even if it is a narrow opportunity it can be a problem, as the narrow opportunity might not leave much room for creative solutions. In the perfect scenario according to IDEO.ORG (n.d.), when HMW is properly performed, it does not give a perfect solution but instead a frame for innovative thinking.

In this project, HMW will be used in the first iteration during the understand phase, where the results will be used to expand the understanding of what needs to be improved in the product and how the collaboration possibilities within the application can be increased.

SWOT Analysis

SWOT analysis, *Strength Weakness Opportunity Threat*, is a method commonly used to identify a products current state in the market and to make strategic business planning (Benzaghta et al., 2021). It identifies the strengths, weaknesses, opportunities, threats to a product and uses this information to take more well informed decisions of what needs to be improved and what is working right now. This way the focus will become something new and original instead of reproducing the work of someone else.

A drawback with SWOT analysis is that it does not rank the importance of the collected information. This can lead to problems in correctly identifying what is most important to focus on and what changes would have the most impact. This drawback can be dealt with by using any supplementary ranking method. The benefits of the method is that it provides knowledge of improving considerations

in relevant areas. In the scenario of these considerations being overwhelming in quantity, a method of ordering them in priority can always be done.

It is most common according to Benzaghta et al. (2021) to use SWOT analysis in areas such as general managing, education, marketing, healthcare and agriculture. However, this does not mean that it is not useful for other scenarios, (Nunnally & Farkas, 2016, p.192) suggest it as a common method in a user experience research scenario. Therefore it will be used in the understand phase during the first iteration, to gain an initial understanding of how the situation appears.

Thematic Analysis

This method is about familiarising with the data to identify different themes within the data. These themes will be analysed and the analysis will then be reported. According to (Braun & Clarke, 2006, p. 87) the process of a thematic analysis can be divided into six steps, familiarising yourself with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes and producing the report.

To be able to extract valuable information from the data that is collected through interviews and observations during the user study, the method thematic analysis will be used. The form of the data collected is assumed to be in mostly qualitative data, which thematic analysis can handle well (Caulfield, 2019).

4.1.2 Define

The second phase of the triple diamond is the define phase. This phase is focused on evaluating the knowledge learned from the understand phase to organize project's future direction. Commonly this is done through identifying the context and finding the desired outcomes of the envisioned product.

Assumption Mapping

Assumption Mapping is a methods recommended in Google (2022) for the define phase. It aims to explore assumptions that the designer team has within the the areas of desirability, viability and feasibility. After exploring these areas a map is produced to visualize the areas where the assumptions exists. Different areas on the map requires different approaches to handle the assumptions in an appropriate way. By sharing assumptions in this method, the designer team gain shared knowledge in how to continue the project.

The advantage of using assumption mapping compared to other methods in the define phase, is that it is more thorough and digs deeper into the ideas. Hence, it produces processed data that is more refined than it would be after using other methods. The disadvantages are that it takes more time and effort to perform. In addition it sometimes has areas focused on the business side of things, which is irrelevant for us. Nevertheless, it has enough upside to be worth a consideration.

Success Metric & Signals

This method is can be used for the define phase of the triple diamond. The goal of the method is to get everyone in the group to have a common understanding of the project goals and how to reach them. It aims to come up with metrics that defines when parts of a project is successful or not. The data collected for this method can both quantitative and qualitative, dependent on the the metric.

Compared to other methods recommended for the define phase by Google (2022) such as Design Principles or Future Press Release, Success Metric & Signals is less focused on the business aspects. Although the other methods would also help in defining the problem, they would define it in areas that is less relevant for this project. Therefore is Success Metric & Signals a suitable method for the first iteration of this project.

Insights Questions Ideas

This method is recommended by Google (2022) for the define phase. It aims to make use of the data collected in a structured process to ideate around solutions, instead of jumping to conclusions and mistreat the data. To accomplish this, the method has three categories that identifies three different aspects of a product, insights, questions and ideas. By separating into these three categories it gives the designers a structured way of looking at the data.

To make the most out of the method all three categories should be considered at once. This is to make it easier to tell them apart, which leads to a better understanding of the differences. It also stops the team from taking premature decisions that can lead to a misrepresentation of the data.

4.1.3 Sketch

After the define phase in the triple diamond design process comes the sketch phase. This phase is for starting to make ideas come to reality. It is also a phase where alternative solutions are explored and the focus is to expand on how to solve the defined problems.

Crazy 8

The method crazy 8 (Google, 2022) involves sketching in a fast pace to come up with multiple solutions to a problem. More in depth, it require the designers to sketch eight different ideas in eight minutes. It is important to move on to the next idea after each minute in order to not lose valuable time on the next, even if the current one is incomplete or empty. This is to push the designer to not overthink and just write the first idea that comes to mind.

Crazy 8 is an effective way of coming up with multiple ideas in a short amount of time according to Gkatzidou et al. (2021a). In this project, crazy 8 will be

used to come up with ideas in the sketch phase on how to implement collaborative functionalities in the interface of the application. The ideas that are created are on a concept level and need refining to become complete sketches. But the more concepts that have been consider the more likely it is to find a more optimal solution in the end.

Boot up note taking is a method for the sketch phase. It works as a preparation method to Crazy 8 where ideas and plans are collected to know what to sketch. This is to make sure that what is needed to be sketched get sketched and nothing is left behind. To not miss any ideas or sketch irrelevant ideas, this is a method that will be performed before any Crazy 8.

The Comparable Problem

Another method for the sketch phase that Google (2022) recommend is the comparable problem. This method is a way to expand on knowledge of how similar products that already exist work and take this into account when sketching for a solution. It is a type of warm up for sketching as it sparks ideas of how solutions might look like.

For the project, this will be useful before making a digital prototype or making Crazy 8's. By taking inspiration from existing products, the designers can more easily get into a creative mindset. It will be useful in the start of the sketch phase for both iterations of the project.

4.1.4 Decide

The next phase in the triple diamond is the decide phase. This phase is dedicated to decide what solution to move on with or how to combine solutions. It aims to get the opinion of each individual for each solution, this way the team can form a consensus and find the optimal solutions.

Dot Voting

There are multiple methods for deciding what solution to move on with. Since this project only consists of two persons, the decision is to go with dot voting from Google (2022). Dot voting let each member of the team put out dots next to the solutions they want to proceed with. This method allows the team to see what the others think and then a consensus can be formed after a short discussion.

4.1.5 Prototype

The fifth phase of the triple diamond process is the prototype phase. The aim is to create the prototypes and mock-ups of the solution that was chosen in the previous phase. For this project, this is also where the development of a the prototypes and mock-ups will occur.

Digital Mock-ups

To be able to create higher fidelity prototypes we will use the method of digital mock-ups. This will be done in Figma and it is a way to try out design ideas before actually implementing them in the application. By doing this, changes to the design can be made faster and time can be saved in the implementation part of the project (Rooks, 1998). The prototypes are supposed to act as a temporary template for implementation of design changed to the interface.

A MVP is a product that has the minimal amount of features a needed to accomplish the main goal of the product and nothing more according to Interaction Design Foundation (2022b). A MVP can complement digital mock-ups since it identifies the minimal requirements for a product, which is the opposite of adding features. By mixing these methods, the product can find a sweet spot in between, where it has collaborative features but they are all necessary for the best collaborative user experience in the tool.

4.1.6 Validate

The last phase is the validate phase, where the prototypes will be evaluated. This is where the prototype or in this case the web application will be tested by the users. The feedback from this phase will determine the results of the triple diamond design process.

User Study

When conducting a user study, it is important to be aware of the planning it requires. It is easy to rush the process and end up with unreliable results. For this reason, the methodology and concepts of how to conduct a study, presented by Tellis (1997), will be considered throughout the study. With this in mind, the results should become more valuable and accurate.

In a user study it is crucial to have the user in center and let their opinions be heard. Therefore they will be left alone during the study to not intervene with their thought process and collaboration. This is not enough to assure their opinions will come out in the end since research bias during the observation can impact the results. To ensure researcher bias is reduced it should be recognized and minimized as much as possible according to Campbell (2015).

A user study will be conducted during the validate phase of both the first and the second iteration of this project. The goal of this is to gain data that will be crucial when evaluating the application. To be able to compare the user study in the evaluation and to give the participants a less stressful schedule it will be split into two parts. The first part will take part after the first iteration and consist of the first three phases in the triple diamond, where the users spend an estimate of one hour on each phase. Changes can then be made to the application during the

second iteration before the second part of the user study and that should reveal the impact of these changes. The second part will be identical, the only difference being that they perform the last three phases of the triple diamond instead of the three first.

The user study will include a group of interaction designers whose goal is to perform a design sprint together, collaborating in Designer's Toolkit 2. The users will be handed a defined problem and be given the task to solve it using the web application. During the time the users are working, they are asked to think aloud and describe their thought process. These thoughts alongside with observations will be noted down during the session and a recording, if allowed by the users, will be made to avoid to miss or forget something of importance. When the group is done with the three phases, the participants will be interviewed in a short semi-structured interview and have to answer an Attrakdiff form.

Interviews

Interviews can be used for various reasons throughout a design process. All of which lead to the same goal, to obtain opinions and thoughts of the person/persons interviewed. This data can later be analysed and valuable information of user experience can be extracted. The way to host an interview can look different depending on the situation. In Sharp et al. (2019) they mention four main types of interviews, unstructured, semi-structured, structured and group. Unstructured interviews are not planned by the interviewer more than what topic should be brought up. This often lead to more open discussion where the results is long and more unpredictable. This can be useful when looking for a deep understanding of a topic. Structured interviews are done by asking predetermined questions with a predetermined pool of replies. The questions are formed in a way to gain data about specific topics. Semi-structured interviews are a combination between the other two, where the questions are both closed and open their formulation but the answers from the interviewees are allowed to branch out a bit more. The same topic are asked to each interviewee but the questions asked can be personalized. Group interviews are held with multiple interviewees at the same time, where they different point of views can be discussed. This can lead new discoveries by discussing different perspectives, these discoveries might otherwise never have been found.

In this project, interviews will be used to evaluate the user experience from the user study that will be held. A semi-structured interview is reasonable as it leave more tangible data while still allowing the user to express deeper believes that they might have experienced during the user study. This in combination with observations should leave enough data to be able to conduct an analysis with a rigorous result.

Observations

The idea of observations is to inspect users when they perform a task and take notes of problems that occurred or surprisingly did not. These notes often work as a good complement to interviews, one reason for this is that it provide an outside perspective of the situation. It is important not to intervene with the participants, but to just observe what is happening, as it otherwise can impact the actions of the participants (Jim Ross, 2018).

To collect data throughout the user study is the main reason for using the method of observation in this project. The data will be collected during the user study will later be analysed in a thematic analysis. Another reason for using observations are to compliment the data gathered from the interviews that will happen after the user study.

During the observation the participants will be asked to use the think aloud protocol, where they say everything that come to their mind. This technique can be demanding on the participants, but since the users are interaction designers the assumption is that they will have some experience with this technique and that it will not be an issue for them to perform it properly. However, in accordance with Martin & Hanington (2012) it is important when planning a think aloud session not to directly evaluate the usability of the whole web application but instead evaluated individual aspects of it.

Questionnaire

To collect data from users is an essential part of understanding their point of view and improve their experience. Questionnaire is a method for coming up with structured questions in order to collect data within certain areas. In accordance with Sharp et al. (2019), semantic differential scales are often used in questionnaires and they let the user pick an answer in a range of values between two attributes. This produces quantitative data but depending on how it is structured the data can be quantitative, qualitative or both.

Questionnaires in this project will mostly be used to collect qualitative feedback for collaboration features that has been added. It will also be used to confirm or collect data for some methods that needs it for later evaluation. Another use will be to collect the general collaboration experience of users and attempting to be able figure out how it can be improved.

A questionnaire is always written in advance and can not be adapted to the situation and the potential of flexibility is lost. This can make the element of discovery hard to achieve according to Gillham (2008). the contrary, questions can be carefully formulated to acquire specific answers. It takes the users less time to fill it in compared to interviews, as they do it simultaneously. Hence, more data can be collected in less time.

Measuring Hedonic and Pragmatic Qualities

There are multiple questionnaires that have predefined questions to measure hedonic and pragmatic qualities. Such tools are QUIS (Chin et al., 1988) SUS (Brooke, 1996) and AttrakDiff (Hassenzahl et al., 2003). The advantage with Attrakdiff compared to the former two is that it automatically provides a visualization of the data it collects and is a more recent model. This makes it simpler to compare the first iteration with the second. It is also used by experienced UX researchers.

AttrakDiff uses a semantic differential as a measurement scale consisting of 28 questions in total about the pragmatic and hedonic qualities of an application. The are phrased as bipolar adjectives such as "Strong - Weak", "Fair - Unfair" or "good - bad". The user has to choose how much it leans to either of the adjectives by selecting a point on a seven point scale. See figure 4.2 which shows an example of the layout of the AttrakDiff questionnaire. The qualities measured by the questionnaire are represented as the following:

- PQ: Pragmatic Quality
- HQ-I: Hedonic Quality - Identification
- HQ-S: Hedonic Quality - Stimulation
- ATT: Attractiveness

A set of bipolar adjective questions are used for each of the qualities presented above. For each quality, the average rating of its respective set of questions is calculated by the AttrakDiff tool and visualized in a graph presenting the average values of PQ, HQ-I, HQ-S and ATT. Since the bipolar semantic differential has a scale of seven points, the chart values range from minus three to plus three, minus three being least attractive and plus three being most attractive.

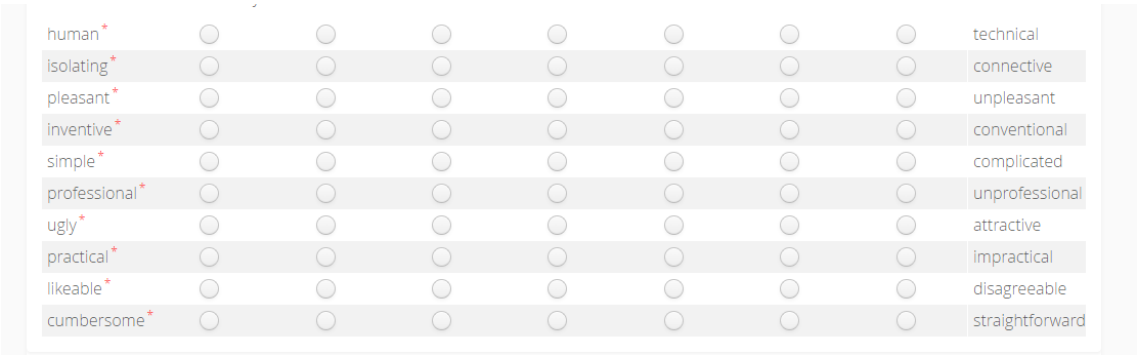

Figure 4.2: A set of questions used in the AttrakDiff questionnaire

Finally, AttrakDiff produces a chart which compares the hedonic quality with the pragmatic quality with eachother, see figure 4.3. The various blocks in the chart are used to identify how users perceive the application overall. The point P in the figure surrounded by a yellow rectangle represents the confidence area.

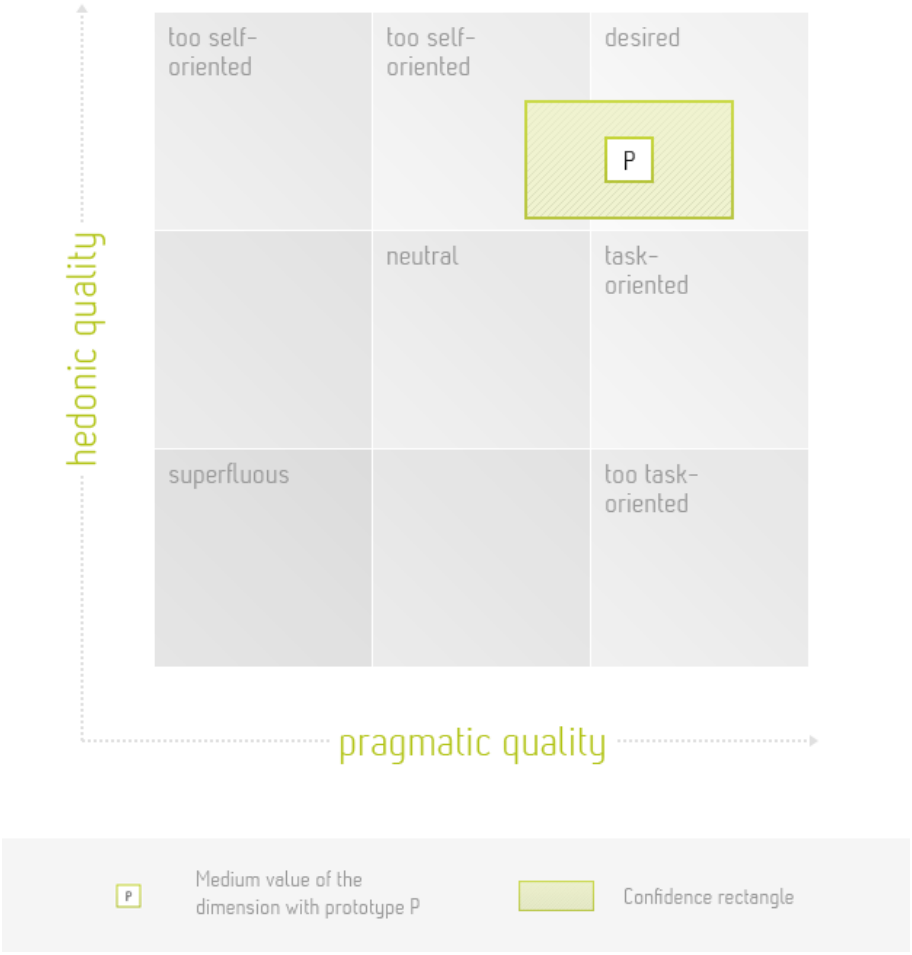

Figure 4.3: A chart comparing the hedonic vs pragmatic qualities of an application

The AttrakDiff survey needs to be completed by at least two users in order to produce charts that visualize the perceived qualities of the application.

As mentioned in section 3.1, one of the three aspect of UX is context of use. Fischer and Amin find that AttrakDiff does not factor in context of use in the questionnaire (Fischer et al., 2018). In their study, they were exploring the spatial impact on user experience with media façades. They therefore argue that AttrakDiff cannot measure the hedonic and pragmatic qualities caused by spatial design. In our research however, the aim is to develop a web application and spatial design is not of concern. This makes AttrakDiff suitable for the research.

5
Planning

This chapter will go through different ethical considerations within the topics of accessibility, sustainability and data collection. It will also show the original time plan that was made for this this project.

5.1 Ethical Considerations

There are various ethical concerns to be considered when working on an interactive project because of the nature of involving users in the process and in the end product. This section will go through various ethical concerns ranging from inclusive design to privacy in data collection by presenting instructional information within these topics.

5.1.1 Accessibility

When it comes to creating and designing websites it is easy to forget about the accessibility, especially since it is not a physical product. In order to not forget about accessibility in this project's design, the WCAG 2.1 standard (WAI, 2018) will be looked at in order to identify potential flaws in the design. This will minimise the risk of excluding some users from being able to interact with the application.

Accessibility focuses on designing products in a way where everyone can use them, regardless what ability, language or culture they have. This means that users with impaired vision, hearing, movement, etc, will be able to fully use them. The web is a great tool and it is important for designers to remember to not exclude some people from being able to use their product. This decision should be made by the users themselves, if they want to use the product or not, not the designer.

The laws in Sweden requires accessibility on websites and the standard that should be follow is WCAG. Regardless of the laws there are multiple reasons for why accessibility is important. First of all, it helps individual people to be included by giving them access to the same tools as everyone else. It also benefits businesses as it increases the user experience and therefore also the opinions of the business brand. Lastly it supports the society as a whole, since it gives the society a way to rely on the web to give equal opportunity to people with various abilities.

5.1.2 Sustainability

The topic of sustainability is highly relevant since the United Nations released their 17 goals (United Nations, 2015) that aims to be fulfilled by 2030. This project will not directly impact any of these goals but it does aim to improve the efficiency of interaction design projects, especially among newer practitioners. This could mean that less time is wasted on the process and more time is spent on solving the actual problems and these problem could effect UN goals. It also could mean that more interaction designers can get a faster way into the line of work and start working with these goals among other topics.

In the start of this project it was decided to not create a brand new application but instead reuse an already existing one. This is sustainable as it saves time on not developing something that already exists and it also helps improve an application that otherwise might just have been forgotten about.

5.1.3 Data Collection

In recent years, data collection from browsers, web applications and services has undergone massive criticism due to the undisclosed usage of the users data **??**. Furthermore, data breaches and leakages have become more of a concern recently and it is important to think about when developing a web application. A study of how to handle user information when e.g. creating an account on the platform which is being developed should be done. It should also be communicated to users who use the web application in order to gain trust and follow the GDPR guidelines regarding data privacy (Regulation, 2018).

Another aspect of data collection is in the form of surveys, interviews and questionnaires. It is important to disclose with the users that information will be kept anonymous and private.

5.2 Time Plan

The master thesis project will follow the process of the Gantt chart seen in figure 5.1. The Gantt chart displays the allocated time for each part of the master thesis project. It is divided into four parts. The first two contain the design process of the project and the last two are dedicated for miscellaneous project task as report writing and milestones.

The triple diamond design process will be used throughout the project. This is reflected in the Gantt chart by looking at rows A and B. The triple diamond design process seen in Google Design Sprints is also taken as a reference, this excludes the decide phase.

The aim of the project is to produce guidelines. This will be done in an iterative process in the same way as the triple diamond. Therefore, the plan is to produce and update guidelines for each iteration of the process. In context of the Gantt chart, this will be done in the validation part.

	Month		Jan		Feb			Mar					Apr				Maj				Jun	
#	Activity	Dependent on	Week																			
			3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	Exploring and understanding																					
A1	Learning Development technology																					
A2	Literature studies																					
A3	Defining limitations	A2																				
A4	Scoping project																					
	Development process																					
B1	Ideating	A3																				
B2	Sketching	B1																				
B3	Prototyping	A1 B2																				
B4	Evaluation	B3																				
	Report writing																					
C1	Planning report	A2																				
C2	Report and results	A B																				
C3	Presentation	C2																				
C4	Finalizing	C2																				
C5	Opposition																					
	Milestones																					
D1	Project report (95%)																					
D2	Development done																					
D3	Thesis finalized (100%)																					

Figure 5.1: Gantt chart displaying allocated time

6
Execution and Analysis

This chapter will go through the execution and process of the project which will ultimately answer the research question. The chapter includes the execution of the various design methods defined in the Method chapter, see figure 4 for an overview of all the methods used in each design phase in the design process. There were in total two iterations. The design process followed the triple diamond design process by Google Design Sprints (Google, 2022).

There was a change in direction for the study during the design process. The original goal was to research cross-disciplinary collaboration between interaction designers and software developers. However, due to the lack of users willing to participate in our hour and a half long user studies, the direction changed to focus on collaboration between interaction designers only. As a result of this, the inclusion of software developers in various methods can be seen during the design process prior to the first user study.

6.1 Prestudy

Before starting the execution of the design process, a prestudy was carried out which contained two main activities, a literature study and understanding the tech stack. This section will go through both of these activities.

6.1.1 Literature Study

In order to understand the subject of collaboration, a literature study was carried out. The main search engines used for literature reading were Google Scholar (*Google Scholar*, 2022) and Chalmers university library (*Chalmers Library*, 2022). A literature map was created in order to keep track of all the found literature surrounding cross-disciplinary collaboration, design sprints, similar applications etc., see figure 6.2. The literature map was used to connect various articles together in order to make it easier to track back

As mentioned previously, the initial plan was to research cross-disciplinary collaboration specifically, therefore some of the literature examined in the literature study was for cross-disciplinary collaboration. Most of this material was not relevant after the change of of research question. However, cross-disciplinary collaboration articles had general collaboration insights which were still relevant to the research.

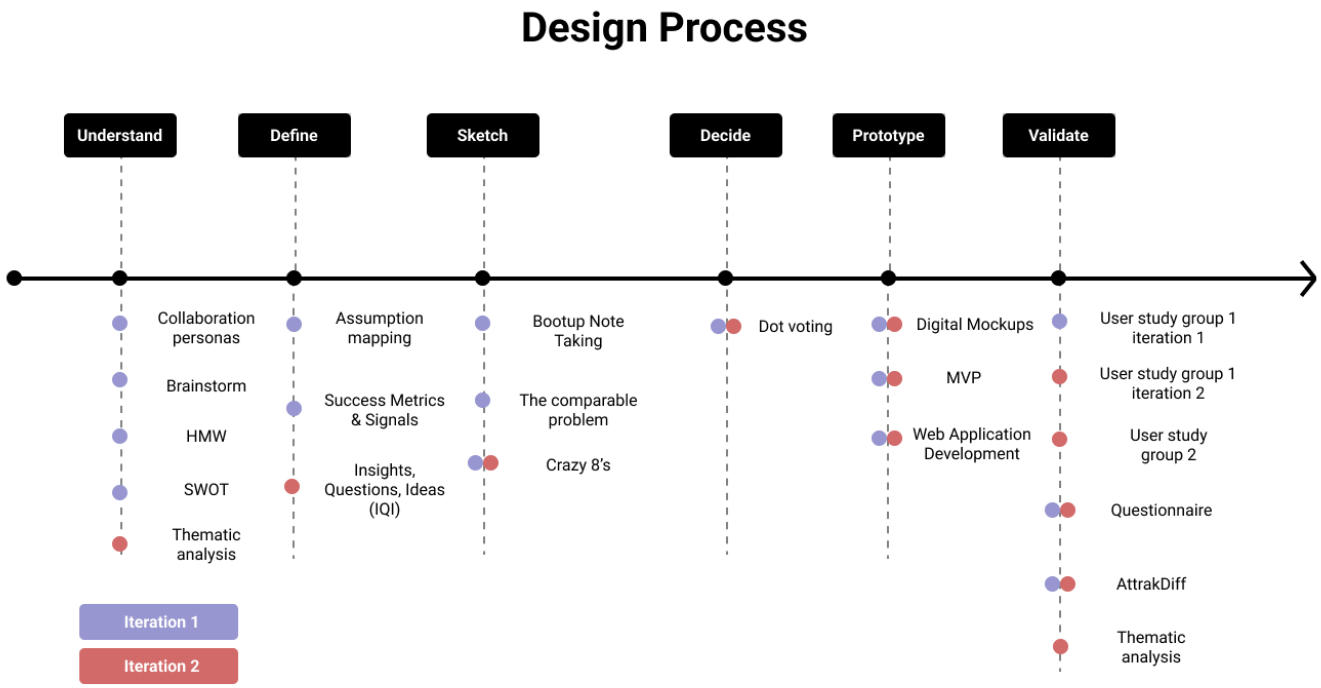

Figure 6.1: The design process

Therefore, those articles still had value for the team.

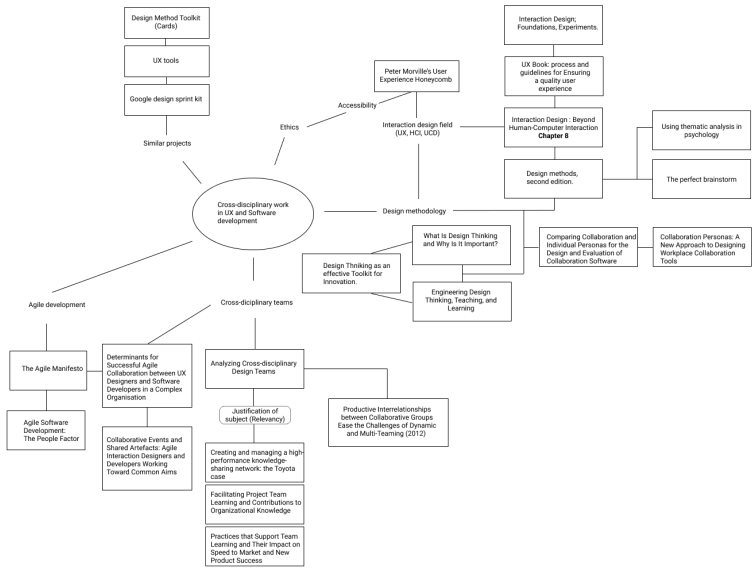

Figure 6.2: Research map

6.1.2 Tech Stack Study

An important part of the development of a web application is understanding the tech stack. This is a list of all the underlying technology behind the developed web application. Since the aim of this thesis is to further develop a web application alongside the design and research, it was important for us to study the tech stack in order to further develop the web application. In the case of Designer's Toolkit 2, three major technologies are highlighted as being the core part developing the application. These are:

- *Meteor*: A web development framework
- *React*: A front end development framework
- *Redux*: A state manager
- *MongoDB*: A document model database

During the prestudy, the team spent time reading documentation for these technologies in order to get an understanding of what type of features would be possible to implement. At this point in time, the web application did not include any features which interacted with a database. Therefore, most of the time went into understanding how to structure a database with MongoDB which is used in web applications developed with Meteor. Furthermore, an analysis of the existing code of the web application had to be examined in order to ideate how to implement new features.

6.2 Iteration 1

The first iteration of the project mostly set out to understand how the web application could be expanded to a collaborative tool. Therefore the main purpose of the first iteration was to ideate on new features that would be useful for a group of users to work together in the web application. There are a lot of possible features that could be considered to add to the web application but the team had to narrow down to the most crucial features to a collaborative web application. This is because the ideated features should be feasible to develop within the given time frame of the project.

Alongside understanding what types of features to include, it was also important to understand the strengths, weaknesses, opportunities and threats for the web application, thereby creating a SWOT analysis in this iteration. To understand the users and their perspective, collaboration personas was done. A brainstorm from what users potentially might desire and need was also done. A large focus was also put on assumption mapping. This method helped with evaluating the desirability, viability and feasibility of the extended web application. The method of success metrics and signals was done to help with defining the problem. To sketch solutions to the defined problems the methods of crazy 8, boot up note taking and the comparable problem were used. Dot voting was the only method used to decide what solutions or part of solutions to move on with.

After deciding what to include, prototypes were made in the form of digital mock-ups. The mock-ups were later used to develop the web application and to make the mock-ups a reality. To validate the web application, a user study was held.

6.2.1 Collaboration Personas

Collaboration personas were created to capture the dynamic between a team of users coming from slightly different backgrounds. The main backgrounds were interaction designers, project managers and software engineers. Each person in the team made their own collaboration group a dedicated scenario which the collaboration personas played part in.

The scenarios were mainly about being in a design team which is aiming to develop a new product. It was the most appropriate type of scenario since the web application we are building upon is one where several people are supposed to come together to create a design sprint plan. The final collaboration personas were created along with their scenarios and can be seen in figures 6.3 and 6.4.

Figure 6.3: First collaboration personas

After having conducted the collaborative personas exercise, the following points were derived from the scenarios that the personas played in regarding collaboration in a design team.

Figure 6.4: Second collaboration personas

- **Communication**
  A collaborative team needs to be able to communicate ideas without being in a call together all the time
- **Deadlines**
  A way to set deadlines for the design team could be useful in order to come to solutions within a given time frame

In the development of the personas, software developers were included who were outside of the target demographic. This was because the research was initially going to extend to cross-disciplinary collaboration. Even though this was not the case anymore, the points we extracted from the exercise were still somewhat relevant to our understanding of collaboration teams. Therefore, what we extracted from the exercise would be useful for the brainstorming exercise which came afterwards.

6.2.2 Brainstorming

Among the first methods used for the understand phase was brainstorming. The main goal was to brainstorm what features can be added to the web application to support collaboration. This was done by establishing a core problem phrased as "How can we support collaboration in the web application". The session consisted of writing about what could make the collaboration experience in the app better. This was done by noting these ideas on digital post-it notes in Miro. The result of the brainstorm exercise were the various ideas presented in figure 6.5.
The ideas gathered in the brainstorming exercise were seen as a good starting point to ideate new features for the web application. The next step in the understand phase was to come up with potential issues that the users might have in the web application.

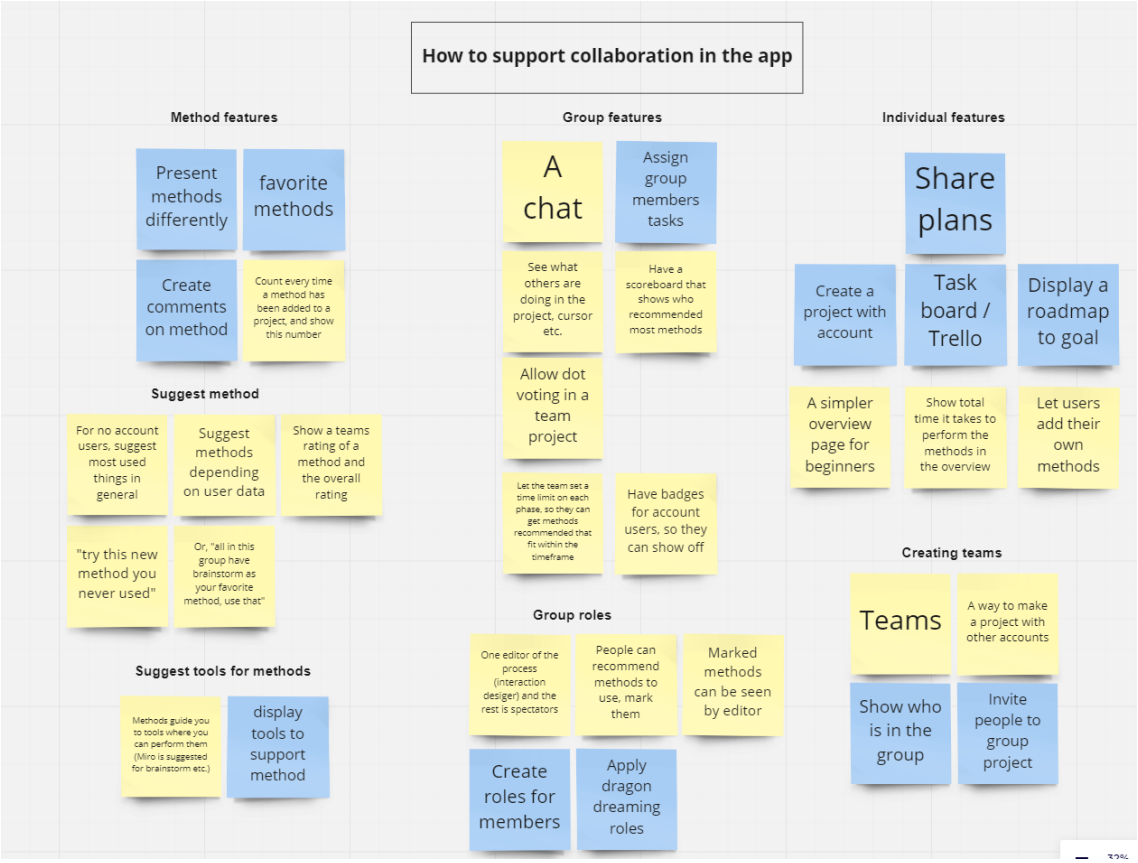

Figure 6.5: Brainstorming session results

6.2.3 How Might We

After having brainstormed ideas regarding how to improve the collaboration experience for users, the team set out to conduct a How Might We exercise. This exercise involved coming up with potential issues or pain points that a user in a team might encounter, and asking ourselves how we might solve the issue. The intention was not to come up with solutions to the problems but rather come up with problems that we could sketch solutions for later in the design process. The problems were noted on digital post-it notes in Miro, see figure 6.6. These notes would then act as design opportunities for the next step.

6.2.4 SWOT

A SWOT analysis board was created to initially highlight the strengths and weaknesses of the application as it is prior to making any changes to it. The SWOT analysis was also used to think about the opportunities when extending the application to a more collaborative tool rather than single person use. The final SWOT analysis board can be seen in fig 6.7. The opportunities presented in the SWOT analysis were interesting to look at in order to develop new features for the application. The weaknesses were also good to look at in order to evaluate what the web application lacks.

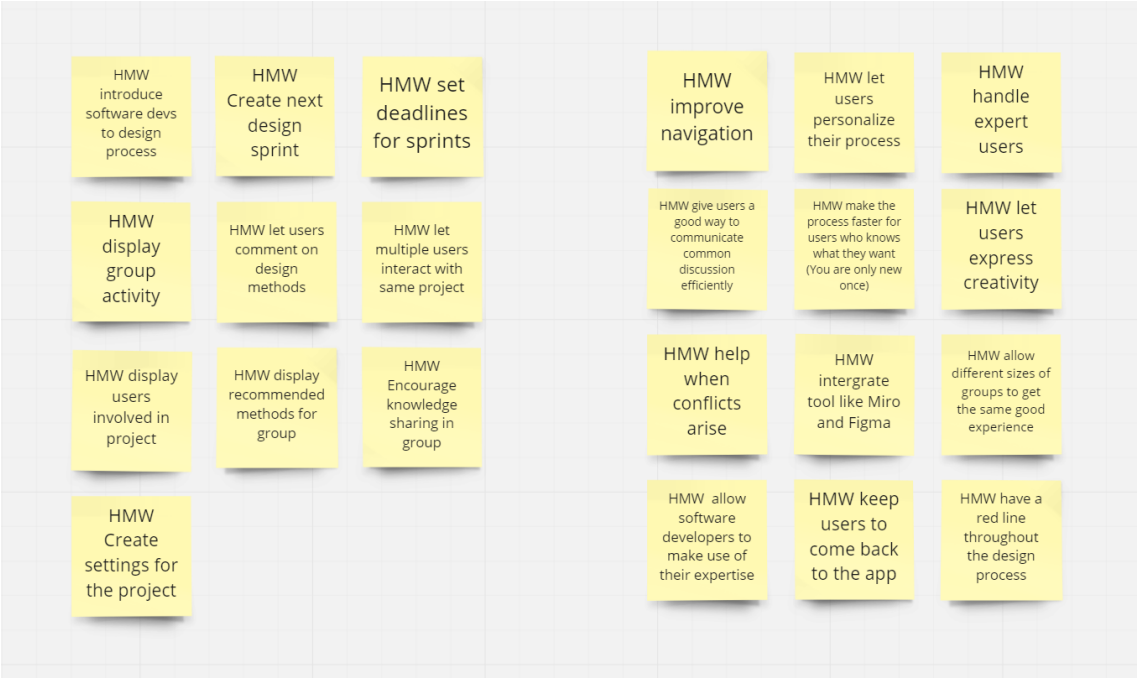

Figure 6.6: Results from the HMW method

In the design methods used later in the design process, this information will be used to further ideate on the strengths, weaknesses, opportunities and threats.

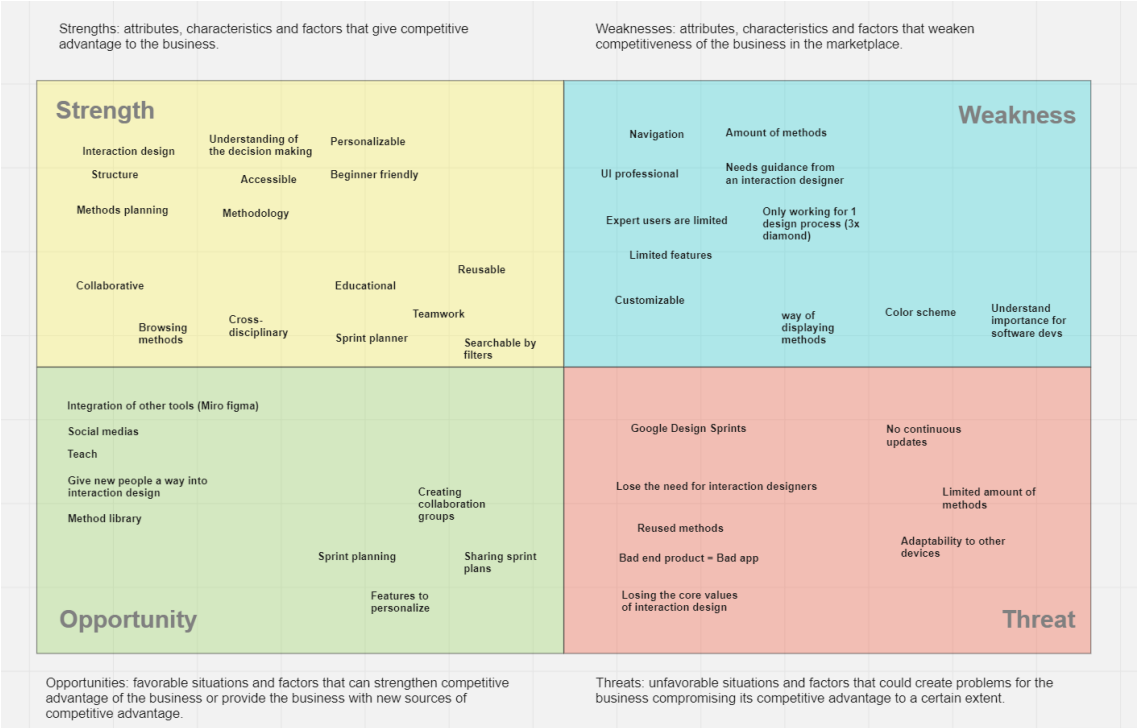

Figure 6.7: The final SWOT analysis board

6.2.5 Success Metrics & Signals

After having done enough design methods to understand the problem, the team set out to do methods in the define phase. The first of which was the Success Metrics and Signals. The benefit of using this method now is that the team now has problems to work with coming from the understand phase. These problems were rephrased as *goals* and what was created in the exercise were the signals and the metrics. This was a way for the team to define examples on how to solve problems. See figure 6.8. With the help of the defined Metrics, the team now also has a way to measure how successful certain goals are.

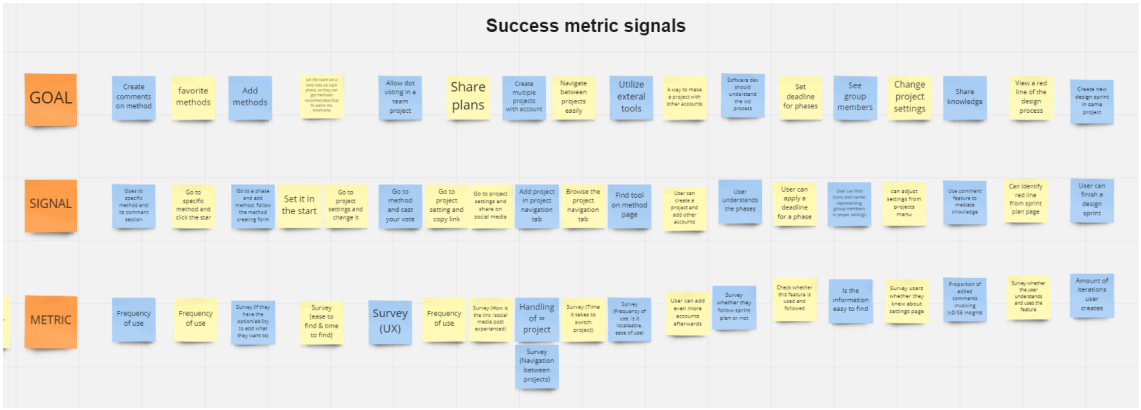

Figure 6.8: Success Metrics and Signals exercise results

6.2.6 Assumption Mapping

Assumption mapping was a long method to carry out. It ended up in creating an assumption map which was useful for the team to check various aspects of the web application which made it desirable, feasible and viable. Furthermore, to define exactly what was important to focus on, the assumption mapping resulted in concrete features to focus on at the end. The assumption mapping method went as seen in figure 6.9. The team started out by writing down initial assumptions for each category in Desirable, Viable and Feasible together. After having done that, the team split up and put the the post-it notes containing assumptions on to their own assumption maps. Afterwards, the team members came together to discuss their respective placements of the assumptions in the individual assumption maps. The discussion would lead into creating a combined mapping of assumptions that both team members agree on. The following is a more detailed look at the process of assumption mapping.

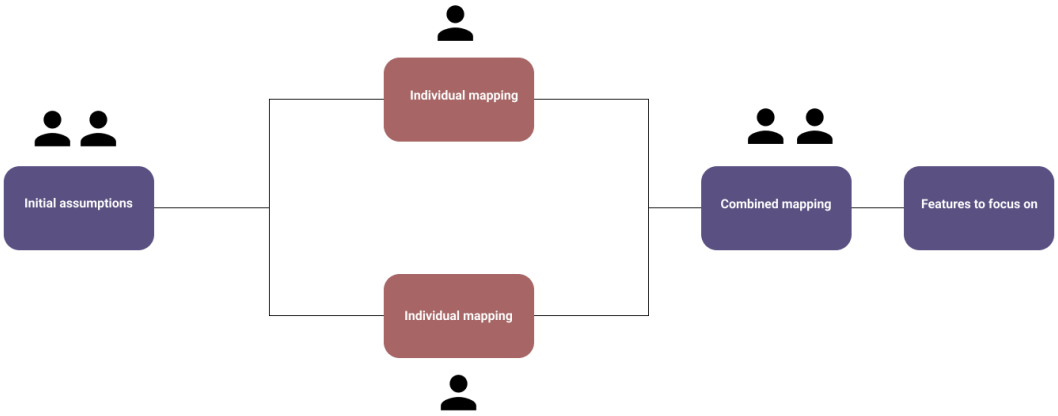

Figure 6.9: The teams plan for conducting the assumption mapping exercise

Step 1: Listing assumptions under each parameter

As mentioned earlier, there are three parameters to analyse, each of them ask a fundamental question, they are the following:

- **Desirable** - Do they want this?
- **Viable** - Should we do this?
- **Feasible** - Can we do this?

Each parameter has its own area of assumptions. All of the assumptions were filled in for each parameter and its related questions. These can be seen in figure 6.10. Desirable are noted in orange notes, Viable are noted in Yellow notes and Feasible are noted in blue notes.

Step 2: Creating individual assumption maps

The next step for each team member was to create their individual assumption maps and place the notes from step 1 on their individual graphs. The final graphs for each member can be seen in figure 6.11.

Step 3: Combined assumption map

After having done individual assumption maps, the team members came together to create one combined assumption map based on the ones created in step 2. The final assumption map can be seen in figure 6.12.

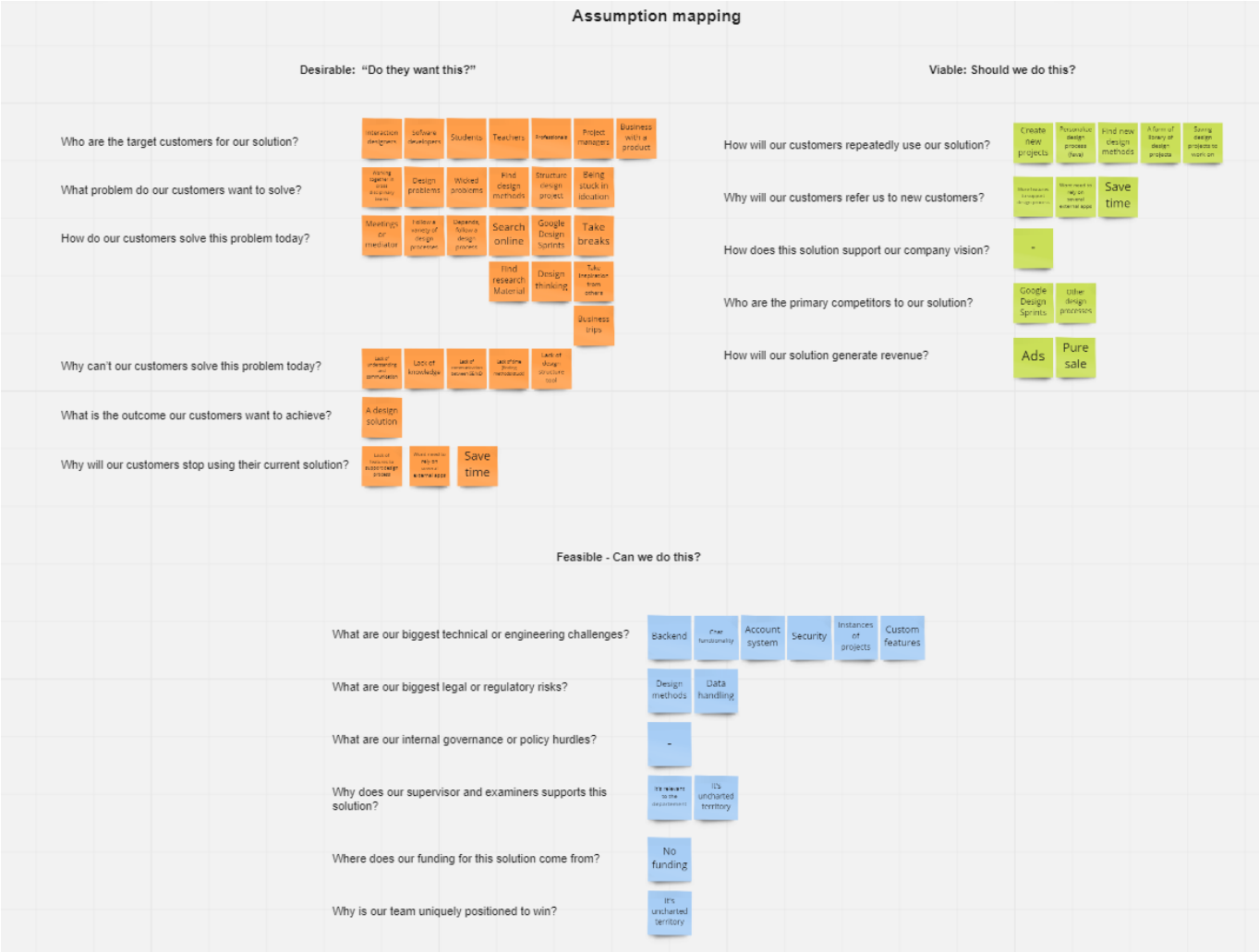

Figure 6.10: First stage of assumption mapping

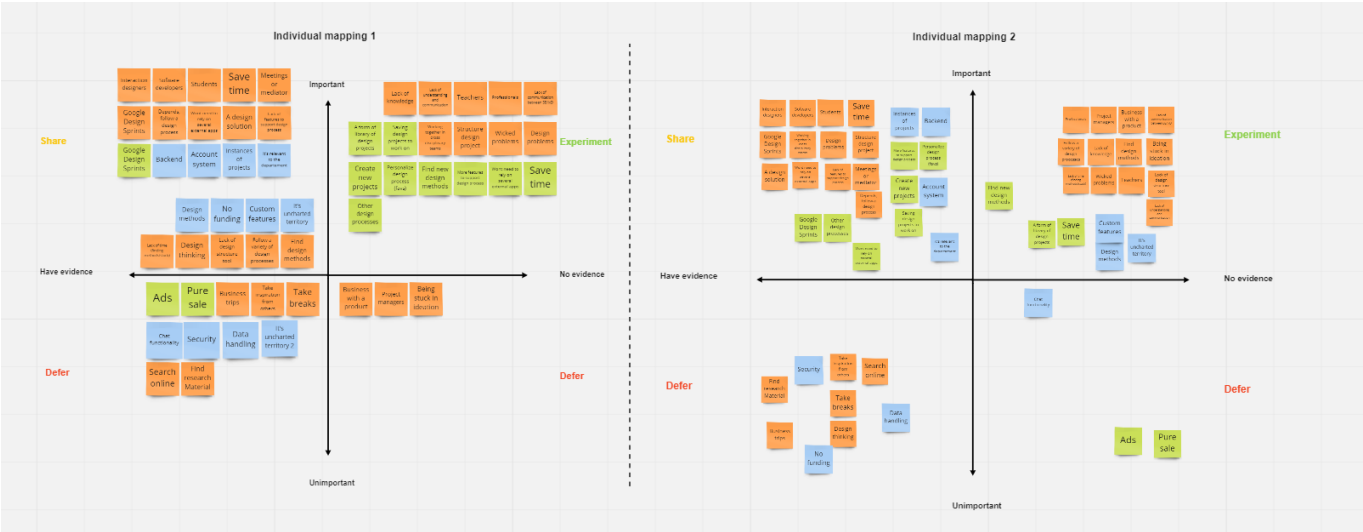

Figure 6.11: Both of the assumption maps created by each team member

Figure 6.12: Both of the assumption maps created by each team member

Step 4: Analyse the quadrants

Each quadrant in the final graph gives an indication on what assumptions to focus on and which ones to either save for later or not consider when going forward in the design process. The top right side of the graph in fig 6.12 is the one that the team focuses on since that is the quadrant which includes assumptions worth experimenting on.

Step 5: Decide how to test assumptions

The final step was to take out all of the notes from the top right side of the graph and decide how to evaluate each assumption. The final result can be seen in figure 6.13.

The exercise was longer compared to the previous exercises. However, the team found that the assumption mapping exercise resulted in an assumption map where the team could see what types of assumptions to focus on. Furthermore, it gave the team an opportunity to explore how these assumptions would be tested in the validation phase. Having done this exercise, the team felt ready to go forward to the sketch phase.

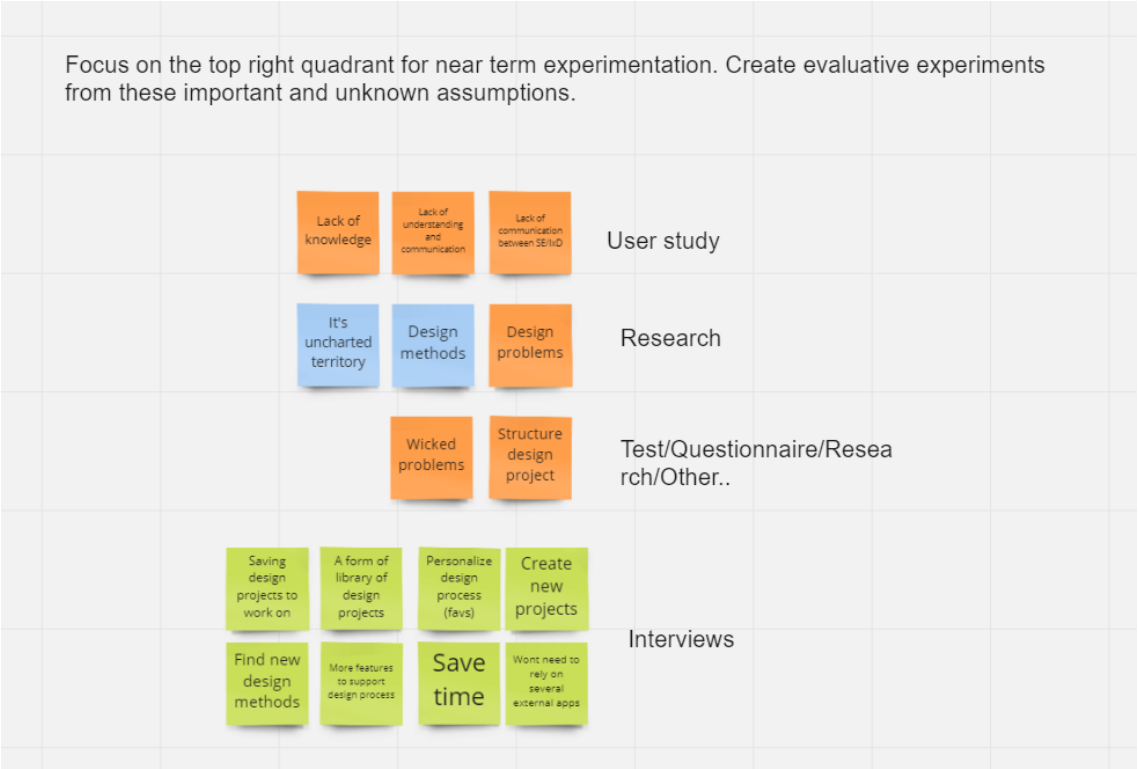

Figure 6.13: What methods to use to evaluate each assumption note

6.2.7 Boot Up Note Taking

Going into the sketch phase, the team decided to do the Boot Up Note Taking exercise. Each team member created their own notes containing features that they would like to explore and implement. After finishing creating notes individually, the team members came together and discussed all of the created notes. After having done that, a priority list was created in order to identify which features were mostly worth focusing on going forward in the sketch phase. All of the notes and priority placements can be seen in figure 6.14. Left hand side are all of the notes created by each team member, color coding separates the team members notes. Right hand side shows the prioritization of the notes. The priority list was split in to the following categories:

- **High priority**: Features important to start detailing out immediately
- **Good to think about**: Features that will be good to have but are time consuming and/or not relevant for collaboration.
- **Low priority**: Also good to have but will not be developed until later because the ideas are slightly out of scope

The team decided to mainly focus on the features that are under the high priority category as both team members deemed those features to be most crucial for the application.

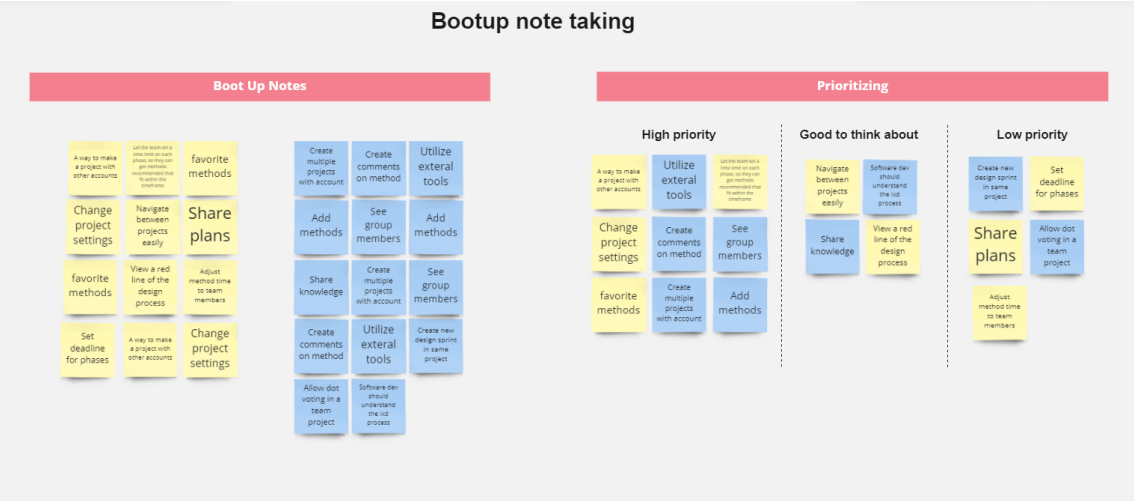

Figure 6.14: Boot Up Note Taking exercise

6.2.8 The Comparable Problem

The team went on to look for inspirations from existing web applications where users can collaborate together. Two of the primary web applications that were initially looked on were Figma and Miro as the team members had been mostly familiar with them. Those tools are commonly used by interaction designers to create digital mock-ups together and create digital boards for post-it note taking. However, the team made an effort to find other tools such as *nTask* (2022), *Teamwork* (2022), *Google Design Sprint Kit* (2022) and *UXTools* (2022) that could also inspire new features for the new web application.

The ambition when conducting this design method is to find similar business problems. The team could not find web application where the main focus was to find design methods and document the design process together. However the team found that there are a variety of web applications which are used for project management, which are similar to the project being done in this thesis.

The first example is a web application called *nTask* (2022). It is used by teams to manage projects by splitting up a project into tasks and assigning the tasks to any number of people in a team. It serves as a web application to manage resources in a team and set deadlines and visualize status of certain tasks. See figure 6.15. for a look at an example of how tasks are visualized in nTask. The visualizations provided for tasks are mostly similar in both application, they visualize them differently however. In both applications there are parameters for task date, allocated time, assigned team members and billing information.

The second example is an application called *Teamwork* (2022) which is similar to *nTask* (2022), see figure 6.16. It is used for project management for teams and provides various tools to visualize the status of a task. Teamwork provides progress bars along with an allocated time for tasks, see figure 6.16. Although the team did not find a similar web application to the one being developed, it was still insightful

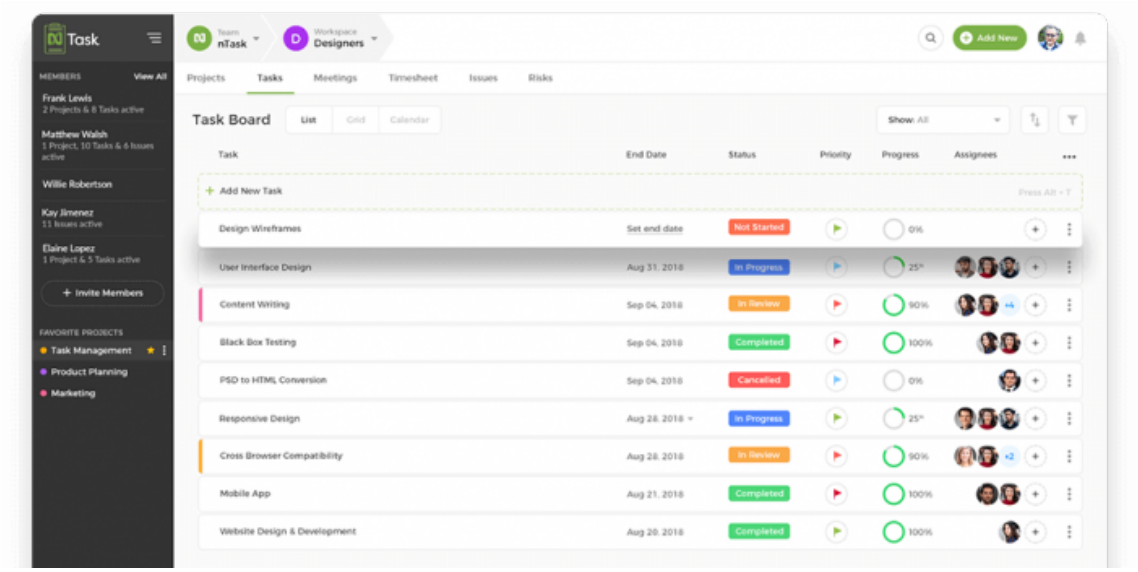

Figure 6.15: nTask application features

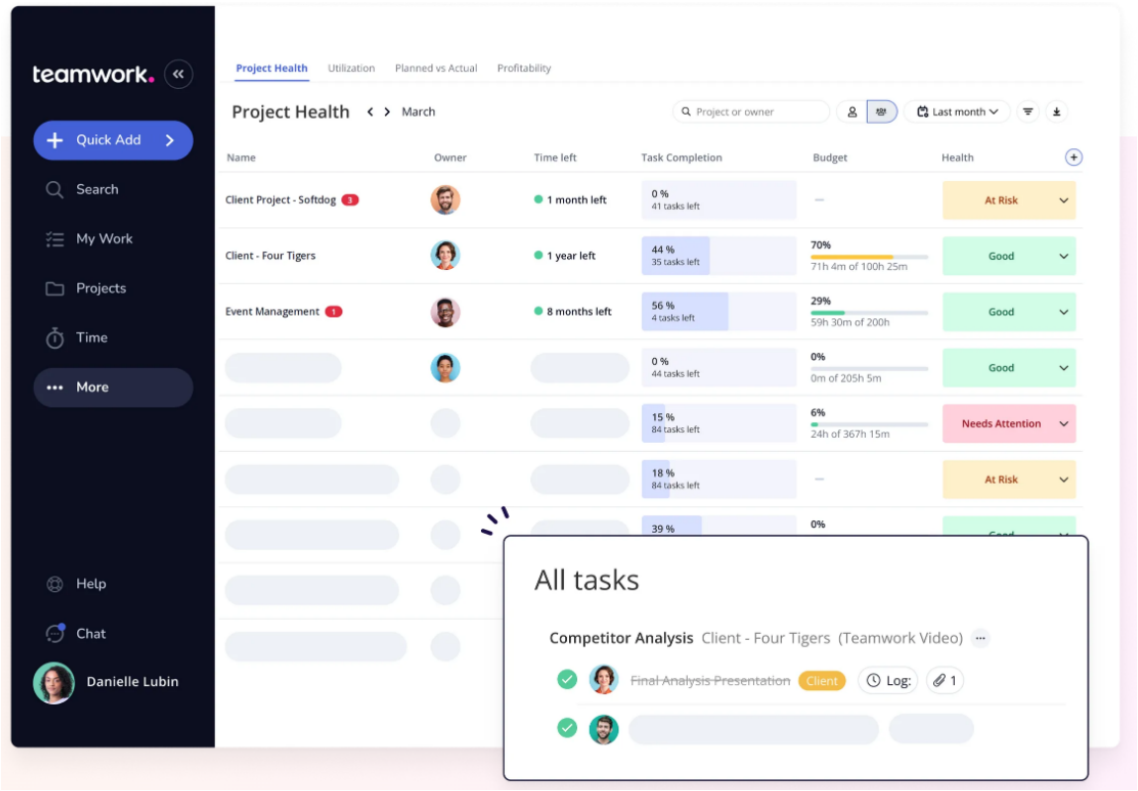

Figure 6.16: teamwork application features

to look at how project management applications visualize information about tasks. We took the parameters seen in these web applications to consideration in the sketch phase, especially the time allocation parameter since it is a resource our web application already has. Each method card has an estimated time, this could be used to fill time budgets in the web application.

6.2.9 Crazy 8's

The team decided to do two rounds of Crazy 8's where the main goal was to sketch out different solutions to the issues that were raised in the brainstorm exercise. The issues that were chosen to be ideated on were the chat feature and the time allocation features. The chat feature was seen as good feature in include in the application where users would use it to communicate. The time allocation feature was chosen because that was seen as a good feature to include since it was highly prioritised in the boot-up note taking exercise and it was also easy to implement in the web application.

After having done two rounds of crazy 8's the team members shared their sketches and started placing out dots to decide which methods were either "interesting", "partly interesting" and "not feasible/unimportant". The dot placements can be seen in figure 6.17. The Crazy 8's exercise was helpful to start visualizing the fea-

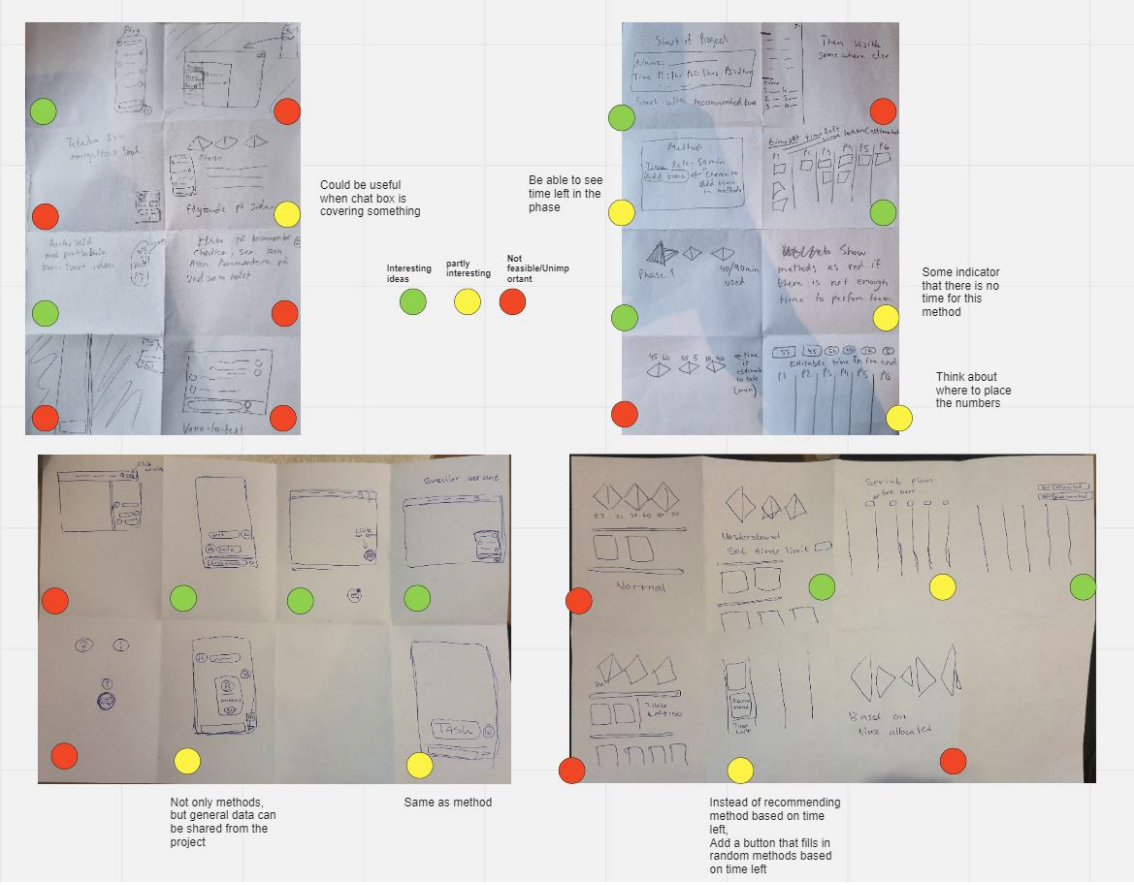

Figure 6.17: Crazy 8's sketches along with voting dots

tures which were ideated in the previous phases. The chat feature had interesting sketches, however, the team decided that the implementation would take too much time implementing. Therefore, more essential features were prioritized, e.g. creating accounts, teams, projects etc. After having done the Crazy 8's exercise, the team concluded that making higher fidelity sketches would be useful in order to have a reference when implementing the features.

6.2.10 Digital Mock-ups

The sketches in Crazy 8's proved to be useful to get a rough idea on how the time allocation was to be visualized in the web application. However, the team now needed sketches of a bit higher fidelity in order see how the web application would look like if the features were implemented. Therefore, digital mock-ups were made in Figma for the other features that were ideated in the understand phase.

Dashboard

One of the crucial features in a collaborative application are the features which users use to invite each other to collaborate in projects. To extend the web application from its static form to a collaborative web application, the team needed to create mock-ups of the features that would allow users to invite each other to collaborate in projects. This is one feature that was placed in the "high priority" category in the Boot Up Note Taking exercise as seen in section 6.2.7. Therefore, the plan was to create a dashboard page for the web application which the user has access to when they are logged in to the web application and is the first page they would see. The digital mock-ups were created in Figma. Each team member created their version of the dashboard, see figures A.1 and A.2 in Appendix A.

After the team members discussed the created mock-ups together, a joint mock-up was made which included ideas from both of the initial mock-ups. The final mock-up for the dashboard page can be seen in figure 6.18. The team chose to go with the idea of making users create teams and inviting other users to the team. When a team is selected in the left hand side, the user can create a project which will be connected to that team. All the team members can see the project when they select the team that they are invited too as well. This solution was chosen since it would be convenient for users to create multiple projects together without having to add the team members again. When creating a new team, the user will have to fill in the form seen in figure 6.19. The user fills in the team name, and then should be able to invite users by writing their name in the second text field and clicking the "Add" button. If the usernames are found in the database, they will be successfully added into a list below "team members". When creating a new project, the user will also fill in the form as seen in the mock-up in figure 6.20. The user will first fill in the name of the project. Afterwards the user would be able to allocate time under each design phase as seen in the figure.

Method Description Page

The team also decided to go further with creating a mock-up for the method description page, which would extend on how the method description page looked, seen in figure 2.7. This is because one of the features that was placed in high priority category was adding comments to a design method, see section 6.2.7. The main goal was to add new information / functionalities to the page which could

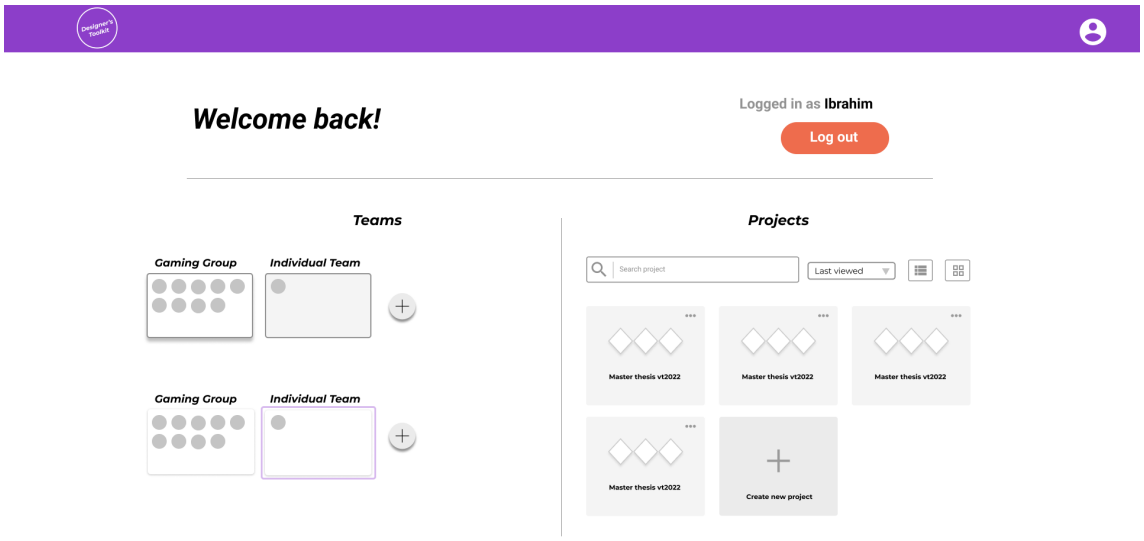

Figure 6.18: The final mock-up of the dashboard page

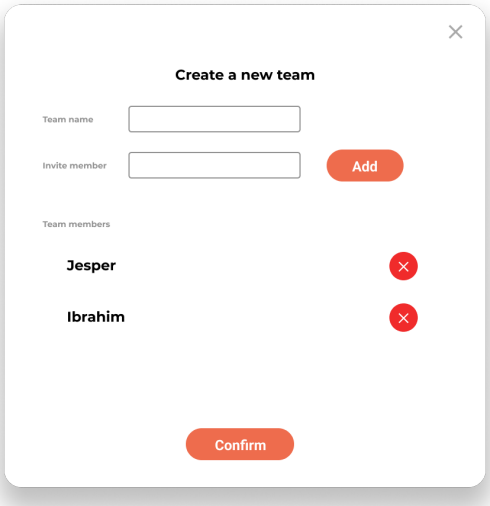

Figure 6.19: Mock-up of the form used to create a new team

be shared between group members inside of a project. The approach was similar to when the team members created mock-ups for the dashboard page, each team member creating their own mock-up for the new method description page. The mock-ups each team member made can be seen in figures A.3 and A.4 in Appendix A. Afterwards, a joint mock-up was made which borrowed elements from the previous two mock-ups, the joint mock-up can be seen in figure 6.21.

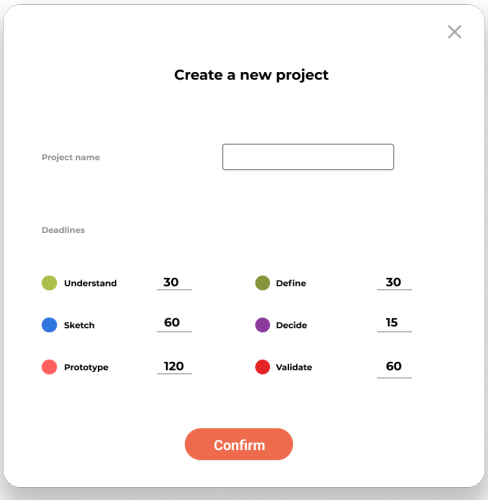

Figure 6.20: Mock-up of the form used to create a new project

The final mock-up for the method description page included a feature where the user can set a score on the method, based on how much they liked it. This score would be used in a total group rating for the method. The users add the viewed design method into an appropriate design phase by clicking on the available design phases listed under the triple diamond icon. The page also presents recommended tools for the team to work with. Figure 6.21 presents three recommended tools which are Figma, Miro and HTML. These tools are recommended based on what type of method the user is viewing. Underneath the methods are also hints at how "difficult" it might be to get started with one of the recommended tools. Going further down in the figure, the user will see team notes. In this box, team members can write notes about a design method that has or will be conducted. Following the notes section, there is also a comments section in which group members can write comments about the selected design method. The notes and comments features were mostly inspired from the web applications found in the comparable problem exercise in section 6.2.8.

The mock-ups created in this exercise were useful to start developing the features in the web application. It was also useful for each team member to visualize their idea in a higher fidelity than sketches on paper.

6.2.11 Web Application Development

After having sketched out ideas and created mock-ups, the team had enough material to work with to start developing the features on the web application directly. The main feature that was put on highest priority was the account system for the web application. This was important in order to get users to be able to invite each other to collaborate together. Since the web application is built using the Meteor platform, the account system was already in place. What needed to be done in terms

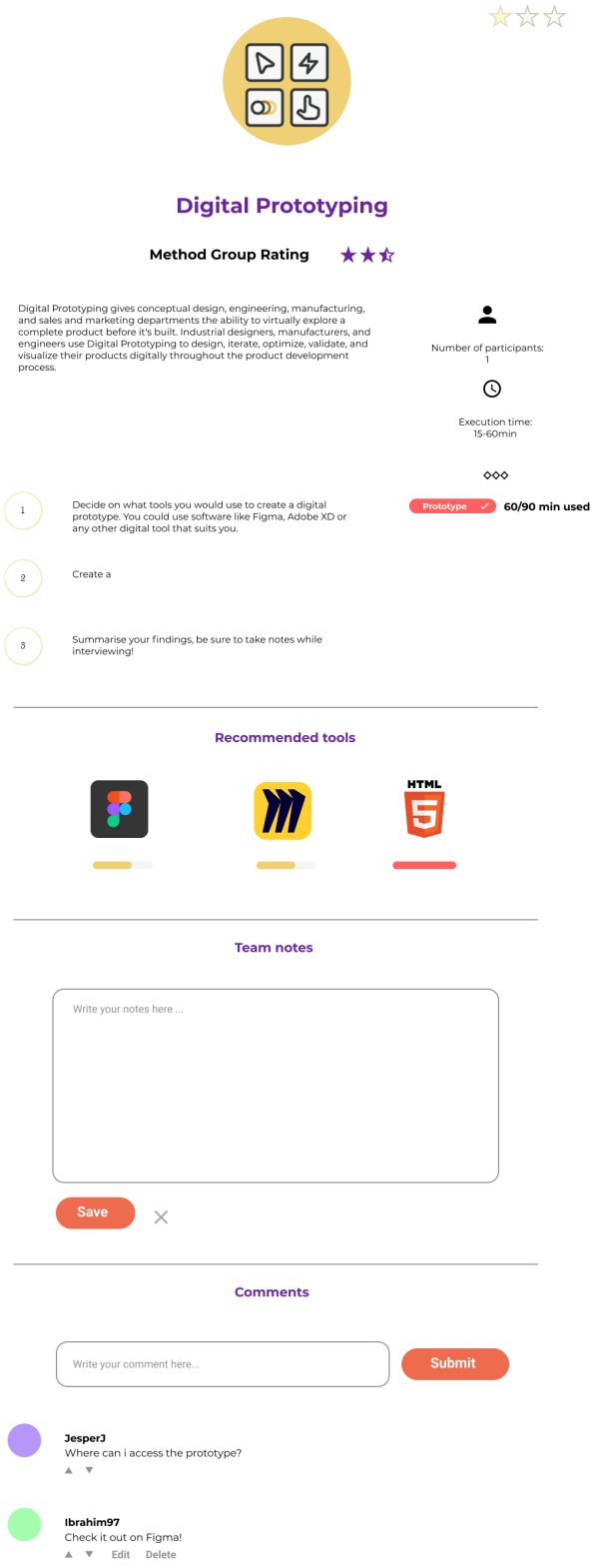

Figure 6.21: The final mock-up of the method description page

of development was creating sign up forms to make new accounts and a log-in form. No time needed to be spent on user authentication and password encryption since Meteor provides that automatically, which is one of the benefits of using Meteor in web development.

Another aspect of extending the web application into a collaborative one was creating a database to store all the information about the following:

- Teams
- Projects
- Methods used in a project
- Time allocated for a sprint

This is the type of information that is going to be required to be stored in a database in order to share with other accounts that are related to a team.

Meteor uses *MongoDB* for creating databases. A portion of time during the project was spent on understanding how to structure the database for the information presented above. And also understanding how to query the database in order to store and retrieve information to display on the web application. The team spent time reading documentation about the technology which is provided by Meteor, in order to understand how to develop the features. Meteor also provides a tutorial on how to create a simple *task-tracker* application. This tutorial was done by the team members in order to practice and gain inspiration for how to implement the features. The other portion of time during the development phase was spent on developing the features into the existing web application. The team used Github for version control of the web application throughout the development.

Other than setting up the infrastructure for the database, the team developed the new UI elements from the digital mock-ups seen in section 6.2.10. This was done using HTML/CSS, made functional with JavaScript and built with the React framework.

In order for the users to create accounts on the web application, a simple sign-up form was created as seen in figure 6.22. The user needs to enter a unique username and enter a password and confirm it. After clicking the create button, the account will be registered and the user is taken to the dashboard page if no faults occur. Otherwise an error message will show up detailing what went wrong. The implemented dashboard page can be seen in figure 6.23. The figure shows that the user has selected a team named "Master Thesis Group vt22" which includes two collaborators, Ibrahim and Jesper, their initials are shows in the team box. and a project called "iteration 1". When selecting a project, the team members can write notes inside each design method which are saved to the project, making it possible for other team members to see the notes. This can be seen in figure 6.24. When the user writes a note in the text box, they can click save in order for the note to be stored in the database.

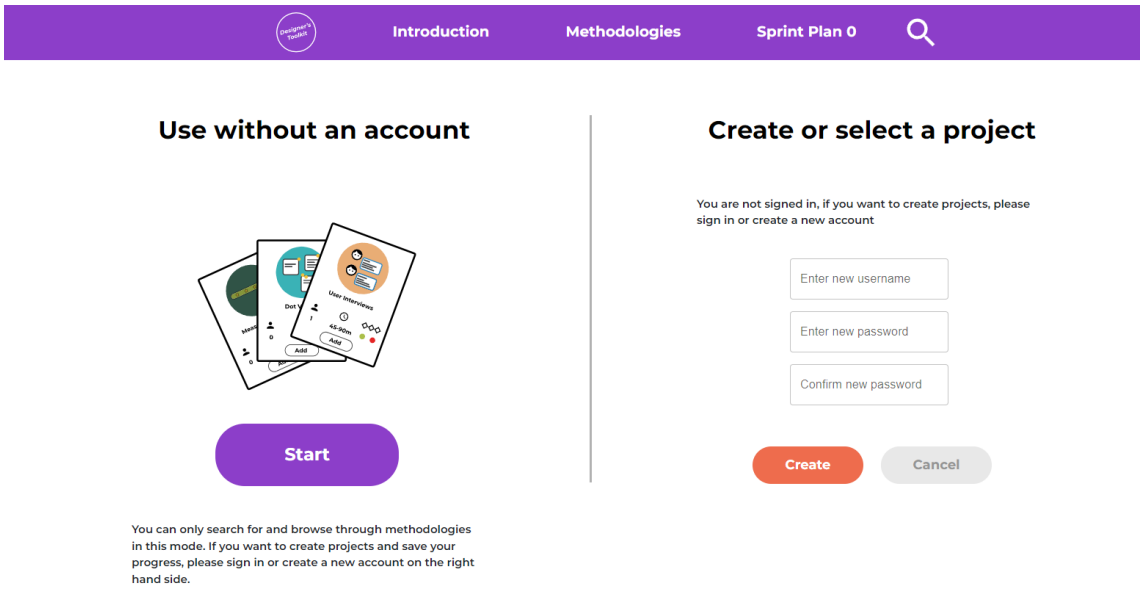

Figure 6.22: The landing page of the application where the user has selected to create a new account

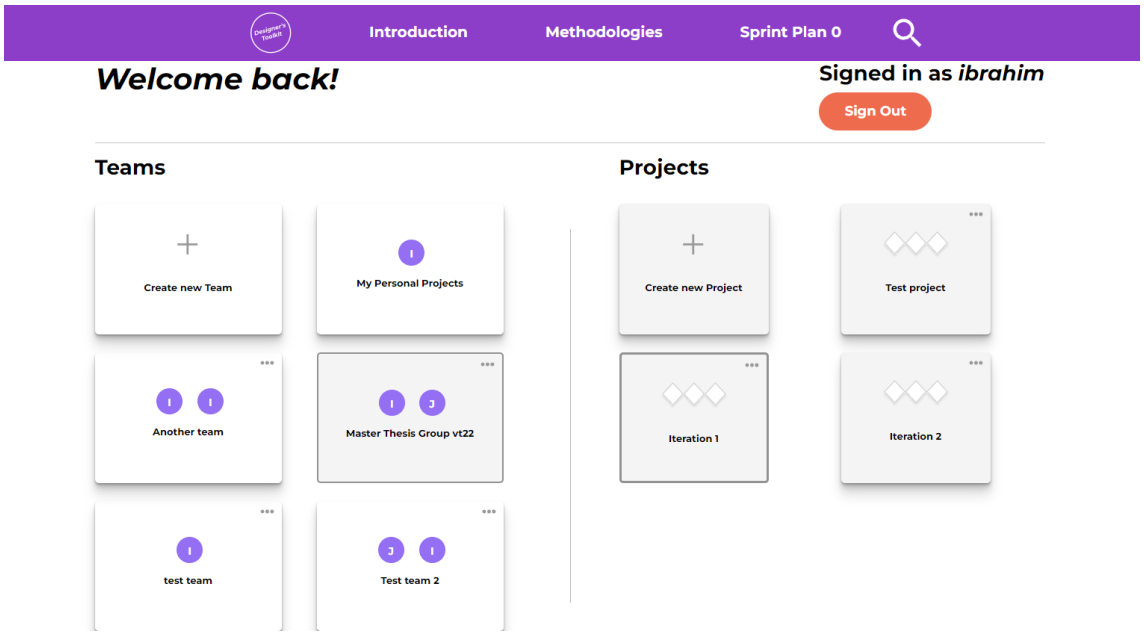

Figure 6.23: The dashboard page as seen in the live web application

Some of the sketched out features in the mock-ups were not implemented due to lack of time. This includes the rating of a design method and the comment section under a method. The team decided that these features were not essential compared to the other features.

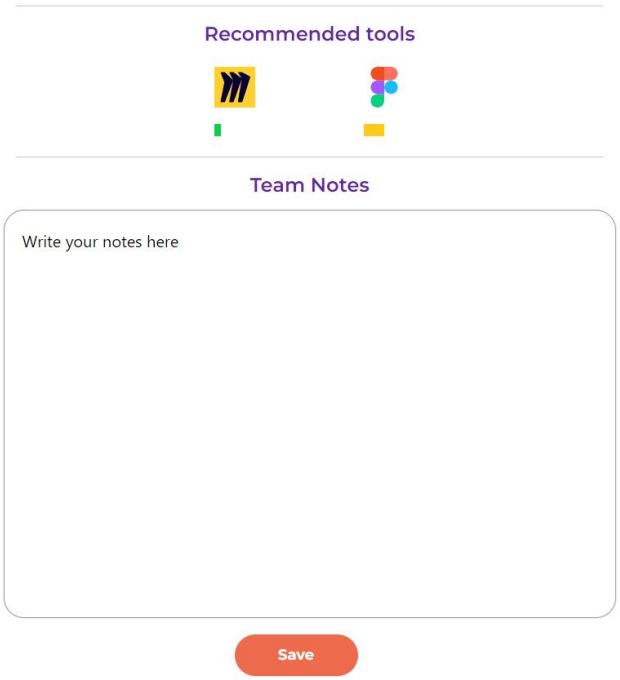

Figure 6.24: Recommended tools and team notes

6.2.12 Questionnaire

In order to get the users perspective on how the web application was experienced, a questionnaire was created. The questionnaire included both qualitative and quantitative questions regarding the overall experience using the web application. Some of the questions put in the questionnaire were used to verify assumptions from the assumption map which was created in 6.2.6. All of the questions asked in the questionnaire can be seen in table 6.1. After having created the questionnaire and developed a working application, the next step was to conduct the user studies.

6.2.13 User Study Group 1 - Iteration 1

The first user study session covered the first three phases of the triple diamond design process, understand, define and sketch. Three users were initially invited to the user study but one of the users could not show up during the scheduled day, therefore the user study ended up with two users.

Conducting the User Study

The user study was conducted on a video call through Zoom and was structured as follows. A Google Presentation was created which was shown to the participants as they entered the video call. The presentation outlined the structure of the user study which was scheduled to last roughly one and a half hour. The team members started by presenting themselves, the project that is being worked on and that it is

part of a master thesis. Afterwards, a live demo of the web application was given to the participants. This was done to give the participants a quick overview of the web application and all of its features so that they do not need to spend time learning the features on their own. Afterwards the team gave a presentation about the project that the participants would do with the help of the web application.

The project that was given to the participants was broad. The decision to make the project broad was made so that the users could freely form the project however they see fit and would not need to adhere to specific rules set by us. The project revolved around making an app that did not have a user interface, meaning the user doesn't interact with it by touching the screen. Examples were given to the participants to let them know roughly what to do. A suggestion given to the participants was to make an app that gives the user workout exercises after a set amount of time in while a user is working on their computer.

After having presented the application and the project, the users were given a link to the web application. The participants were told to use the think aloud protocol as they are using the web application. Furthermore, the participants were asked for permission to record the video call on zoom for further data gathering and analysis. The participants had no objection to it and agreed to conduct the user study with a video and voice recording.

After the participants had completed the first three phases of the user study, they were asked to fill in the questionnaire and the AttrakDiff forms. The participants were invited for a second user study where they would use an updated version of the web application and also finish their project by conducting the final three phases. The notes taken from the user study can be seen in Appendix B

AttrakDiff

An AttrakDiff survey was created on the AttrakDiff website *http://www.attrakdiff.de/*. The website requires the create an account in order to create an AttrakDiff survey. After creating an account, the team members created the survey which was then sent out to the participants.

6.3 Iteration 2

After having collected and analyzed data from iteration 1, it was time to get into iteration 2. This was much briefer than the first iteration as the team primarily worked off of the user feedback that was gathered. Therefore, fewer methods were used in the define and sketch phases. In the understand phase, thematic analysis on the gathered data was used to validate and understand what the users perception of the web application. Another group of participants was introduced in this iteration because of the few amount of participants in the first iteration. Finally, a thematic analysis was done on the final data gathered from the questionnaires. This section will go through these steps.

#	**Question asked regarding the web application**
Q1	How was your experience of creating teams in the web application?
Q2	What could have been better or what was good in regards to creating teams?
Q3	Was it intuitive to create a project with a group in the web application?
Q4	What tools do you currently use to do design processes.? E.g. Google design sprints, Miro.
Q5	Did you make use of the note feature inside of the design methods to document the project?
Q6	Are there any other features you would like to have within a design method page?
Q7	Do you have a background in interaction design?
Q8	Picture a scenario where you didn't know about interaction design processes: would this web application have helped you in understanding the process?
Q9	Do you think that this tool helps you collaborate on design sprints as a group of interaction designers? Or would you rather keep doing a design process in your own way?
Q10	Was there something that made your collaboration less efficient?
Q11	Is there a feature you would like to have that you believe would improve the collaboration?
Q12	Do you feel like this web application can save you time if used in your projects?
Q13	Do you like the idea of having a whole design process stored in one place? Also being able to go back to previous projects easily
Q14	The feature of users being able to create their own methods has been considered. Would you like a community library to go to for design methods, or rather only see the ones that you create?
Q15	Did you find the recommended tools useful? Why, why not?

Table 6.1: Table presenting all of the questions asked in the first user study

Theme	Amount
Future considerations	6
Layout	6
Assumption mapping confirmations	4
Feedback from the application	3
Team notes	3
Irrelevant	3
Teams & projects	2

Table 6.2: Table showing the how many times a certain theme was identified in the gathered data from the questionnaire

6.3.1 Thematic Analysis

The thematic analysis done for the data collected in the questionnaire and the observation from the user study. Potential guidelines will also be discussed.

Questionnaire

Both quantitative and qualitative data were gathered from the questionnaire and the team members chose to do a thematic analysis on both. The team members started by discussing the data together and making comments about it on the same Miro board next to the data. Afterwards, themes were identified after having processed the whole data set. The following themes were found:

- Teams & projects
- Layout
- Feedback from the application
- Team notes
- Assumption mapping confirmations

Furthermore, the team added two more themes which were used to filter out data that would be useful for future considerations or are irrelevant for the next phase. These themes were the following:

- Future considerations
- Irrelevant

The themes were color coded in Miro as seen in figure 6.25 and colored dots were placed out on the data as seen in figures 6.26 and 6.27. The total amount of data falling under each theme is presented in table 6.2.

Observational Data Analysis

During the user study conducted in iteration 1, the team members noted down their observations when watching and listening to the participants using the web

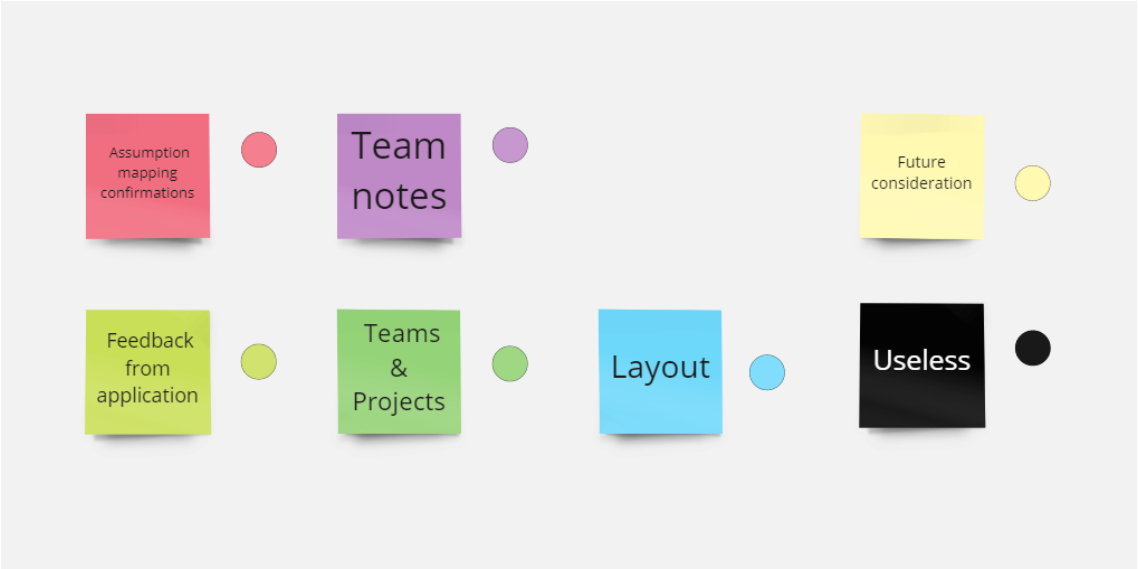

Figure 6.25: Color coding of themes for thematic analysis

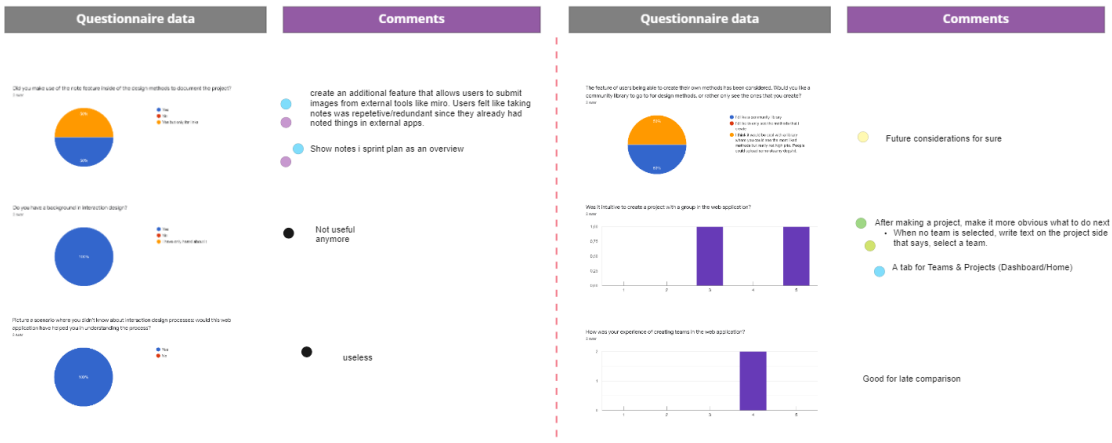

Figure 6.26: Thematic analysis on the quantitative gathered data from user study 1

application. These notes can be found in Appendix B. The team processed this data by analysing it together. The data was put into post-it notes in a Miro board and the data that showed similar observations were grouped together. The team members marked the data which was most useful to look at for the next iteration with green and the ones which were interesting with yellow, see figure 6.28. The green shapes indicate important data to look at. The yellow shapes indicate less interesting data to look at.

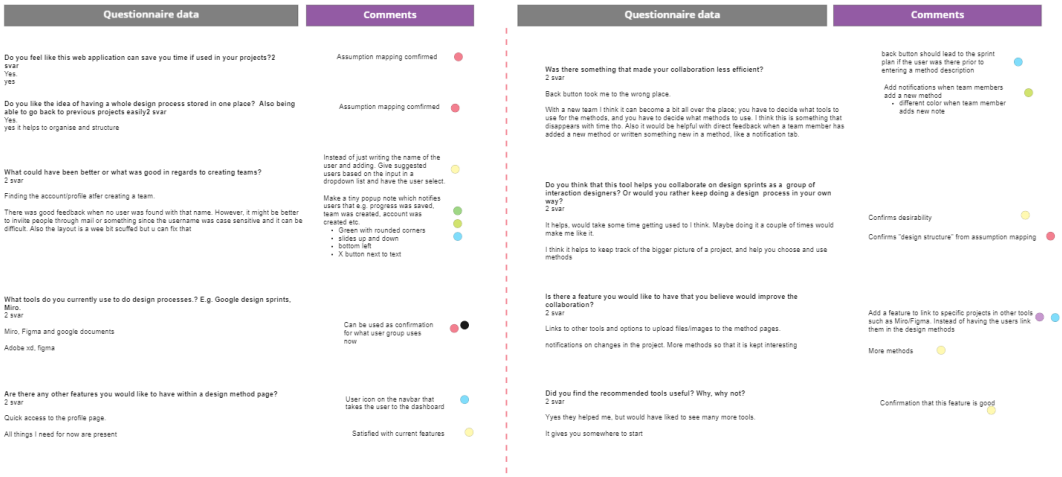

Figure 6.27: Thematic analysis on the qualitative gathered data from user study 1

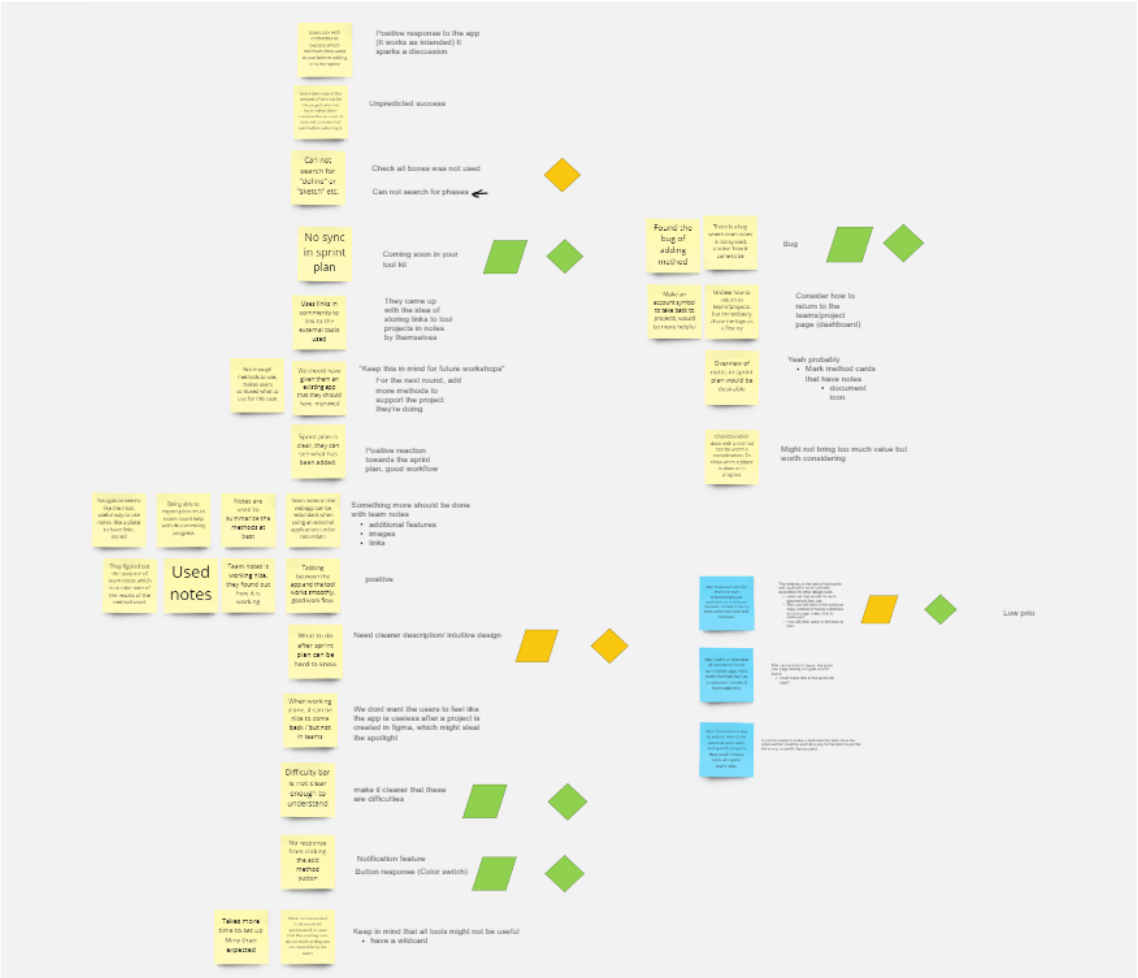

Figure 6.28: Observational data grouped together.

Guideline Analysis

By analyzing the questionnaire through a thematic analysis, the data was broken down to a simpler form and the start of processing guideline from the data could start.

There were seven potential guidelines that were identified from the data analysis of this user study seen in figures 6.26 and 6.27. The first two were about the confirmation how the team notes and recommended tools features were appreciated and desired among users. The team notes feature aligns with Hassenzahl (2003) hedonic attribute *identification* which is about fulfilling the users need for self expression

The third was an extension of the team notes feature, which was about the possibility of uploading images as notes inside of the design methods. This also aligns with Hassenzahl (2003) hedonic attribute identification. The fourth was also about an extension to team notes, it was about how an overview of all the team notes was desired in the web application. This also aligns with Hassenzahl (2003) hedonic attribute of evocation, which is about the applications ability to provoke memories within the user.

The fifth was a notification system, where users wanted to be able to see actions from other team members to be able to know what they should do themselves in the team. This was also discussed in the theory in section 3.2 regarding collaboration. The use of notifications is brought up and it is argued by Ardissono & Bosio (2012) that notifications are an essential part of communication in a collaborative application.

The sixth point identified was a need for users to add their own personalized methods to the web application. Last up was the need of a way to confirm and mark progress in the sprint plan, a way to select a method as completed.

6.3.2 Insights, Questions, Ideas (IQI)

After having processed the data with thematic analysis from the validation in iteration 1, it was time to process it further in the define phase. This was done with the IQI. The method allowed the team members to collaboratively analyse the data by noting down questions regarding the data, insights and further ideate features from looking at the received data from the validation phase in iteration 1. The IQI method was conducted in Miro and the full board with contents can be seen in figure 6.29. For a closer look at each section of the IQI exercise, see Appendix C.

By having conducted the IQI method, the team members had organized ideas for each category of data. Furthermore, the team prioritised the ideas that they thought were interesting to keep iterating on. These ideas were taken forward to the next round of Crazy 8's.

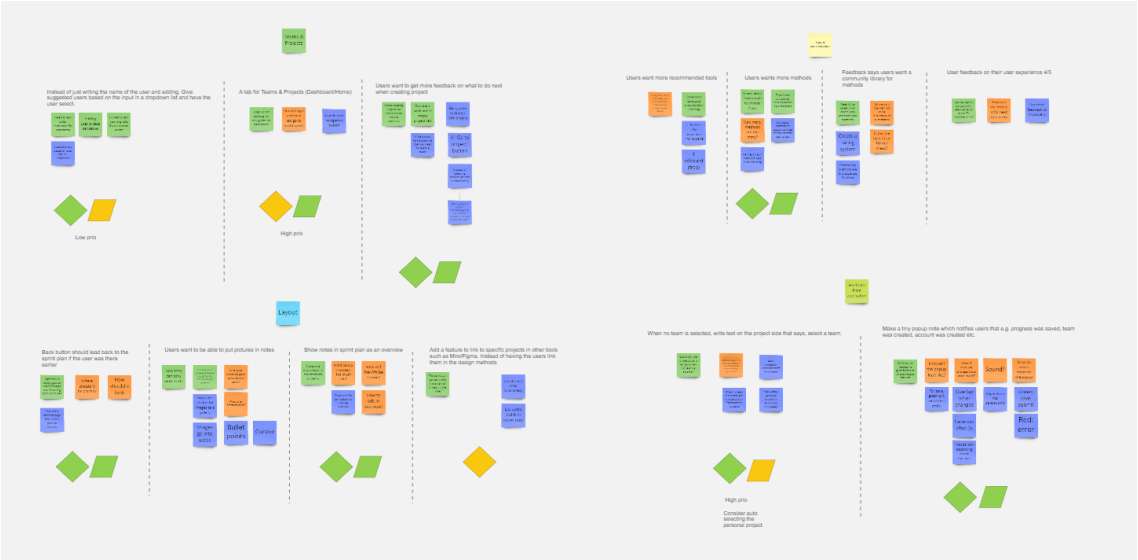

Figure 6.29: Board with all the IQI notes under themes from the thematic analysis exercise

6.3.3 Crazy 8's

In this iteration, a round of Crazy 8's was done similar to iteration 1. The main agenda for this round was to create sketches based off the gathered data from the first user study. By having the data processed in the IQI exercise, the team members chose to sketch new features or changes based on the results from the IQI exercise. The Crazy 8's sketches can be seen in figure 6.30. The sketches focused mainly on redesigning the method cards. From what was gathered from the questionnaire and observations, the users wanted a way to mark the methods as "completed" in order to notify team members that the methods do not need to perform them. The users also wanted a way to see an overview of all the conducted methods and the notes written on all of them. The figure shows sketches that adhere to those needs.

6.3.4 Second Digital Mock-ups

The second round of digital mock-ups focused on adding to the sprint plan page. Users wanted a way get an overview of the methods they had written notes on and also more feedback from the application. And the team decided to create mock-ups for these desired needs in the application. Figure 6.31 shows a mock-up of a remade sprint plan where the user can turn the method cards to view the notes. The sprint plan also has an added tab where the user can switch between an overview of the selected design methods and an overview of all the notes written on the methods. A redesign of the navigation bar can also be seen. This is because the users felt like the number next to the sprint plan, which was used to represent the amount of methods added, was misleading. Therefore, the number of methods added was moved to the right and given an icon.

The note overview tab can be seen in figure 6.32. In this view, only the meth-

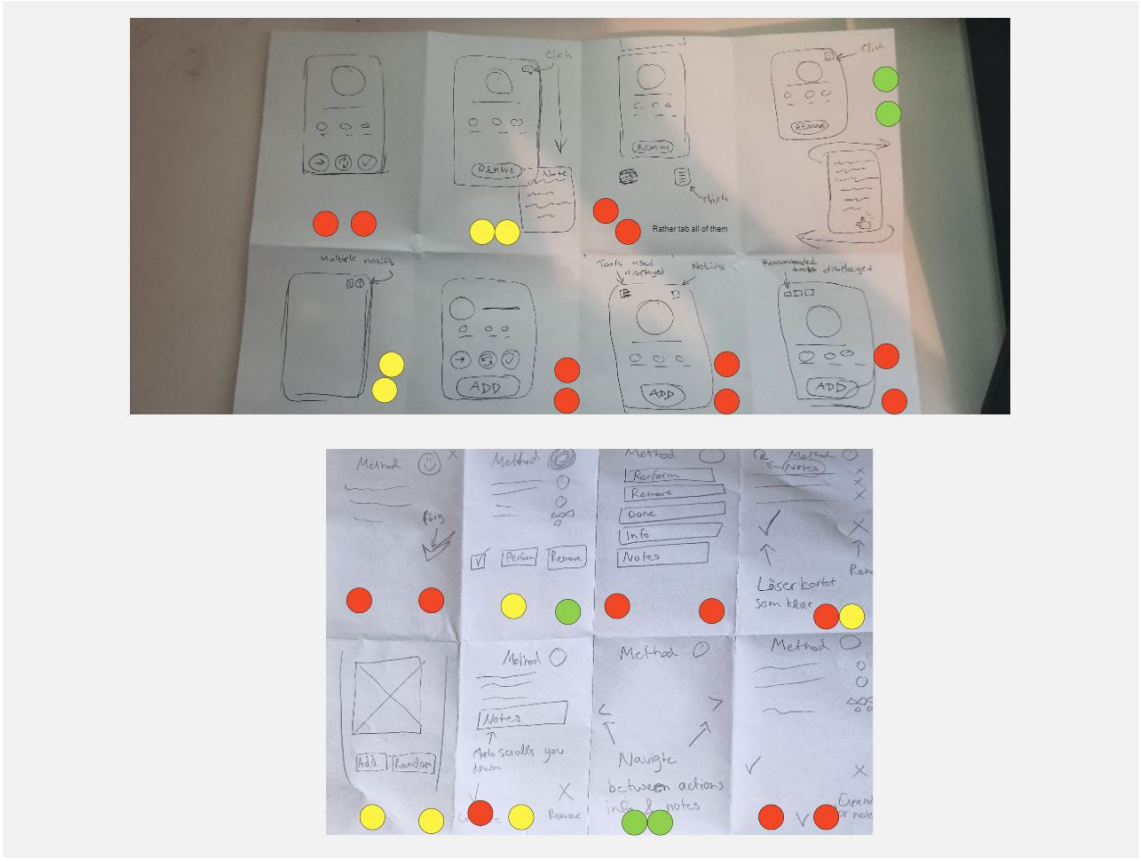

Figure 6.30: Crazy 8's sketches made in the sketch phase of iteration 2

ods with notes written on them will be displayed with bigger cards which include the method image, title and the note written on it.

The team also decided to create mock-ups of the notification feature. The intention was to give feedback to the users when they e.g. create Teams, Projects, save a note or add a method. Users mentioned that they needed feedback from the web application and therefore, these additions were sketched. The notification mock-ups can be seen in figure 6.33

6.3.5 User Study Group 2

Due to the small amount of users in the first iteration, another group of users were invited in order to get more feedback on the web application. In this user study, the study group would go through the first four phases: understand, define, sketch and decide. The group consisted of three members.

Changes were made to the user study. From what the team learned from the first user study was that the design project given to the user study group was too broad, and lead to too much time sinking into finding ideas for a concrete product to design. Therefore, in this user study, the team decided to give the users a specific project to do in order to be able to conduct a short four phase design sprint without

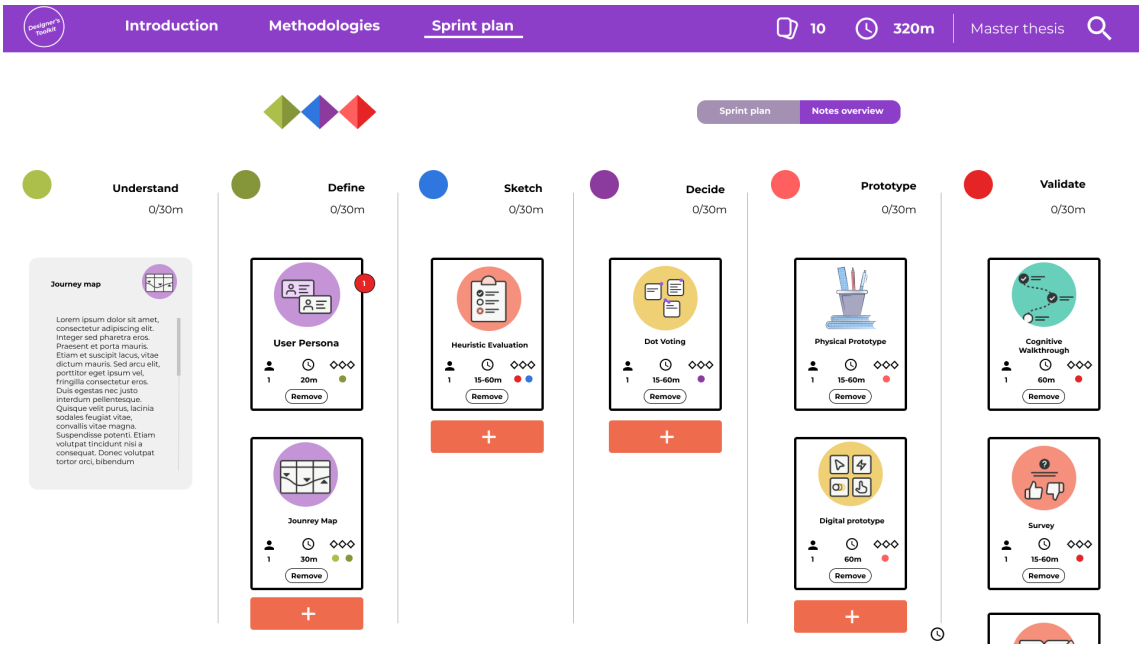

Figure 6.31: Mock-up of reworked sprint plan

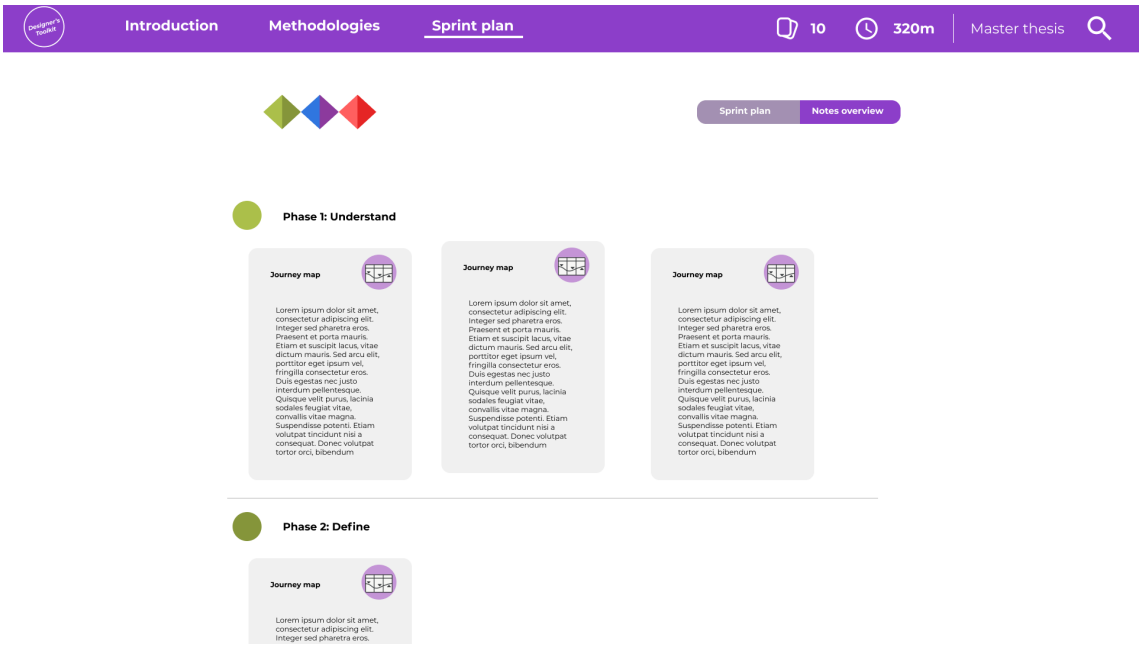

Figure 6.32: Mock-ups of the note overview page

feeling time pressure or stress. The team chose to change the user study project into one where the users would create a user interface for a game.

The game chosen for this study was Curve Fever (*Curve Fever*, 2022), a game where players move a colored dot around a surface together with other players. The dots leave behind a trail when they move, and if a player crashes into the trail, they lose.

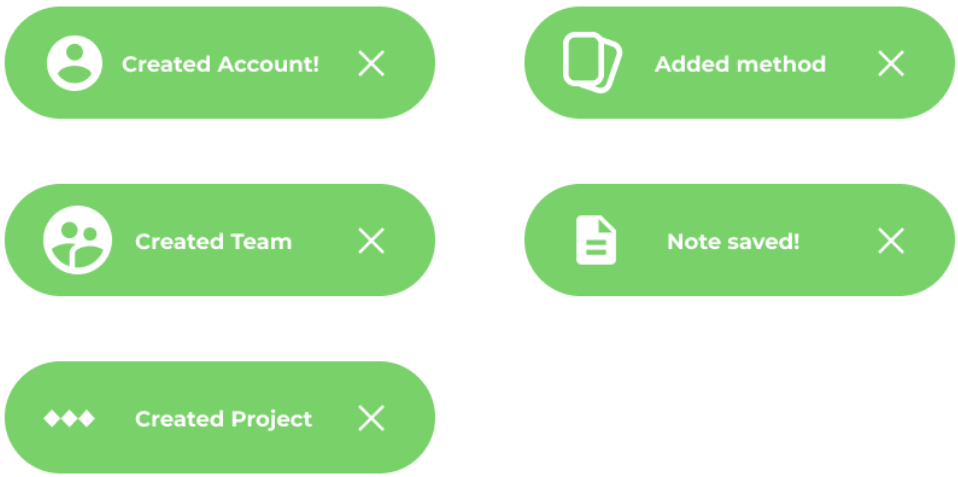

Figure 6.33: Mock-ups of the notification elements

When conducting this user study, the participants had something concrete to do and the process went faster.

Guideline Analysis

From the first user study seven potential guidelines were identified as seen in 6.3.1. These were all confirmed by this user study showing the same needs. In addition to these seven potential guidelines, an eighth was found, which is:

Give tools within the application which aids the collaboration in the web application

This one was about giving users specialized tools to facilitate methods that could use them.

6.3.6 User Study Group 1 - Iteration 2

The same group that participated in the first user study were invited back to conduct their final three phases for their project (decide, prototype and validate). After finishing up their design, they were given the same questionnaire and AttrakDiff forms as the new group of users, in total making it five users.

There were no new guidelines identified in this study but all eight potential guidelines found in the two previous user studies were confirmed as desired once again. This meant that the results had not changed and therefore no more user studies were needed.

From the questionnaire in this study, the results (see Appendix B) showed that the perceived user experience of the collaboration within the web application was between origin and the middle of top right quadrant in the collaborative design framework. This was based on the replies of the questionnaire where the users answered the questions about design subject matter and the style of guidance.

7
Results

This chapter will go through the various results uncovered during this thesis project. It will start by presenting the guidelines that has been made for what to consider when designing a web application to support collaboration between interaction designers when conducting a design sprint. Then it will move on to go through the theoretical evaluation results that has been done. Lastly it will present the collaborative features added to the final web application that was developed during this project.

7.1 Guidelines

According to the analysis of the data collected from the user study a set of guidelines was created, for the full analysis see subsections 6.3.1, 6.3.5 and 6.3.6. In this section, the eight guidelines developed will be presented and defined.

- **Guideline 1** Visualize other members' critical actions
- **Guideline 2** Allow visual documentation
- **Guideline 3** Present helpful links to relevant external resources
- **Guideline 4** Give customization options
- **Guideline 5** Provide the ability to signify progress
- **Guideline 6** Provide documentation capabilities
- **Guideline 7** Include an overview of all the documentation
- **Guideline 8** Give tools within the application which aids the collaboration in the web application

Visualize other members' critical actions

The team members involved in a project should be able to see what other team members are doing in the project. This could be updating the sprint plan with new methods, adding a new comment to a method etc. Depending on the application being developed, various features could be made where the users know about how they are updating the project. This is something that the participants of the user studies noted that they were missing in the web application. In chapter 3.2, the use of notifications is brought up and it is argued by Ardissono & Bosio (2012) that notifications are an essential part of communication in a collaborative application. He also mentions keeping a balance in the amount of notifications to not cause the users to lose focus.

Allow Visual Documentation

Users should be able to have a form of visual documentation features in the application. These features should allow the users to upload and maintain figures or drawings made by the team. This is close related to hedonic quality, more specific, the emotional attribute of *identification* presented in Hassenzahl (2003). This quality is about fulfilling the human need for self expression. As observed during the user study, interaction designers often sketch figures, create storyboards create a table of post-it notes. Having these sketches maintained in the web application is something that the participants in the user study 1 wanted as seen in subsection 6.3.1.

Present Helpful Links to Relevant External Resources

Providing links to online tools and resources are a way to help interaction designers cut time cost when conducting a design sprint. The first user study showed that users are already familiar with most of the recommended web applications but appreciate getting to know new ones. These tools can help conduct certain design methods.

Give Customization Options

Give the users the ability to customize their design sprints. This can be done by letting users add their own design methods or editing existing design methods to their own needs. Customization provides the users with the freedom to add their own knowledge to the application to share with others. In an application where multiple projects can be made, allowing customization provides the users with a way to add their knowledge to the application to reuse in future projects. The user studies showed that participants would like to have features that allow them to add their knowledge to the application such as personal design methods.

Provide the Ability to Signify Progress

When users are working in a project environment such as a design sprint they need a way to communicate the progress to each other. Providing the users with an option to signify what has been done this far in the project is vital. This was discovered by observations and verified by the questionnaires in all user studies, see subsection 6.3.1.

Provide Documentation Capabilities

As users are conducting methods during a design sprint they end up with a bunch of content. This content is often scattered around in different external applications. To provide a place to write and save documentation can help users to share their work when collaborating in the application. During user study 2 by group 2 a user said "Yes I like that. Nice to be able to put in notes so you remember" in a questionnaire question about the idea of storing notes for each method. In Hassenzahl (2003), the

emotional attribute of *identification* in hedonic quality is connected to this guideline. This is since it lets the users express their work in the application and make it.

Include an Overview of all the Documentation

If the web application has a functionality to store and save documentation for various methods, a place to see all the content at once is necessary. This can be done in different manners as long as the navigation time between the documentations is reduced. According to Hassenzahl (2003), it is also said to increase the user experience for the hedonic qualities when the emotional attribute of *evocation* is reached. If an overview is provided to the user of the documentation, this attribute is reached. In user study 2 by group 2, a questionnaire answer from a user backs this up by saying "I think so! It provides a team of designers a feature for communicating and write down thoughts about each method individually" about the notes overview feature in the web application.

Give Tools Within the Application Which Aids the Collaboration in the Web Application

It is common for some methods to use special tools such as timers for collaborative activities. To facilitate the collaboration, the web application should have such tool integrated. Where to best integrate them should be investigated for each unique application. This guideline was supported by the observations and questionnaire in subsection 6.3.5, where a users suggested voting and timer features for specific methods.

7.2 A Collaborative Design Framework

To verify where on the collaborative design framework the users thought the collaboration in the web application was, they where asked about the design subject matter and the style of guidance, the results are highlighted by the green square in figure 7.1. The users, after the second iteration of the project, thought the web application was between in the middle and the center of the top right quadrant of the collaborative design framework. Therefore, the user experience of the collaboration in the app can be seen as aimed at expanding or assessing given options, adding elements of interests, feasibility and concreteness.

This is a result for future reference when comparing the collaborative experience between the applications. It will lead to new findings and therefore a better understanding of how the users experience the application and if this is the desired collaboration.

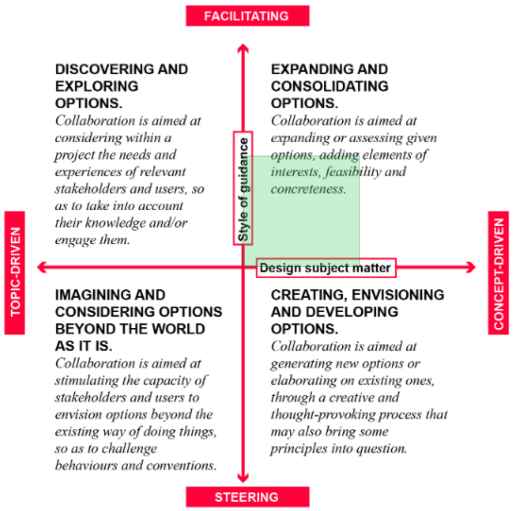

Figure 7.1: Where the users grade the web application on the collaborative design framework

7.3 Attrakdiff

The users were given the AttrakDiff survey to fill in on the online tool in the users studies. The tool produced two sets of graphs the visualize the attractiveness of the application in each iteration.

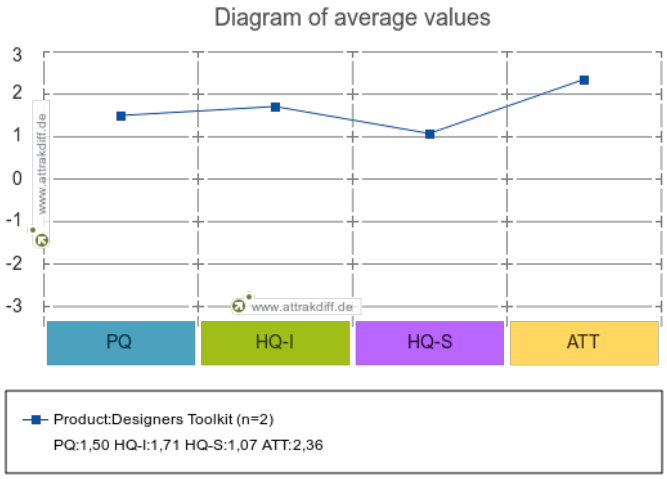

Figure 7.2: Diagram of average values from the first user study

The user study in the first iteration had two participants in total. The average values for each quality can be seen in figure 7.2. The lowest rated quality being HQ-S (Hedonic Quality - Stimulation) and the highest rated quality is ATT (Attractiveness).

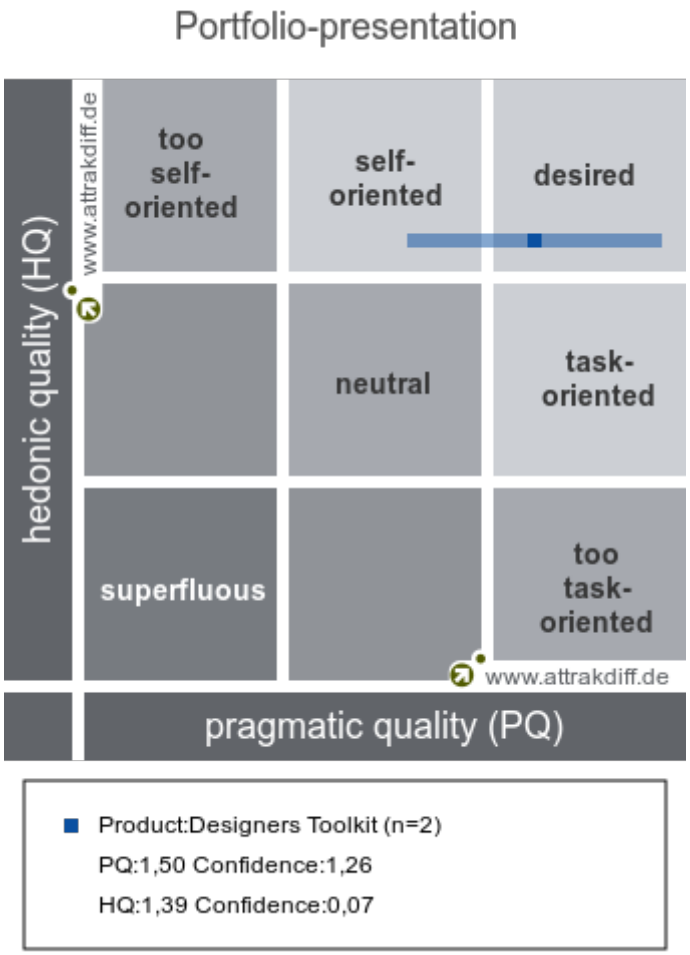

Figure 7.3: Portfolio of results from the first user study

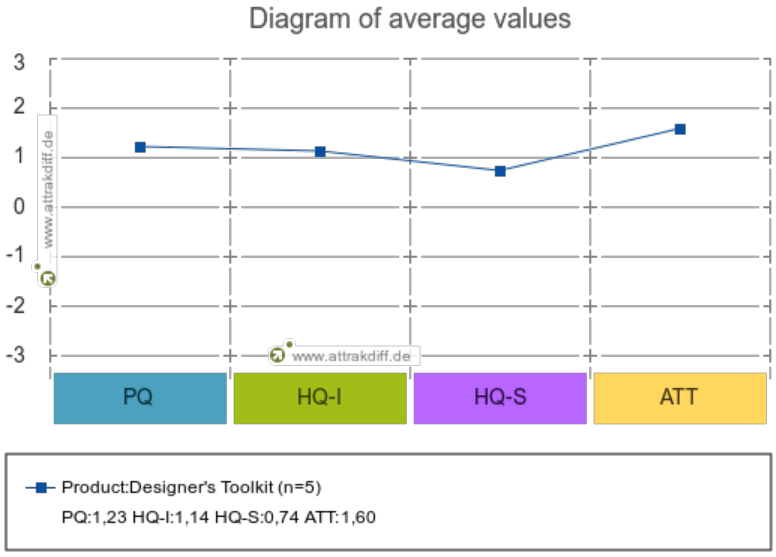

Figure 7.4: Diagram of average values from the second user study

Figure 7.4 shows how the hedonic quality compares to the pragmatic quality. The application lies on the desired rectangle on the graph with a confidence value of 0.07 on the hedonic quality and 1.26 confidence on the pragmatic quality.

The user study in the second iteration included the two previous participants and three new participants. In total, there were five participants in the user study of the second iteration. Another AttrakDiff survey was given to the participants. Figure 7.5 shows how the average values of the different qualities. Similar to iteration one, HQ-S was rated lowest and ATT was rated highest.

Figure 7.5: Portfolio of results from the second user study

Figure 7.5 shows the hedonic and pragmatic qualities compared together. In this iteration, the application lies on the "task-oriented" rectangle with a confidence of 0.49 on the hedonic quality and 0.68 confidence on the pragmatic quality.

See Appendix D for a detailed view on how each quality was rated based on the set of questions asked in the bipolar semantic differential questionnaire.

Comparing these graphs, a change in attractiveness between the user study in

iteration one and user study in iteration two can be identified. User study one showed that the attractiveness of the application was *desired*, while user study two was only *task-oriented*. This means that the level of hedonic quality slightly decreased from the first study to the second.

7.4 Levels of Collaboration

By observing users throughout the user study 2 by group 1, see subsection 6.3.6, the level of collaboration was determined. The level of collaboration that can be reached in the model by Coleman (2012) for the web application is *collaboration*. To show this, starting from the first level, the user study showed that the level of *conversation* was reached as soon as the application was started when the users first greeted each other. The user study also included discussions of how to perform different methods in the app which makes it reach the *communication* level. When they later discussed how they would work as a group to make a plan for how to work together they reached the *coordination* level. The *cooperation* level was also reached when they later decided to act out these plans. Lastly, *collaboration* was also reach when the users used their experience of using certain methods in order to decide which to use and later how to structure the method they decided to perform.

Note that this is the result of the level of collaboration reached for the web application during the user studies. This does not directly transfer to any project done in the web application. However, it does show that the web application has the capacity of being used in the highest level of collaboration.

7.5 Web Application

This section will go through the final web application and present all of the pages and implemented features.

7.5.1 Account Creation and Sign In

Users can create accounts on the web application and sign in with them. This is done on the landing page of the web application.

Sign Up

The user can choose to create an account on the right side of the landing page of the web application, see figure 7.7. When clicking the "Create Account" button, the sign-in form switches to a sign-up form as seen in figure 7.6. The user needs to enter a unique account name, meaning one that has not been used by someone else in the web application. The user then needs to write their password and confirm it in the following two fields. If the user has written an existing account name or the passwords do not match, an error message will appear above the sign up form

detailing what went wrong. When the user successfully creates an account, they are taken to the dashboard page immediately.

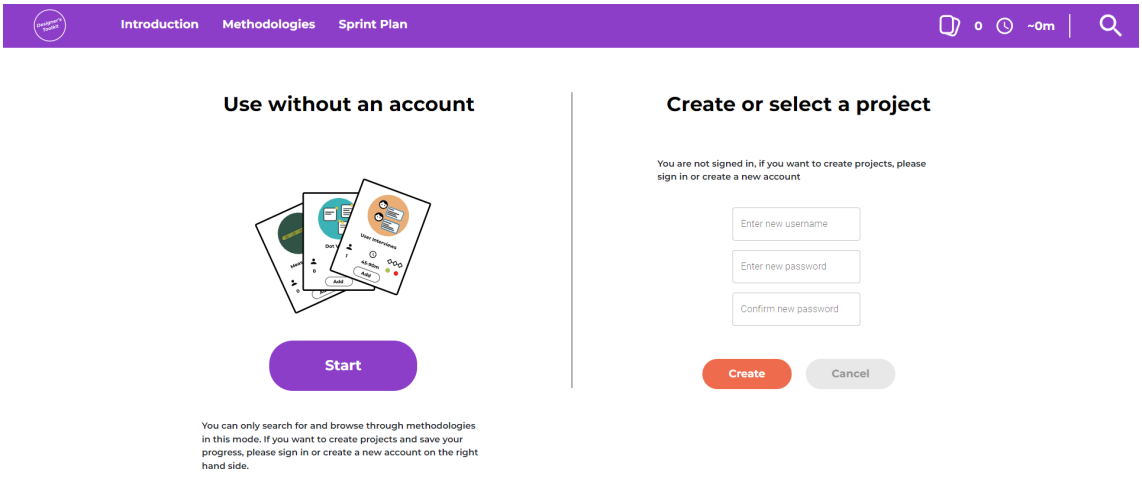

Figure 7.6: Final page for the sign up feature on the landing page

Sign In

If the user has an account and is not signed in, they can sign in through the sign-in form on the right side of the web application as seen in figure 7.7. If the user cannot successfully sign in, an error message will appear above the sign-in form detailing what went wrong. When the user successfully signs in, they are taken to the dashboard page.

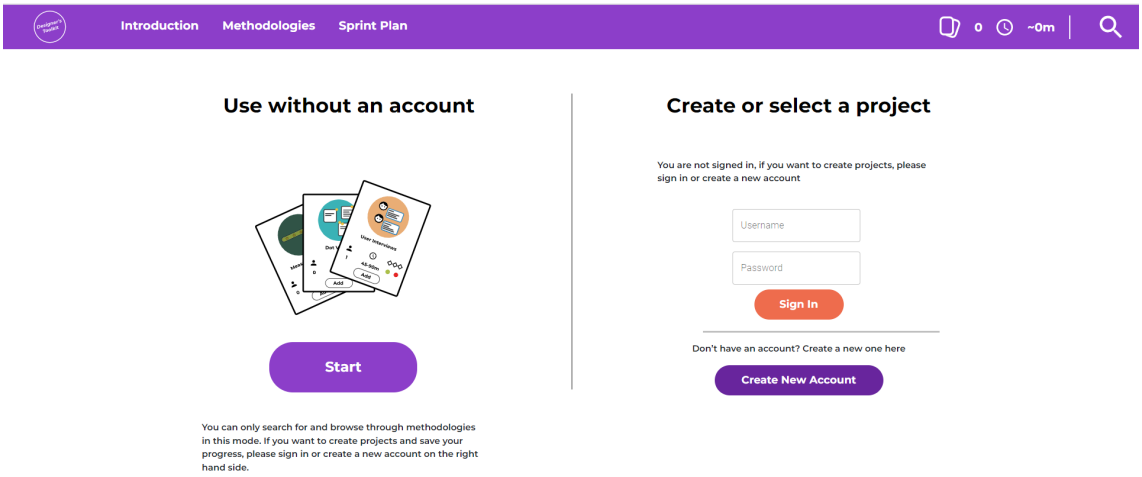

Figure 7.7: Final page for the sign in page

7.5.2 Dashboard

When the user signs in to their account, they are taken to the dashboard page, see figure 7.8. The page shows the user which account they are signed in with on the

top right of the page along with a button to sign-out. This page contains a Teams section on the left hand side and a Projects section on the right hand side. Teams are used to create groups with other people who have accounts on the web application. When a team is created, the team members can create projects on the right hand side. These projects will become visible and accessible by all team members. Each user also has a personal team which is placed at the very top of the teams section named "My personal projects". This team is used to create private projects that cannot be shared with anyone.

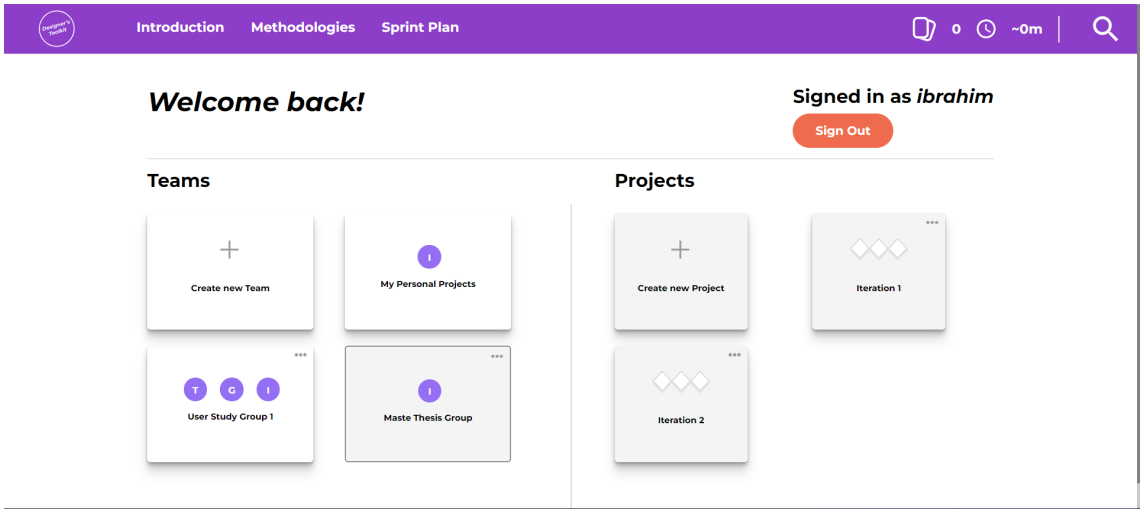

Figure 7.8: Final page for the dashboard page

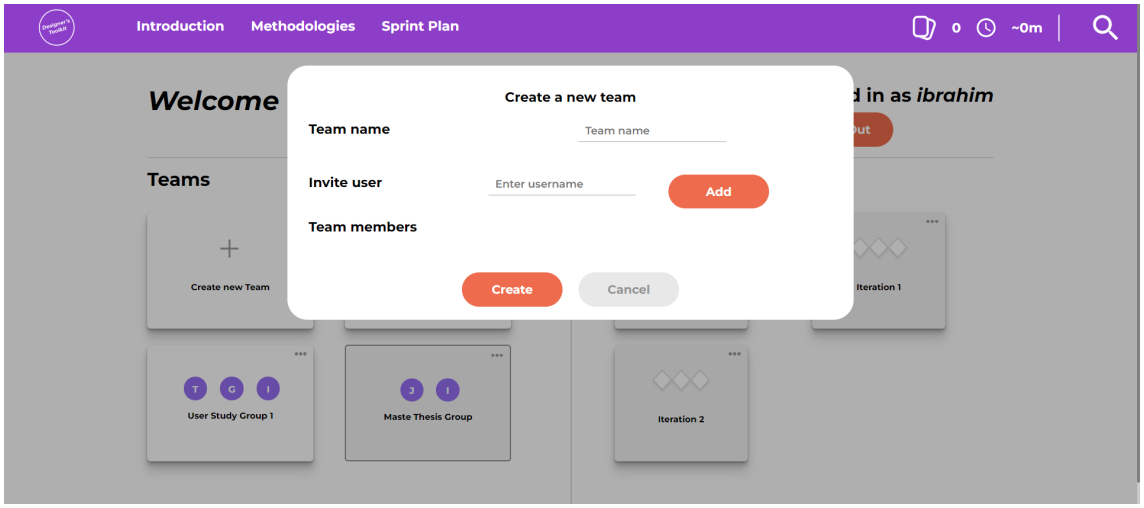

Figure 7.9: A form used to create a team in the web application

Creating Teams

When a user wants to create a team, they can click on the "Create new team" button on the top left of the Teams section as seen in figure 7.8. When the user presses the button, a form will show up where the user can enter a team name and add team

members, see figure 7.9. When adding team members, the user needs to type their account names and then click the Add button. If the username is not found in the database or the user is already added to the team, an error message will be displayed detailing what went wrong. When the user is finished, they can click the "Create" button to create the team. If the user does not type a team name, a placeholder name will be applied which is "Team name". If the user does not add any team members, then the team will only contain the user that created the team. The user that creates the team is also the owner of the team. When the team is created, a team box will be created in the Teams section on the dashboard page as seen in figure 7.8.

Editing Teams

When the user wants to edit a team, they can click on the three dots on the top right of a teams box. When they click on the three dots, a form will appear as seen in figure 7.10. This form is similar to the one used to create a new team. The difference is that this form displays who the owner of the team is. Other team members who are not owners of the team can also edit the teams box. Team members are displayed at the bottom of the form. The team owner is not a part of the team members list, they are the team displayed as the team owner. The team owner can remove any team member by clicking the cross button next to their names. If a user is a member of a team and is not the team owner, they can only remove themselves from the team and not other team members. The form used for editing the team can also be used to add more team members and change the name of the team. When the user has finished all of their changes, they can click the save button where all of the changes will be updated in the database. The user can also cancel the edits by clicking the cancel button, which will close the form and no changes will be made.

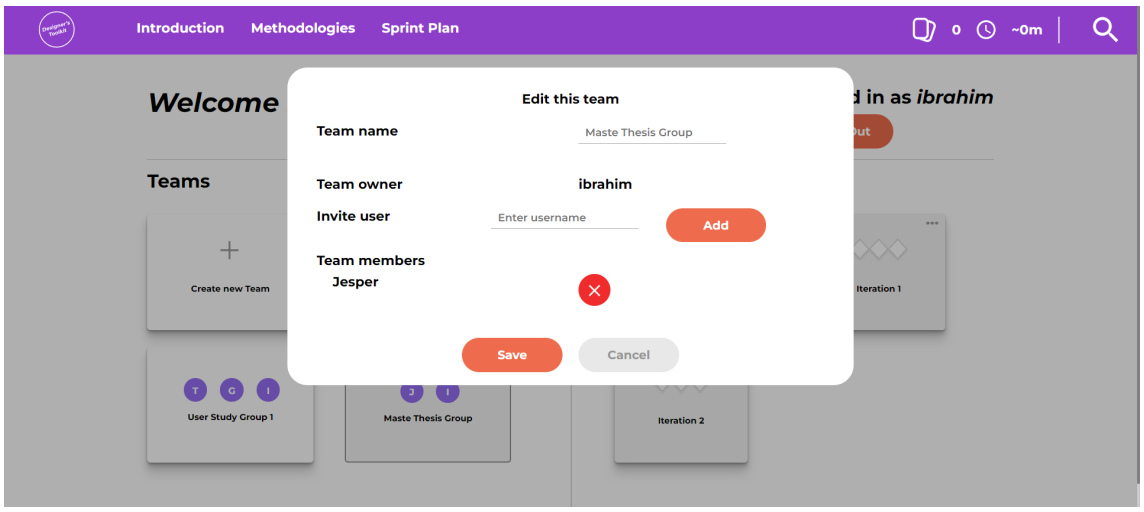

Figure 7.10: A form used to edit a team in the web application

Creating Projects

When the user wants to create a project, they need to first select a team on the left hand side of the dashboard by simply clicking on the a team. An option to create a project will then be presented on the right hand side in the Projects section. The projects presented here are related to the selected team on the left hand side. When the user clicks on the "Create project" button, a form will appear as seen in figure 7.12. The user can apply a project name and allocate time for each phase in the triple diamond design process. The allocated time is for each phase that the user applies is in minutes. The figure shows default values that are applied for each phase if the user chooses not to apply the values themselves. If the user does not want to apply a name for the project, a placeholder name will be applied which is "Project name". When the user is finished filling the form, they can click the "Create" button to create the project and an entry for the project will be saved in the database. The created project can be seen in the Projects section in the dashboard. If the user wishes to cancel the project creation, they can click the "Cancel" button and no project will be made and no data will be saved in the database.

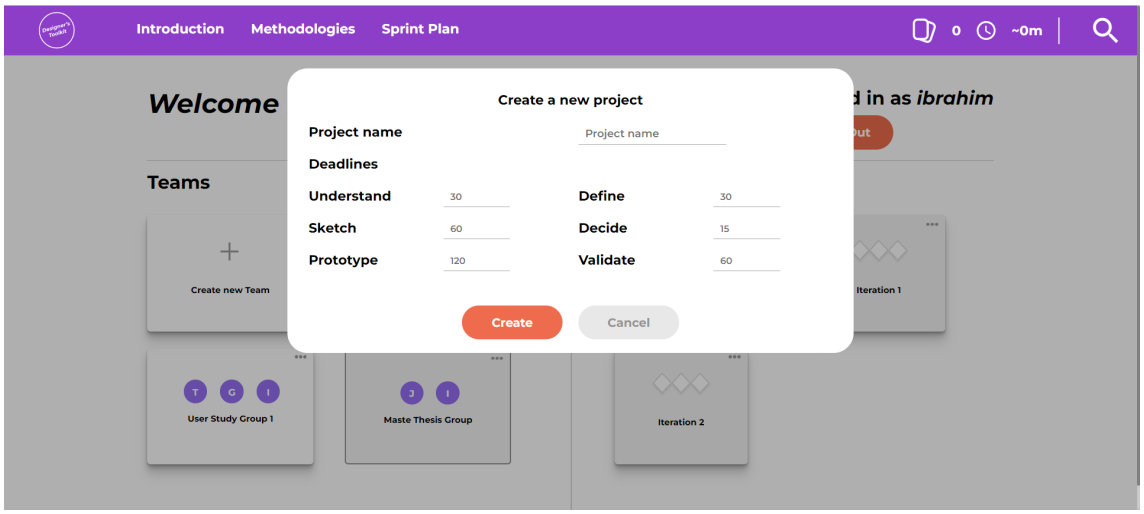

Figure 7.11: A form used to create a project in the web application

Editing Projects

If the user wishes to edit a project, they can click the three dots on the top right of a project box in the projects section. This feature can be seen as a part of guideline 4, as it give the team a way to personalize their project to fit their needs. When clicking the three dots, a form will appear which is similar to the project creation form, see figure 7.12. The form has the project data filled in from the database. An addition in the edit project form is the option to delete the project. This can be done by clicking the trash can icon next to the project name. Clicking this icon will remove the project data from the database. The user can choose to update the fields of the project by editing the data in each field such as the project name or the time allocated to each phase in the triple diamond design process. When the user is finished, they can click the "Save" button which will update the data in the database

for the project. If the user wishes to cancel the edit, they can click the "Cancel" button, the form will be closed and no updates to the database will be made.

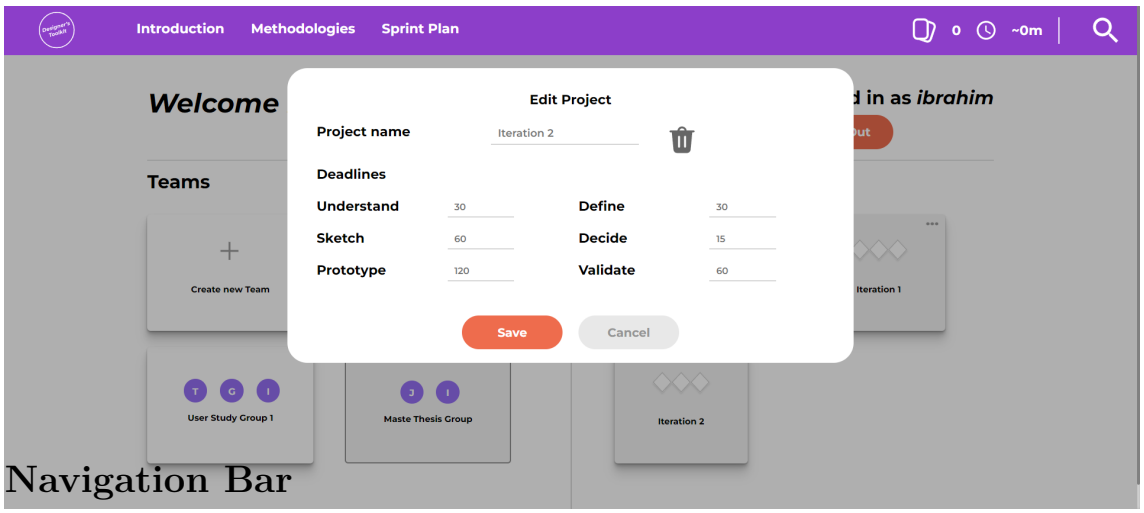

Figure 7.12: A form used to edit a project in the web application

On the left hand side, the navigation bar allows the user to navigate between different pages in the web application. The logo of the web application is used to get to the landing page. If the user is logged in, the landing page is replaced by the dashboard where the user has access to all their teams and projects. On the right hand side of the navigation bar, the user can see various information about the selected project. First, the user can see the amount of selected methods in the selected project. Next, the user can see the estimated amount of time to execute all of the design methods in the selected project. Afterwards, the user can see the name of the selected project. Finally, the user is presented with a search button which is used to open the search and filter drawer.

7.5.3 Method Description Page

There is a description page for every method in the application, on figure 7.13 the method page for how might we can be seen. This page describes the method and gives detailed steps of how to perform it. An *add method to sprint* button was added as an alternative way of adding a method to the sprint plan.

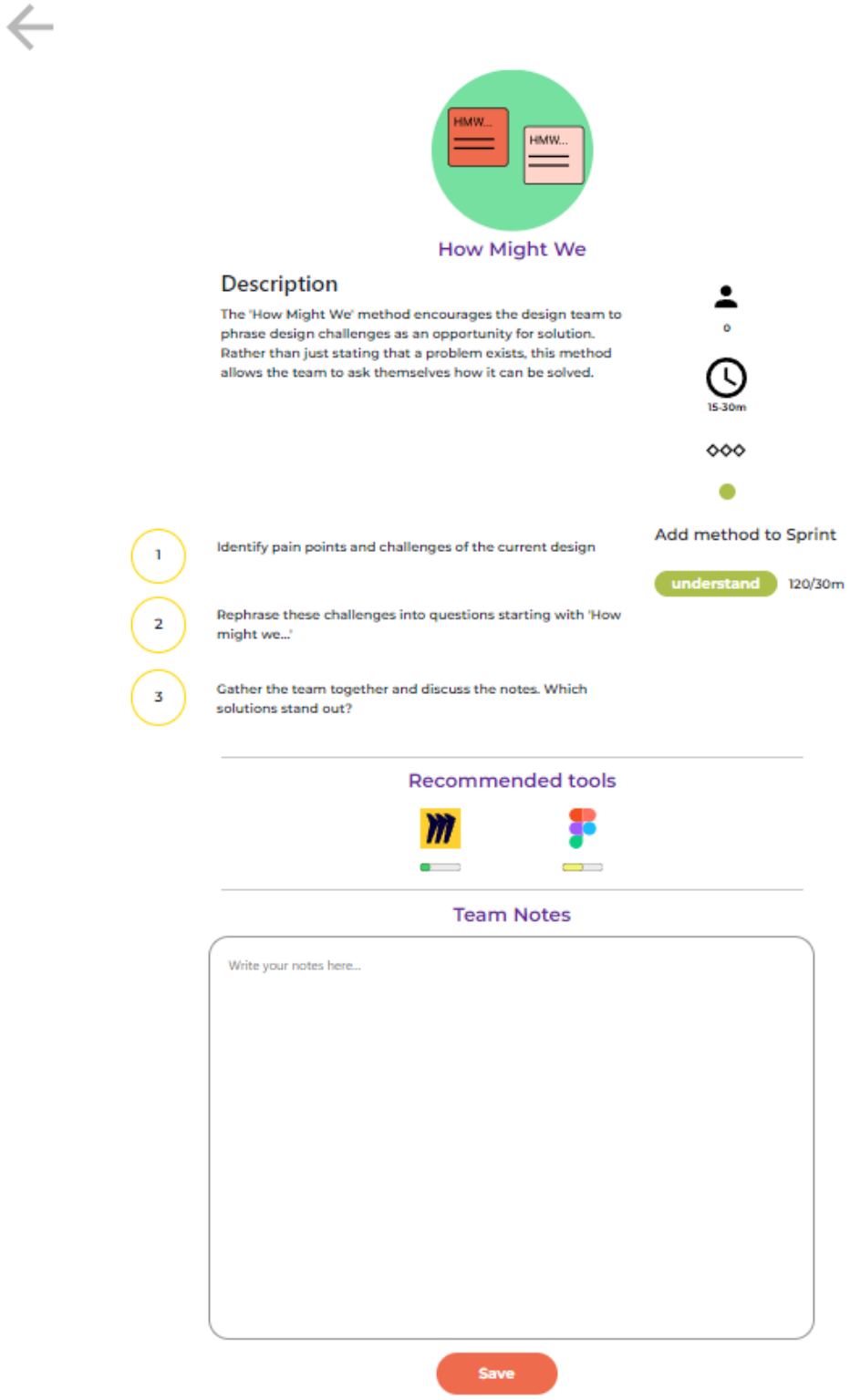

Figure 7.13: An overview of the method page in the final web application

Recommended Tools

The feature of recommended tools can be seen in figure 7.14. This feature provides some external tools that can be used to perform the method they are recommended for. It is clear that this feature was added with guideline 3 in mind, as it provide the users with helpful external tools to use for all the methods. The tools have a difficulty bar to potentially help users who are unfamiliar with the tool or never used it before. The difficulty is visualized by a progress bar that increases as the difficulty goes up, the visualization is also supported by color going from green to yellow to red as the difficulty increases. If the logo of the recommended tool is pressed a new window will be opened in the web browser of the home page of logo pressed.

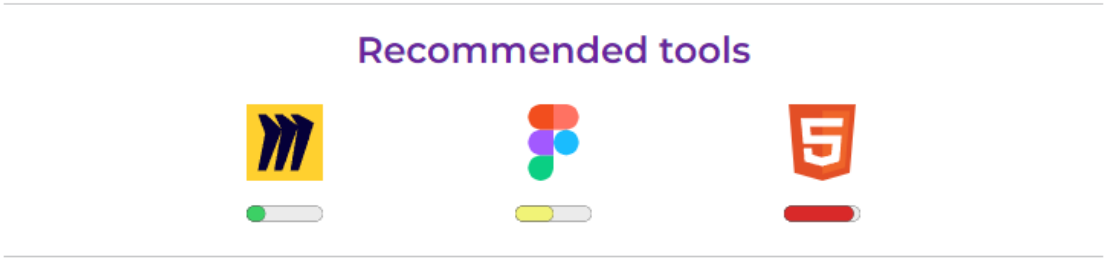

Figure 7.14: The recommended tools feature

Team Notes

Team notes can be seen in figure 7.15 and is a feature that allows a team to write notes for each method. These notes can be seen by anyone in the team of the project it has been written in. It works by writing a text in the note box and pressing the save button. Pressing the save button will update the data base and the text that is in the note box at that time will be saved. This method is closely related to guideline 6 that suggests documentation capabilities for this type of application.

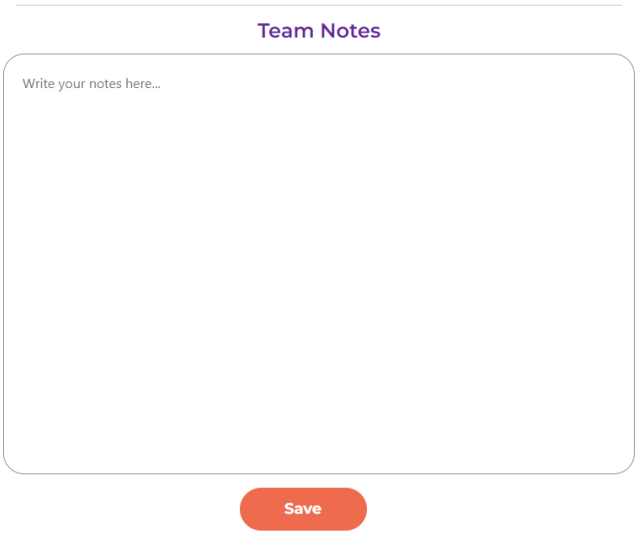

Figure 7.15: The recommended tools feature

7.5.4 Sprint Plan

The sprint plan in the final web application has two purple navigation buttons on the top right, see figure 7.16. The functionality of these buttons are that they swap between the sprint plan view and the notes overview view. When navigating to the sprint plan the sprint plan view is by default the first shown. The note overview view is a new feature that allows the users in a team to see all their notes from different methods in one place. Another new feature in the sprint plan view is the time allocation summary.

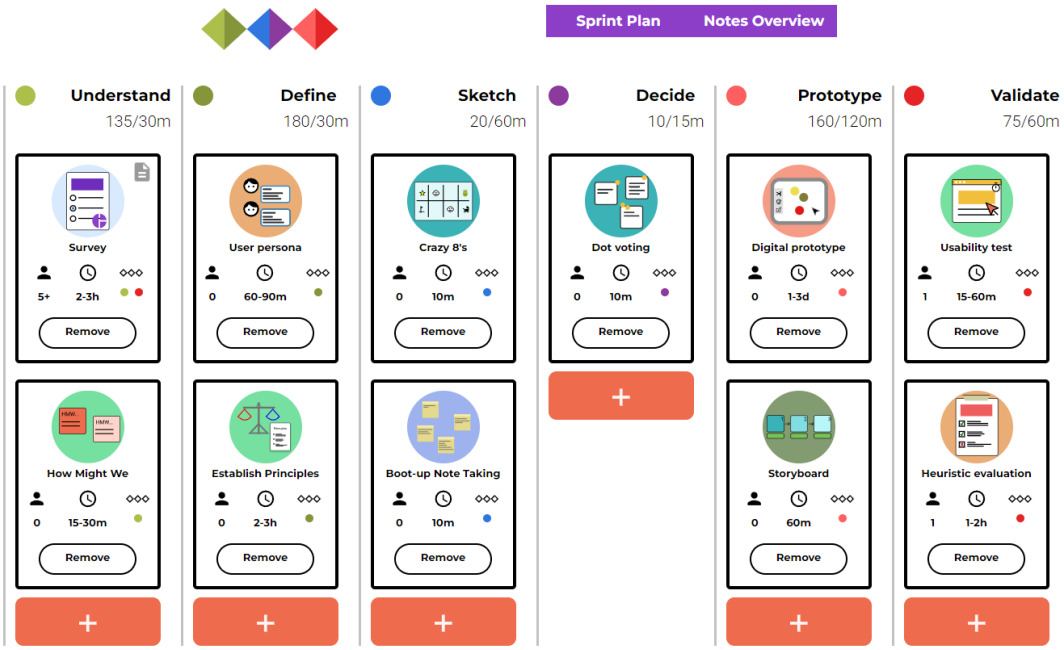

Figure 7.16: The sprint plan in the final web application

Time Allocation

The time allocation functionality is first set when a project is started or later edited in project settings. In the sprint plan a summary of the time the current method takes versus the time allocated for that method is can be seen for each phase as shown in figure 7.17. The web application will allow the users to go over time they allocated and just show them they have overstepped their preset time limit. This feature of the application is related to guideline 8, it is a tool for the process that aids the users of the application to set common deadlines for different phases.

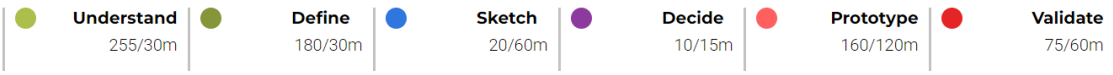

Figure 7.17: The time allocation overview feature in the sprint plan

Notes Overview

The notes overview allows all members of a team to see an overview of all method notes for a project, see figure 7.18. This feature is connected to guideline 7 as it provides an overview of the documentation the users have done in the application. It is located in sprint plan and shows up when the notes overview button is pressed. It shows the six different phases in vertical order and the note card for each method is listed horizontal. There is room for three method cards per row and if there is more methods used, a new row will be started. The method card contains an icon of the method, the method name and the documentation made by the team for that method. In the scenario of the documentation being too long to fit in the method card the option of scrolling within the card will be made available. All in all, this leaves an easily accessible place for a team to see all their methods documentation in one place.

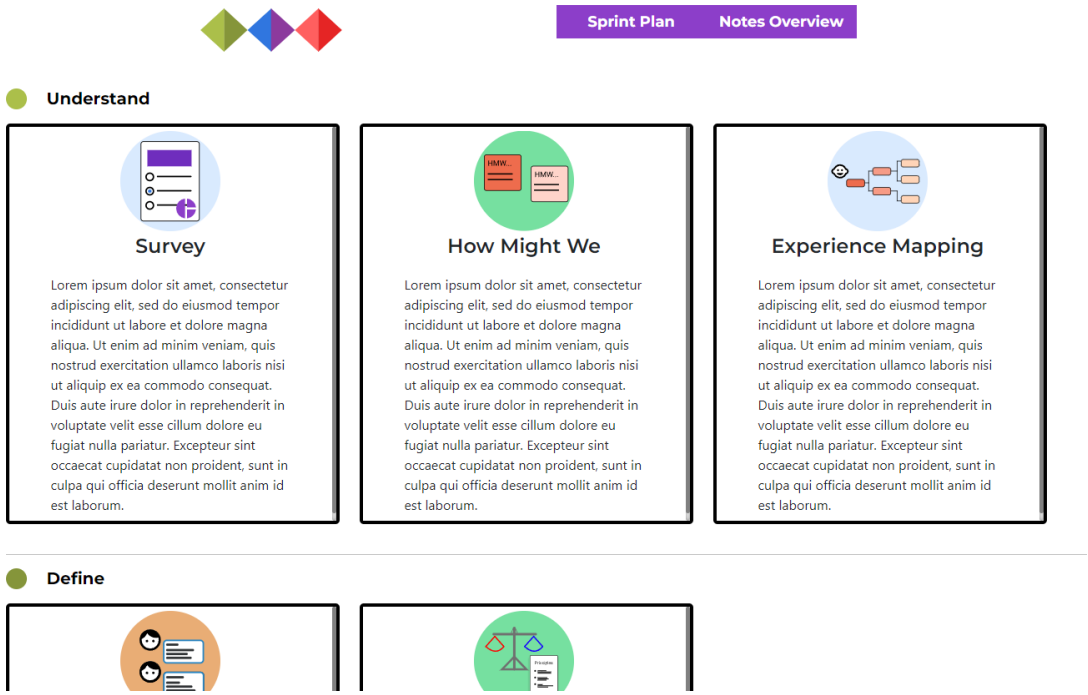

Figure 7.18: The notes overview view in the sprint plan

8

Discussion

In this chapter, the outcomes of the results chapter, the choices of the process and potential future work will be discussed. It will present the teams thought on these topics and motivate certain decisions.

8.1 Final Results

There were eight guidelines produced in this research. They are all unique, have their own purpose and they are supposed help with providing desired functionality to the application. However, there could have been room for finding more guidelines if other methods would have been used to collect the data or the methods used would have been performed differently. This could have been done in the form of open or semi structured interviews, where the participants are required to give more feedback around features and functionality they would like to have in such an application. Alternatively, it could have been done through differently formulated questions in the questionnaire. As Campbell (2015) mentions, the research bias on how data is collected have impacted the results. This is an area that was thought of when questions was formulated and designed but it can always be improved.

The guidelines were created by analyzing the data from user feedback during the user studies. To be able to get an more honest response, user interviews could have been done in advance. This way, users without any experience with the web application could have given their opinions. The questions in the questionnaire could also have been designed based on those answers. Consequently, the researcher bias could have been reduced and it would have added another layer of user feedback to the guidelines.

The collaborative framework gave an insight in how the participants rated the collaboration during the user study. It is still important to have an idea of where the users see themselves to understand the user experience. This was to gain a perspective of the setting the data was collected in as suggested by Meroni et al. (2018). Which later aided when performing the analysis to find the results.

From the start of the project, the collaborative framework was not planned to be included. It was an addition to the research when cross-disciplinary collaboration was not possible to investigate. This way the collaboration was able to be put in a framework to visualize it and understand it. Levels of collaboration was also

added to put a level on the collaboration and understand where on the spectre the application was able to reach during usage.

The level of collaboration in the web application was able to reach the highest level of collaboration in the user studies. This result itself does not imply that this level will always be reached when using the web application in a group. Although, it does help in finding that the web application is capable of facilitating the highest level of collaboration.

The AttrakDiff tool gave insights on how the users felt about the hedonic and pragmatic qualities of the web application. Although the tool presents insightful graphs, it does not provide additional analysis of the results. There are other tools that can provide benchmarks to compare with other products, such as the User Experience Questionnaire (UEQ) (Schrepp et al., 2017). AttrakDiff made the process of getting results and charts much more efficient. Using AttrakDiff therefore had an advantage in our case since our user studies were already long in time length.

One possible disadvantage of using a questionnaire like AttrakDiff and UEQ is the fact that the participants might misinterpret the adjectives. Or they might not know how to apply the adjectives to the product at hand. This was noticed in one of the user studies when one of the participants asked for the interpretation of an item on the AttrakDiff questionnaire. This was something that the team did not consider before sending out the questionnaire. Therefore, it might have been beneficial to tell the users to ask us questions regarding the survey if anything was unclear before handing it out.

Another note on the AttrakDiff questionnaire is that the amount of users was on the low end. This is because the users had to experience the web application in a collaborative setting first, and then receive the questionnaire. The AttrakDiff questionnaire requires at least two participants and a maximum of 20. We could have conducted shorter user studies with individual people to gauge their experience with the product and add to the AttrakDiff data. However, it would have been without having the collaborative aspect in mind, which might have impacted the result.

8.2 Design Process

In the initial stage of the research, the idea was to explore cross-disciplinary collaboration. This was meant to be primarily collaboration between interaction designers and software developers. There was a struggle in getting users from the software development area to participate in our user studies. Therefore, there was a shift in focus of the research. We decided to focus primarily on the collaboration between interaction designers. This change in direction was made prior to the first user study. The features created for the web application prior to the change in research direction were focused on the general collaboration between team members. Therefore, the change did not affect the development of the initial features. However,

some of the research done surrounding cross-disciplinary teams was discarded as a result of this. This was unfortunate since more of the time could have been spent on researching collaboration between interaction designers specifically.

Interviews were planned to be conducted after the user study. However, the team switched to handing out a questionnaire regarding their experience with the web application. This change was done because the user studies were approximately one and half an hour long. Conducting interviews with each member of the participants would have consumed more time from them. We also considered doing group interviews to save time. However, doing that would not allow us to get to know each participants individual views. Interviews might have yielded more insights to why the users felt the way they did, since the interviewers can be open-ended. The development of the web application consumed a large portion of the time dedicated to the overall project. This resulted in moving the focus from doing user research in the initial stages of the research. It would have been beneficial if we had reached out to the user demographic prior to developing our own concepts and solutions.

8.2.1 User Study

The user studies were all done remotely through video calls in Zoom. We initially considered doing the user studies physically. This was in order to have the participants use an interaction design studio along with the web application. Interaction designers usually need pens, paper, post-it notes etc. when conducting interaction design methods. However, we believed that conducting the user studies remotely would put more focus on the web application. Furthermore, the remote setting tests the web applications ability to be used remotely.

Since the user studies were only able to include a few participants, the results could look different if more users participated (Spool & Schroeder, 2001). To work around this, two user studies were held in the second iteration. This way the results could be compared in order to verify that the results did not diverge. Since the results in these two studies were similar, we can with be more confident about the results and their legitimacy.

Additional user tests would have been beneficial (Spool & Schroeder, 2001). When using the web application, the amount of users that can be invited to a team is not limited currently. However, testing that limit could be beneficial in order to test the functionality of the web application. The largest amount of users that collaborated in the application were three. We did observe a bug when the users were adding and removing design methods in their project. The estimated amount of time to conduct the design sprint was incorrect sometimes. Furthermore, the "remove" button sometimes did not work. These issues could be results of concurrency problems. These can be solved when developing the web application further. However, we did not take them into consideration when developing the various collaborative features. The issues did not occur frequently to the point where the web application was unusable. The users were still able to perform their work.

8.3 Future Work

As the development time for this project was quite limited, there are a couple of collaborative features that had to remain undeveloped. This section will discuss these features and describe how they were meant to be implemented in the application. It will also be explained why some ideas ended up with lower prioritization than other.

Personalized Methods

The idea of a user being able to add their own methods to the application was brought up early in the project. It is an important aspect of giving the users the freedom to shape the process in their own way. At the same time it gives the application a way to stay relevant without it having to be updated. This is because the users have a way of updating their own method library.

To let users add their own private methods gives them freedom but to let them add public methods that everyone on the application can see is a step further. This would allow for a community to build, where a public library for design methods could emerge. This idea is interesting, although it would risk the high standard of the methods we have recommended for each phase. To solve this issue, the idea was to separate official methods from community methods and let the users up vote the community methods in order to sort them in popularity.

The main reason for not implementing this idea is the lack of dedicated memory space on the server that is used. + not community feature

Comment Section for Methods

If users are allowed to publish their own methods on the application, a place where the community can express their opinions of the method is needed. Therefore, a comment section would be beneficial. It would give users the possibility to share there experience of the method but also see what others think of it.

Favorite Methods

To be able to add a favorite method and have easy access to ones personal favorites might seem like an obvious feature to include. It is clear that this would help users faster finding the ideas that they like. However, it does not have the same impact on the collaboration as some of the other features that were implemented. That is why this feature stayed undeveloped.

Mark Methods as Completed

Users wanted to be able to see which methods were completed in an interaction design project. The advantage of this is that future collaborators that are invited can see the progress of the design project. We had different plans to implement this. One of the ideas was to redesign the design method cards altogether. Currently, at the bottom of the method cards, there is a button used to add the method to a phase in a design sprint. One of the ideas was to add another button to mark the method as complete when it is in the design sprint page. Another idea was to mark the phases as complete, instead of individual methods. Having this feature in place would possibly have given the users a call to action and a sense of completion or achievement when viewing the sprint plan page.

Notification Feature

The users from the user studies mentioned that the web application did not give enough feedback when interacting with various features. For example creating a team, saving a note etc. This feature was on the list to be developed, however, we decided to prioritize implementing the time allocation feature and note overview feature. Since we believed that those features would add more to the collaborative aspect of the web application. Future work would need to develop the web application more to support the individual user.

Web Application Style

Currently, the web application does not entirely follow the mock-ups that were created for the web application. Some of the shifts from the digital mock-ups were decided to be made during the development. E.g. The choice to make the method notes in the note overview look more like the method cards. Or changing the style of the teams and projects in the dashboard page. Some of the changes were however due to lack of time in polish work. This can be seen in the team creation and project creation forms. The team decided to put more of the focus on the back-end infrastructure since those features were cubical for the MVP. However, we do acknowledge that the incorrect styling might have affected the hedonic quality of the web application.

Design System

The plan was to design according the application according to the WCAG 2.1 standard (WAI, 2018). This was partly done since we designed with it in mind but there is room for improvement. Since the time was limited for this project, we decided to reused the old Designer's Toolkit's design system. This leaves a new design system left to be done as future work.

9
Conclusion

This thesis started with the objective of expanding a web application into a collaborative web application. By developing the web application and using it to run user studies, the team members sought to answer the following research question:

> *What should be considered when designing a web application to support collaboration between interaction designers when conducting a design sprint?*

To answer this research question, eight guidelines were created by using multiple methods of data analysis from the user studies. After assessing the data from both the observations and the feedback collected from the users, the following guidelines were created:

1. Visualize other members' critical actions
2. Allow visual documentation
3. Present helpful links to relevant external resources
4. Give customization options
5. Provide the ability to signify progress
6. Provide documentation capabilities
7. Include an overview of all the documentation
8. Give tools within the application which aids the collaboration in the web application

The users were also given a questionnaire to assess the hedonic and pragmatic qualities of the web application. From the resultant graphs given by the questionnaire tool, it is determined that the developed web application is task oriented.

Users are able to collaborate in the application by creating accounts and inviting each other to teams and create projects. These features were implemented and can be seen contributing to the collaboration of the group. They can further store notes and see changes made in projects they are involved in. Through evaluations, it is shown that the web application reaches a level where participants can collaborate. Furthermore, by applying the collaborative design framework, we found that the collaboration is directed at consolidating options based on the feedback from users in the questionnaire.

The final web application is built and deployed on the Meteors hosting service. Further work is needed to finalize the development of the web application. There

are a few styling inconsistencies with the created mock-ups and minor bugs on the back-end side of the web application. Furthermore, there are features that the users wished to see in the application which can be developed further in the web application.

Conclusively, the results of the research provide eight guidelines for web application builders and designers. These guidelines can be used in order to develop collaborative web application for interaction designers. Furthermore, the research presents how such a web application can be measured in terms of hedonic and pragmatic qualities. The work also presents a measurement of the collaboration level of the developed web application. Finally, the work presents how the massive co-design framework is applied to a collaborative web application.

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A

Mock-ups

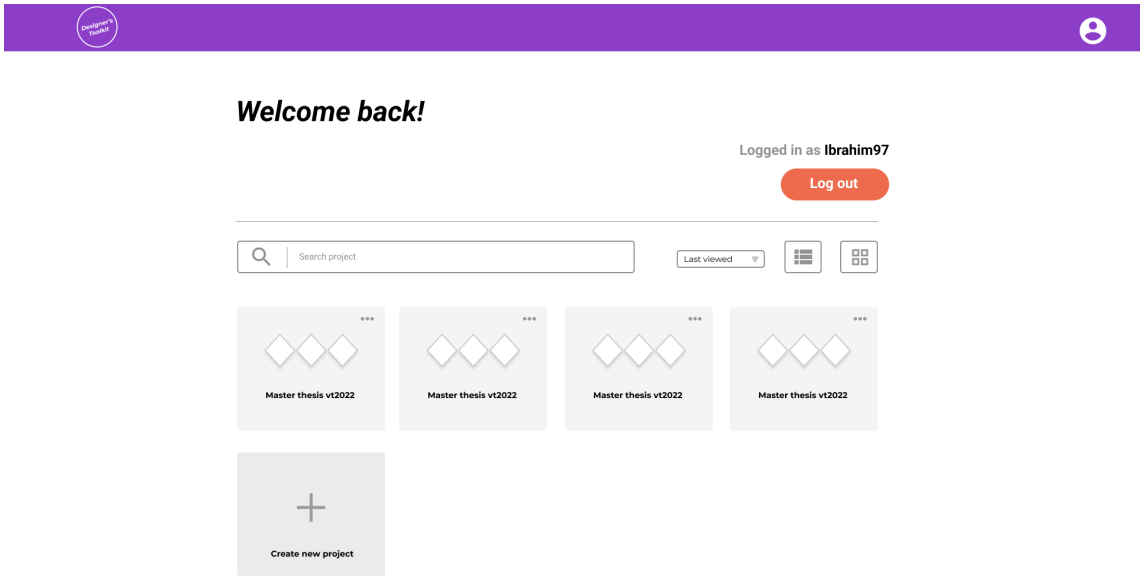


Figure A.1: A mock-up of the dashboard

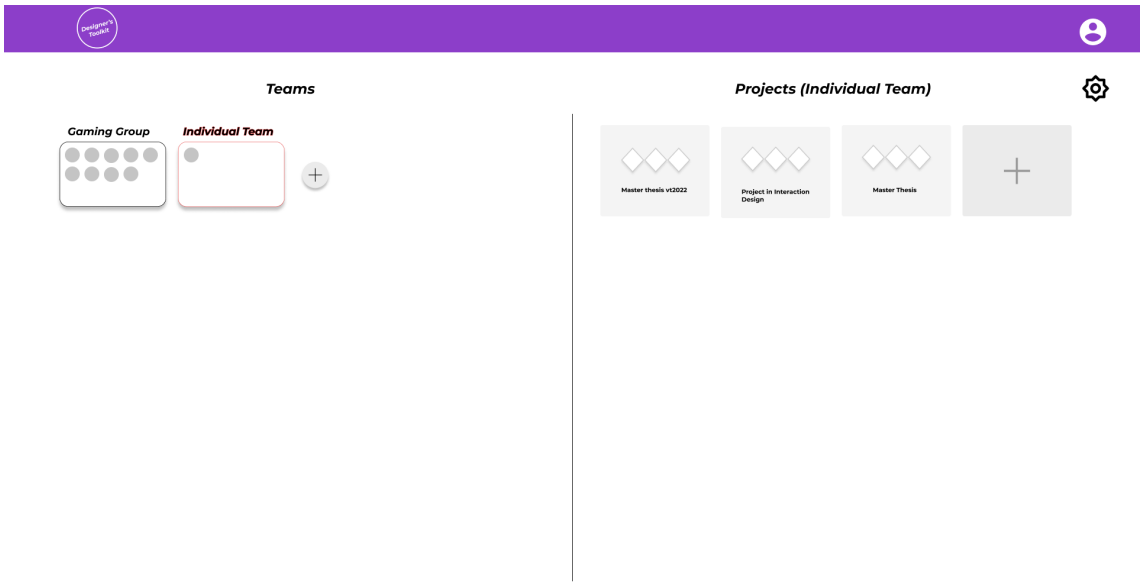


Figure A.2: Another mock-up of the dashboard

Digital Prototyping

Digital Prototyping gives conceptual design, engineering, manufacturing, and sales and marketing departments the ability to virtually explore a complete product before it's built. Industrial designers, manufacturers, and engineers use Digital Prototyping to design, iterate, optimize, validate, and visualize their products digitally throughout the product development process.

Number of participants:
1

Execution time:
15-60min

Suitable in phase:
Understand, Validate

1. Decide on what tools you would use to create a digital prototype. You could use software like Figma, Adobe XD or any other digital tool that suits you.
2. Create a
3. Summarise your findings, be sure to take notes while interviewing!

Recommended tools

HTML

★☆☆ ★☆☆ ★★⯪

Personal notes

Write your notes here ...

Save ×

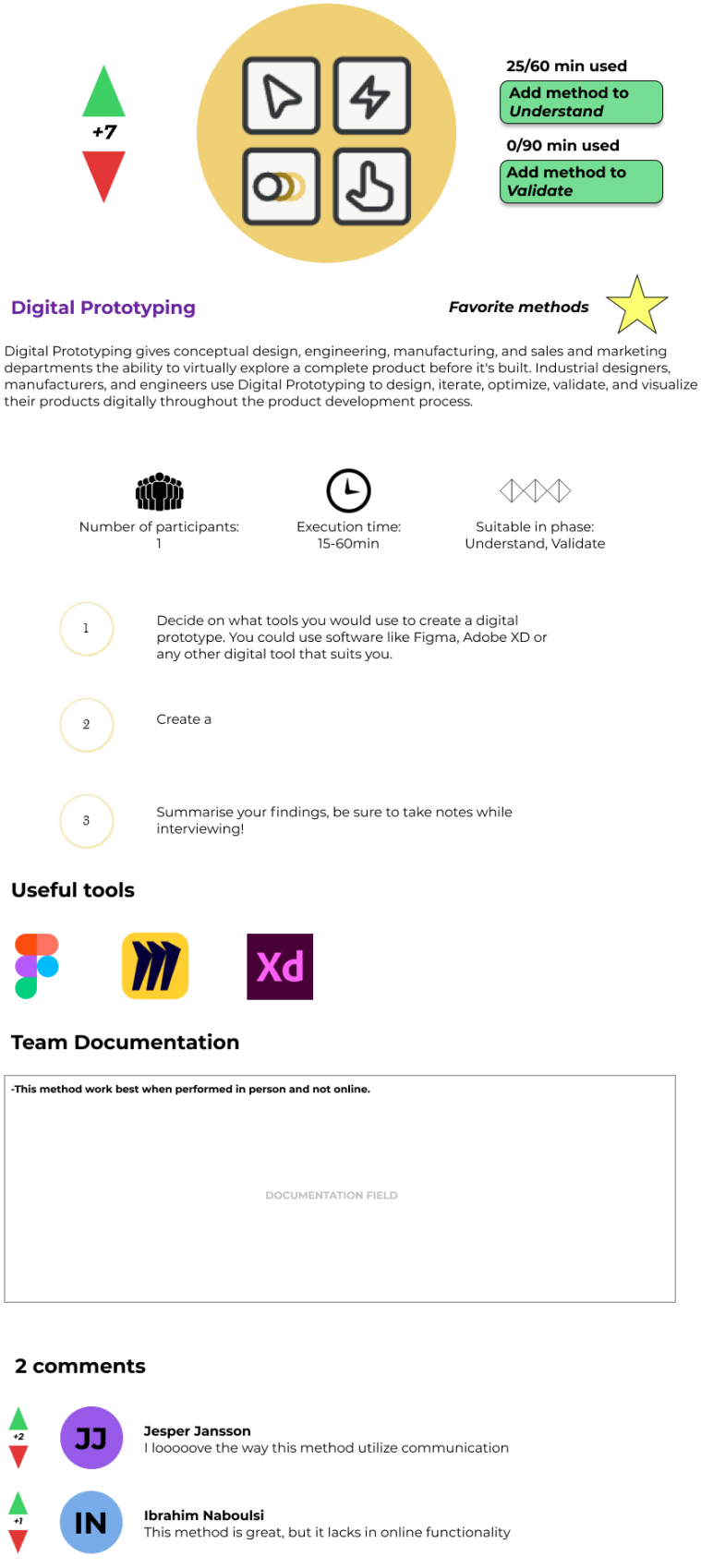


Figure A.4: Another mock-up of the method description page

B

User Study Notes and Observations

Notes from the user study

1. Users talk with eachother to explore which methods they want to use before adding it to the sprint
2. Users take note of the amount of time set for the project which in turn makes them consider the amount of time set on a method card before selecting it.
3. Not enough methods to use, makes users confused what to use for this case
4. Difficulty bar is not clear enough to understand
5. Can not search for “define” or “sketch” etc.
6. Found the bug of adding method
7. No response from clicking the add method button
8. No sync in sprint plan
9. Sprint plan is clear, they can see what has been added.
10. What to do after sprint plan can be hard to know
11. Team notes is working nice, they found out how it is working
12. Takes more time to set up Miro than expected
13. They figured out the purpose of team notes which is to take note of the results of the method used.
14. Overview of notes in sprint plan would be desirable
15. Being able to export pictures to notes could help with documenting progress
16. Uses links in comments to link to the external tools used
17. Team notes in the webapp can be redundant when using an external application can be redundant
18. When working alone, it can be nice to come back
19. when working in large teams, it can be redundant to come back to the webapp and comment in team notes because they already have notes themselves.
20. There is a bug where team notes is not synced, unclear how it came to be
21. Apparent that the logo will take the user back to the projects site
22. Make an account symbol to take back to projects, would be more helpful
23. Checkbox when done with a method can be worth a consideration. To show when a phase is done or in progress
24. Idea: Make users set their emails for each recommended web application so inviting can be easier, instead of having them send emails over chat messages.
25. More recommended tools would be appreciated, in case that the existing once do not work or they are not desirable by the users
26. We should have given them an existing app that they should have improved
27. Tabbing between the app and the tool works smoothly, good work flow.
28. Notes are used to summarize the methods at best
29. Navigation seems like the most useful way to use notes, like a place to have links stored
30. Used notes
31. Idea: Give users a way to submit links to the external tools used, and specific projects they used in those tools alongside teamnotes.
32. Idea: Make an overview of comments in the sprint plan page. Note every method that has a comment to make it more apparent.

Figure B.1: Notes taken from the first user study

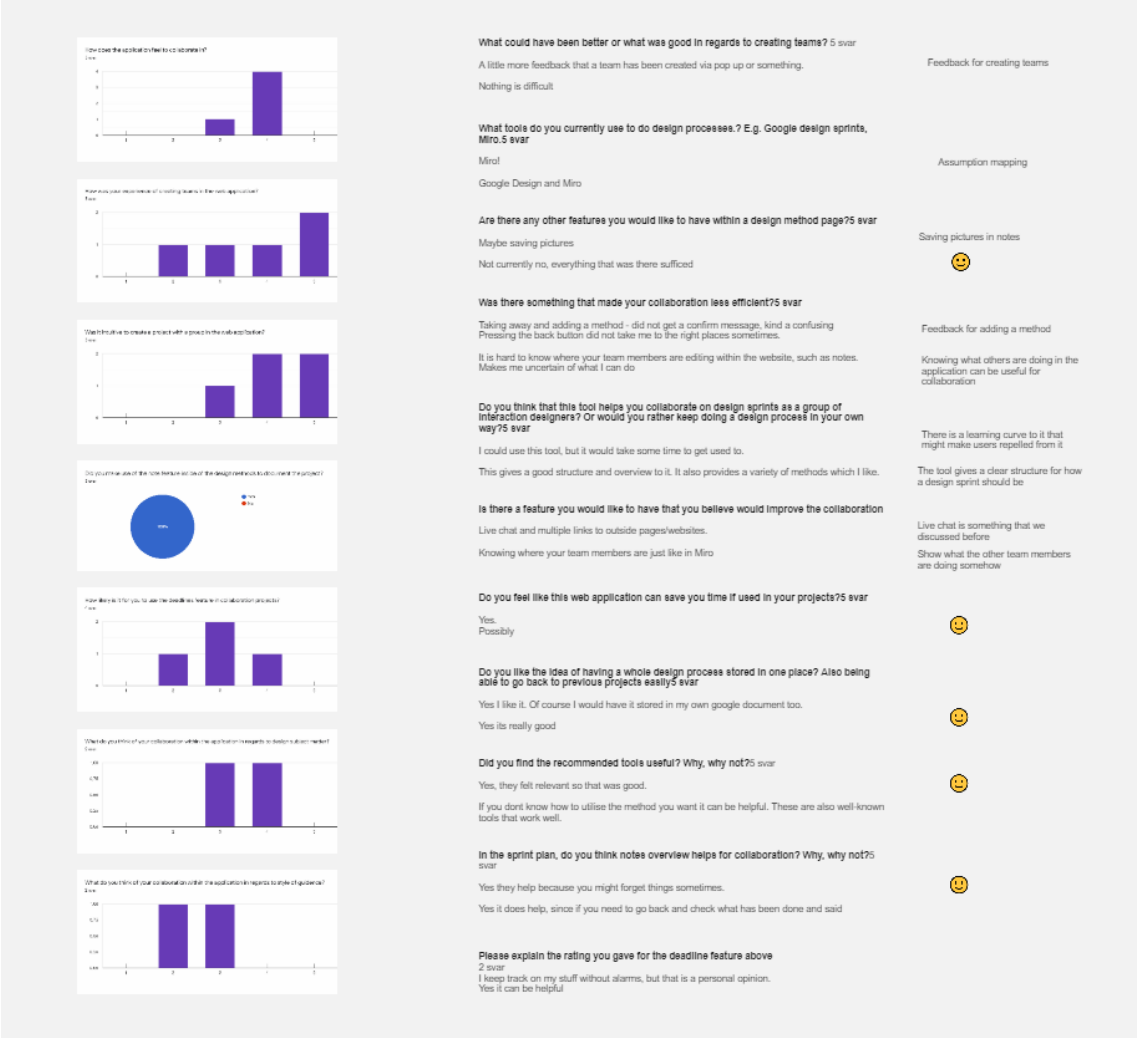


Figure B.2: Results from user study in iteration 2 by group 1

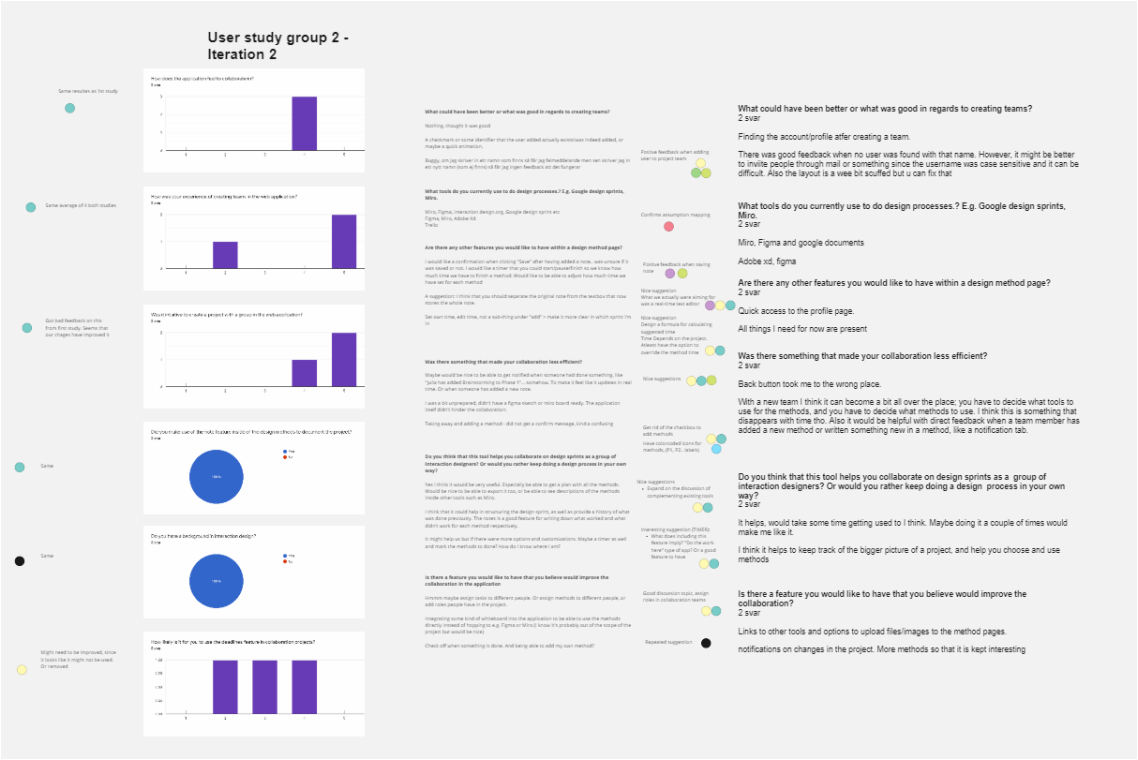


Figure B.3: Results from user study in iteration 2 by group 2

C

IQI Notes

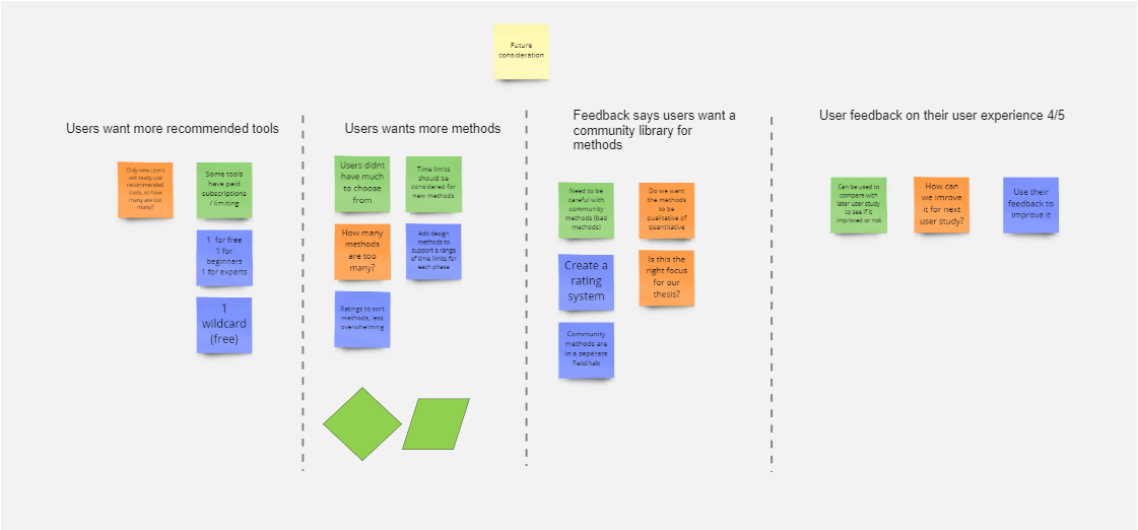


Figure C.1: Board with all the IQI notes under the future considerations theme

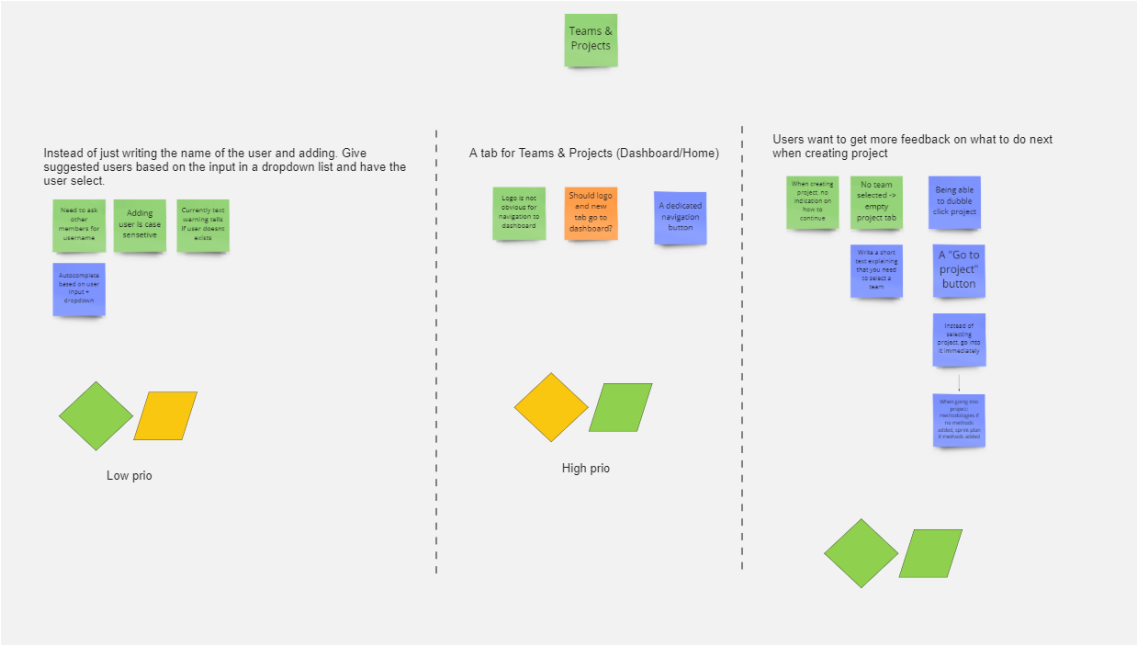


Figure C.2: Board with all the IQI notes under the teams & projects theme

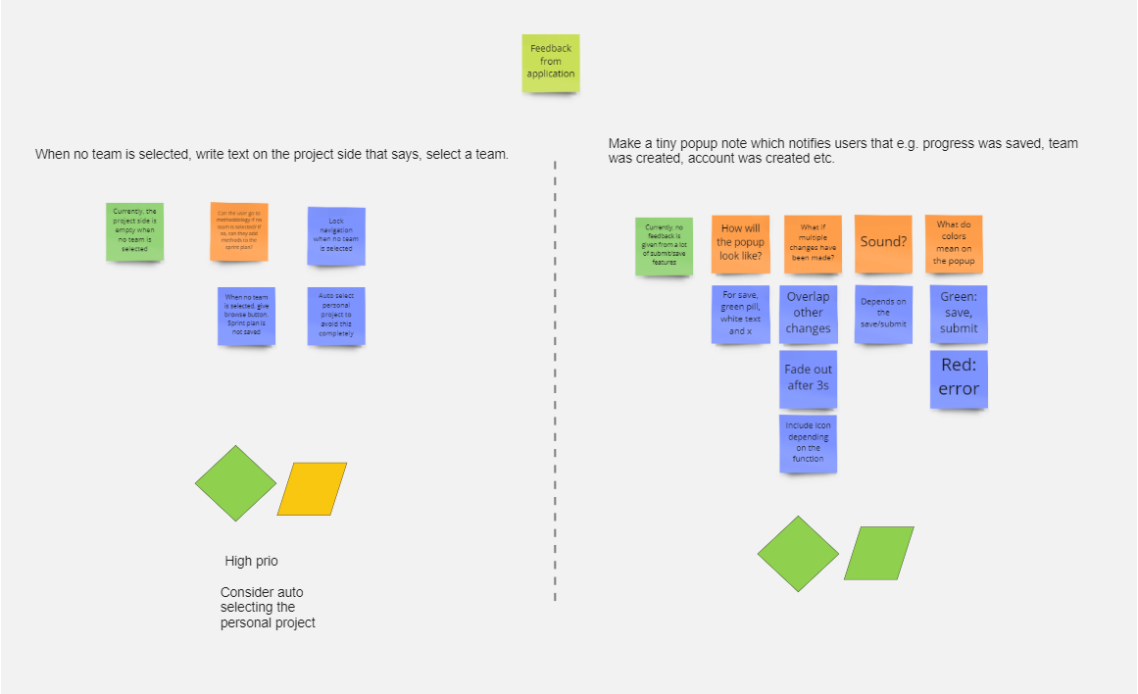


Figure C.3: Board with all the IQI notes under the application feedback theme

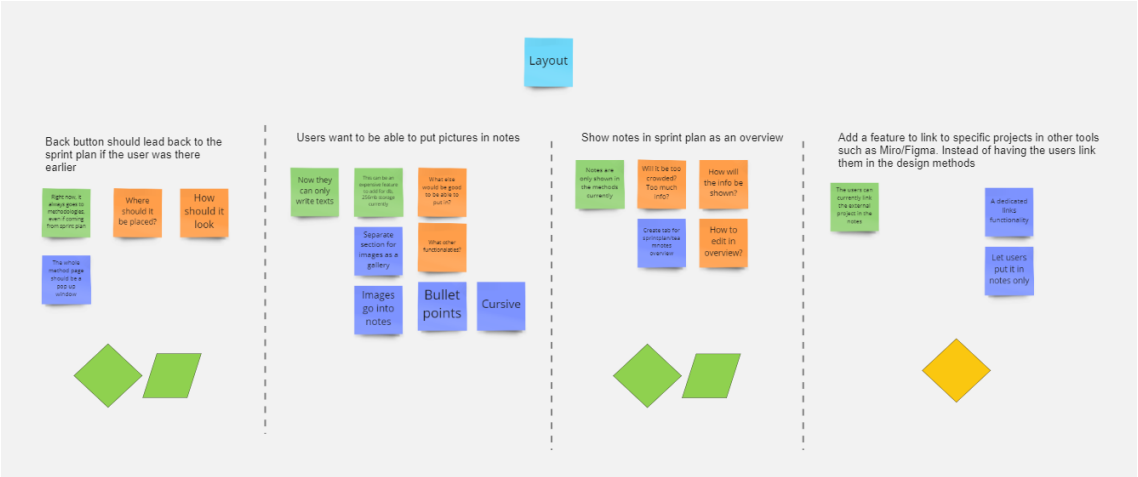
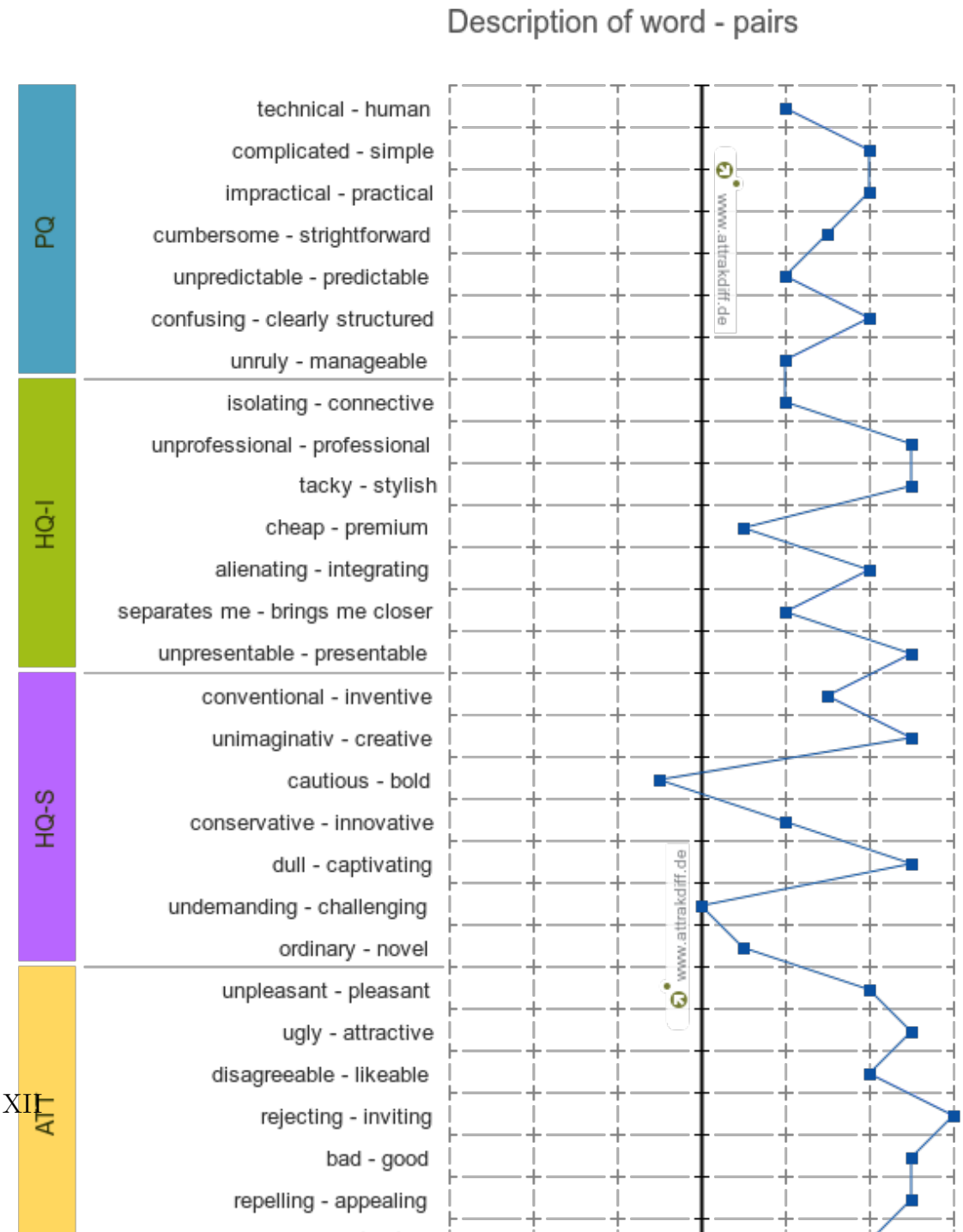


Figure C.4: Board with all the IQI notes under the layout theme

D

Average Values of Bipolar Semantic Differential Questionnaire



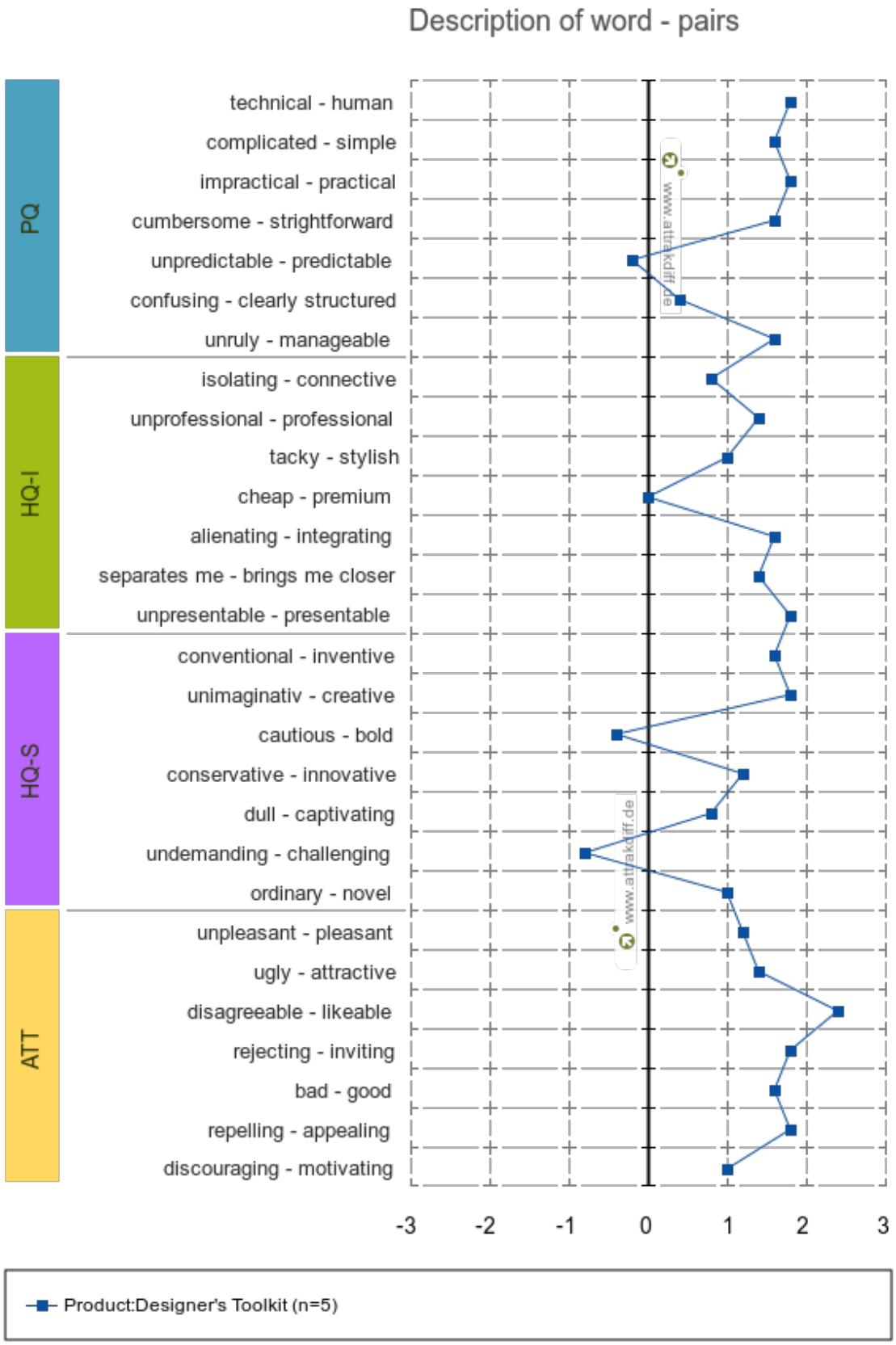


Figure D.2: Values from the second user study