“Exploring how service design tools can help to prototype for a personalized service in the car-sharing industry”

MASTER THESIS BY
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Thesis Information

University:	Aalborg University Copenhagen
Master Programme:	Service Systems Design
Project Type:	Master Thesis (30 ECTS)
Title:	Exploring how service design tools can help to prototype for a personalized service in the car-sharing industry
Semester:	10th
Project Period:	Feb 2019 - May 2019
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Hand In Date:	28/05/2019
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VOLVO

I. Abstract

This thesis examines how service design tools can support the process of prototyping a personalized service.

The research was done in the context of car-sharing, where a case study, in collaboration with Volvo Cars, was used to explore several prototyping methods. The case resulted in a recommendation for a new personalized car-sharing service for Volvo.

Through the case study, several prototyping methods were examined in a practical context of an industry relevant challenge. Four iterations of prototyping helped to find out the advantages and disadvantages of certain methods when designing for a personalized service.

This study reveals that prototyping personalized services can best be done by using direct-experience prototypes, as they showed to have the highest potential when testing the added value of personalization. It also shows that personalizing a prototype itself adds great value to a user test, but extra time and effort needs to be invested when building and testing such prototypes. Another conclusion is that it is important to test a whole service journey when testing a personalized service, instead of isolating a single touchpoint.

Keywords: car-sharing, personalization, prototyping, service design

II. Acknowledgements

Throughout the writing of this master thesis, we have received considerable support from many people. We would like to thank them for being involved in the project by providing their professional knowledge and personal experience.

First, we would like to thank our supervisor Luca Simeone, who gave us guidance to face the challenges that we encountered through the whole process. Furthermore, he was always enthusiastic to join the supervision meetings with us and provided us with constructive feedback.

Second, we want to thank our collaborative stakeholders at Volvo, Claus Christensen and Jesper Nolhage. Their professional knowledge and experience from the automotive industry enhanced the foundation of the project and strengthened the linkage to the real world.

Third, we appreciate all the participants who joined the interviews and user tests during the whole design process, for contributing their valuable opinions and time. Their personal experience helped us to understand the real user's needs, develop our ideas in a convincing scenario, and refine our concept to be more concrete.

Last, we would like to thank our family and friends for encouraging us during the project. Their great love, patience and support are truly meaningful for us.

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CHAPTER 1.

Introduction

In this chapter, we will introduce to the topic of this thesis. We start by outlining the learning objectives and continue by exploring the context of the project. The collaboration partner will be presented and an initial problem statement will be formulated.

The following sections will be discussed in this chapter:

This document is a master thesis, written by Yu-Chun Li and Pieter Overgoor for the master's programme Service Systems Design at Aalborg University Copenhagen from 1 February until 28 May 2019. The project was supervised by Luca Simeone, assistant professor at Aalborg University. Our motivation for this project was to demonstrate our Service Design competencies in the context of a relevant challenge from the industry and thereby to graduate from the master's programme. The thesis aims to focus on the area of mobility and extends on some untouched areas of a previous university project of ours in an earlier semester for the Copenhagen ferry. During that project, new ways of using the ferry next to the growing amount of mobility providers were explored to show the many events going on in the city. As Service Designers, mobility interests us because the services offered in that area include a wide range of different touchpoints that go beyond only the digital and results in complex service ecosystems. A challenge we found in this previous mobility project was to prototype within the complexity of these different touchpoints, user journeys and preferences, which seemed an interesting angle to focus on during this Master thesis. To us, mobility means much more than only bringing people from a to b; we think it is about giving people the freedom to do the activities they like, connect with others and explore their surroundings.

1.1 Learning Objectives

The learning objectives for this thesis are following both the official objectives defined by the Service Systems Design department from Aalborg University and our personal learning goals. We are expected to demonstrate the acquisition of competencies, skills and knowledge for mastering the profession of Service Design.

The official objectives (Aalborg University, 2017):

Knowledge

- Must have knowledge about the possibilities to apply appropriate methodological approaches to specific study areas.
- Must have knowledge about design theories and methods that focus on the design of advanced and complex product-service systems.

Skills

- Must be able to work independently, to identify major problem areas (analysis) and adequately address problems and opportunities (synthesis).
- Must demonstrate the capability of analyzing, designing and representing innovative solutions
- Must demonstrate the ability to evaluate and address (synthesis) major organizational and business issues emerging in the design of a product-service system.

Competencies

- Must be able to master design and development work in situations that are complex, unpredictable and require new solutions (synthesis).
- Must be able to independently initiate and implement discipline-specific and interdisciplinary cooperation and assume professional responsibility (synthesis).
- Must have the capability to independently take responsibility for own professional development and specialization (synthesis).

The personal learning goals were outlined according to the group members' individual motivation.

- Master and develop new types of prototyping tools which can be applied to new service development. The focus is on the area of mobility that consists of both physical and digital elements.
- Improve current mobility services in order to promote more sustainable ways of using transportation.
- Specialize in certain Service Design skills that are helpful when designing for personalized experiences. A deeper explanation about personalization can be found in chapter 2.2 of the Literature review.

1.2 Project Context

The context of this project is the area of mobility and how Service Design can be applied to develop and prototype new mobility services. *Service Design* is being established as an approach that contributes to new service development and improvement by making it more efficient and effective for organizations (Moritz, 2005). It incorporates a human-centered approach to improve the user experience and often includes elements of co-creation, where the expertise of professionals from diverse backgrounds, external stakeholders and often the users themselves are included in the design process (Stickdorn and Schneider, 2012). According to Sanders and Stappers (2008), this human-centered design is the overall approach which includes user-centered design and participatory design. Sanders and Stapper (2008) point out that one of the main differences between user-centered design and participatory design is the level of user involvement in the design process. User-centered design involves users as research subjects, whereas participatory design involves users as co-creation partners. During this thesis, a user-centered design approach will be used, since the focus is on prototyping but not on collaborative design processes.

Service Design follows the ways of thinking and workflow of the design process, involving an iterative approach based on a flexible set of tools borrowed from other areas, such as marketing, branding and user experience design (Stickdorn et al., 2018). These tools are generally easy to understand and to get started with, providing a low-entry learning barrier to include people who are unfamiliar to Service Design. Additionally, the Service Design process includes phases of research, ideation, prototyping, and implementation (Stickdorn et al., 2018), which transforms insights from users' preferences and behaviour to new or improved service offerings. As these service offerings are tightly connected to challenges from the industry, it seemed logical to collaborate with an existing company in the mobility area and explore how Service Design could support them in the development of new mobility services.

As a collaboration partner for this thesis, we had the opportunity to work with Volvo Cars, and more specifically, the Volvo Cars User Experience Competence Center in Copenhagen. Volvo is a Swedish car manufacturer as part of the Volvo Car Group that produces cars since 1927 (Volvo Car Group, 2012). They sold more than 600,000 cars in 2018, employ around 38,000 full-time employees around the globe and have their headquarters located in Gothenburg, Sweden (Volvo Car Group, 2019a).

Volvo is known for their focus on safety, which is proven by their extensive history of technological innovations that increases the safety for both the drivers, passengers and other road users. An example is the famous three-point safety belt that saved many lives. Due to waiving the patents right, it is available for all other car manufacturers and can be found in every personal vehicle nowadays (Volvo Car Group, 2019b). This emphasis on safety is still a main driver for the company, that still reveals new innovations and initiatives around safety. A recent press release states that Volvo is going to introduce a built-in speed limit for its vehicles on 180 km/h (Isidore, 2019). By doing this, they want to start a discussion of whether carmakers have the responsibility to install technology that changes driving behaviour regarding speeding, intoxication or distraction. Their new mission statement even goes a step further, claiming that "no one will be killed or seriously injured in a new Volvo car or SUV by 2020" (Valdes-Dapena, 2016).

1.3 Forming A Focus Area

Before the interested stakeholders at Volvo agreed to a collaboration, a focus area and clear problem statement needed to be agreed upon, which would be both in line with the vision and future strategy of Volvo as well as our learning goals for the thesis. During several exploratory meetings, different research themes were pitched to start the discussion about potential directions for the thesis. These themes included 'the feeling of safety', 'mobility as a service' and 'design thinking within Volvo'. The stakeholders in the Volvo team showed a high degree of interest in these areas and shared other potential directions that could be developed further. Although we had Service Design experience in the mobility area, the specific area of automotive was fairly new to us. Therefore, initial desktop research was conducted to investigate current developments, trend and challenges in the industry. This included research on the topics 'trends in new technologies', 'the future of mobility', 'autonomous vehicles' and 'sustainability goals'. Our stakeholders provided feedback on the research findings and helped to highlight the lesser researched topics within Volvo. Connecting insights from the desk research to a new development in Volvo's strategy of starting a new car-sharing service, led to a mutual interest in the area of car-sharing. Since car-sharing services often include digital elements like an app or website to locate, reserve and open the cars, one of the challenges we identified was how to use data of these digital touchpoints to personalize the experience of car-sharing. By both considering Volvo's interest and our own learning goals, we kept refining and iterating on the topic which lead to a common ground on a problem statement that marked the official start of our collaboration.

Initial problem statement:

How might we design for a personalized experience of a Volvo car-sharing service?

1.4 Stakeholder Supervision

To better fulfil our stakeholders' needs and also keep the progress of our project on track, we involved them through the whole design process in different ways. First, supervision meetings were planned biweekly for reporting what we had done for the case and receiving feedback from our stakeholders. Second, we had one feedback session with all the colleagues from the UXCC department in Volvo. It was a good opportunity to present our work to the company, had discussions about our topic and obtained general suggestions about prototyping for personalization. Third, we were allowed to read and use internal documents related to this project, such as user research and customer journeys. Connecting with stakeholders in the company helped us to get insights from the industry, to provide directions to move into and to receive feedback.

1.5 Reading Guide For This Thesis

After this introduction, the structure of the thesis is according to the following.

Chapter 2. Literature Review

This chapter lays the theoretical foundation for the thesis, which includes an exploration of the car-sharing theme through a review of related literature that gradually transforms into an initial research focus. The design brief will be used to explore an academic research question that contributes to the field of Service Design. The topics in this literature review cover the emergence of car-sharing, service personalization and service prototyping. The chapter concludes with a gap found in the literature around prototyping for personalized experiences, which will be the research focus for this master thesis.

Chapter 3. Methodology

This chapter presents the Double Diamond methodology which will be used to design a new personalized car-sharing service for Volvo, according to the design brief. Throughout this design process, which consists of the phases 'Discover', 'Define', 'Develop' and 'Deliver', the focus will be on the Develop phase. As the thesis will investigate how personalized experiences can be prototyped, the most time and resources will be put on this phase. Furthermore, this chapter explores the downsides of this methodology but motivates why is still chosen.

Chapter 4. Design Case

This chapter documents and reflects on the design process, which is used to explore the academic research question. During the Discover phase, several methods of user research will be conducted to understand the context of car-sharing and motivations or frustrations of current car-sharing users. In the Define phase, these findings are used to narrow down to a specific focus area. During the Develop phase, which is the main focus of this thesis, several ideas will be thought of to improve a car-sharing service by using personalization. Some of these ideas will be prototyped and tested in order to learn about best practices in prototyping personalized services. In the Deliver phase, the findings of the user tests will be combined into a final concept. Here, the concept will be communicated to our stakeholders at Volvo through several representation methods.

Chapter 5. Discussion

This chapter presents a discussion on the key findings of the case study in relation to the academic research question. It contains reflections on various aspects of the design process, including the building, testing and results of the several iterations of personalized prototypes.

Chapter 6. Conclusion

This chapter concludes the three key findings from examining four prototyping methods through a case study. It also presents the limitations and possible future research for this thesis.

CHAPTER 2.

Literature Review

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The following subchapers will be discussed in this chapter:

2.1 Emergence Of Car-Sharing

2.1.1 A Shift Towards Services In The Automotive Industry

Car-sharing is an example of a service that is part of a bigger trend in the automotive industry, namely the transition to becoming a service business instead of a product business (Godlevskaja et al., 2011). This shift towards services is not only happening in the automotive industry, as can be seen on a large scale across different industries. Nowadays, in many developed countries, 80% of the GDP is coming from the delivery of services (Godlevskaja et al., 2011). According to Vandermerwe and Rada (1988), this transition is happening because companies are adding service to their offering as a means of increasing competitiveness, turnover, and market power. Pine and Gilmore (1998) add that this shift towards services is a logical next step when looking at the history of economic progression. We are coming from times where the focus on selling commodities (like the ingredients of a cake) shifted to the sales of goods (ready-made cakes). In the service economy, this changed to the offering of services (ordering a cake to be delivered at home). They state that the competitive position and the price companies can ask for these services is significantly higher than the goods themselves. This is even greater when the service is transformed into a staged experience which means that a company uses services as a stage and goods as props to engage their customers for creating memorable event (Pine and Gilmore, 1998).

In the automotive industry, this shift toward services is happening in several ways. By studying academic literature, three of the main concepts have been identified; 'mobility as a service', 'peer-to-peer car-sharing' and 'car-sharing executed by corporations'.

Mobility as a service is an integrative concept that bundles different transport options into joint, seamless service offerings, as a means to provide tailored mobility solutions that cater for end-users' travel needs (Mukhtar-Landgren et al., 2016). Mobility as a service is often offered as bundled services that combine the use of public transport and other transport services (Smith et al., 2018). This integration of multiple mobility service providers enables users to plan, combine and pay for several modes of transportation through a single app or interface. An example of such a bundle is Whim, according to the Finnish company MaaS Global, the first mobility as a service solution in the world (MaaS Global, 2019). Whim offers several mobility bundles which include limited to unlimited use of public transport, taxi rides, car-sharing and bike-sharing for a fixed monthly price.

Another development that shifts the automotive industry towards services is peer-to-peer sharing platforms. Through *peer-to-peer car-sharing*, car owners convert their vehicles into shared cars that can be rented out to other drivers on a short-term basis (Hampshire and Gaites, 2011). Companies that develop such peer-to-peer platforms are an outgrowth of social media which brings together people with common interests to share ideas, information, or personal observations. They can grow exponentially through the power platforms dynamics and network effects (Cusumano, 2014). An example of such peer-to-peer platform is the Danish company GoMore, that enables users to rent their vehicles out to others (GoMore ApS, 2019).

Next to that, car-sharing executed by corporations and car manufacturers also lead to a shift towards service offerings in the automotive industry. *Car-sharing* refers to the sharing of a vehicle fleet by members on a per trip basis (Ferrero et al., 2018). The difference between peer-to-peer platforms is that the fleet of the car-sharing service is not owned by the users themselves but by a service provider. Car-sharing services can be split into two forms; station-based and free-floating. Station-based car-sharing refers to services where the location of the pick-up and return of the vehicles are fixed (Kopp et al., 2015). This means that users always have to start and end their trip at a fixed station. Free-floating car-sharing services refer to services where users

can pick up and return vehicles on any location within a designated service area. Station-based car-sharing has not been flexible enough to compete with private cars, which is recognized by companies that have started the development of more flexible free-floating services (Kopp et al., 2015). An example of such a free-floating service is car2go, which offers small-sized vehicles for users in big condensed cities (car2go Nederland B.V., 2019). The rest of this thesis will focus on free-floating car-sharing services, as they are the most recent development and we think they have the biggest potential to be improved.

2.1.2 Causes For The Adoption Of Car-Sharing

The concept of sharing vehicles is not a recent one, as the first shared vehicles system was initiated in Zurich, back in 1948. Until the 80's such car-sharing systems were not successful, but new technology accelerated the improvement of the services (Ferrero et al., 2018). Thierer (2002) adds that not only the technological push leads to successful adoption of services, it also requires the right timing when the market is ready and the service needs to fulfil clear needs. Next to the technological development, the two main causes for the adoption of car-sharing described in the academic literature are changing lifestyles and an increase in environmental awareness, which will be discussed in the following paragraphs.

Li and Voege (2017) point the adoption of car-sharing to changes in people's' lifestyle which makes them not depending on owning a car anymore. Especially younger generations decide to change the suburban lifestyle, which is heavily car-dependent, to living in cities. Cohen et al., (2008) elaborates on this, stating that the adoption of car-sharing services is significantly higher in high-density neighbourhoods, where the use of public transport is more efficient. Kumar and Bierlaire (2012) relate this efficiency to the traffic congestion of cars in cities. They also show that the main driver of adopting car-sharing services is related to cost reduction. Klein and Smart (2017) conclude that current millennials own fewer cars compared to generations before and are less likely to ever get a driver's license.

Another aspect that drives the car-sharing trend is an increase in environmental awareness. According to Li and Voege (2017), the usage of new car-sharing services is accelerated by increasing concerns for sustainability and the environment. Shaheen et al. (2009) derive the increase of usage to a mix of pragmatic reasons, such as cost reductions, and idealistic reasons, such as reducing the environmental effects of travelling. Ferrero et al. (2018) elaborate on this by stating that car-sharing itself increases citizens' awareness about the environmental impact of using private cars. Combining this increase of environmental awareness and changes in people's' lifestyle with the technological capabilities of car-manufacturers and service providers lead to a wide scale adoption of car-sharing services.

2.1.3 Effects Of Emerging Car-Sharing Trend

Several studies have been conducted to research the effects of this emerging car-sharing trend. One of the conclusions is that the use of car-sharing services leads to a reduction in car ownership. A study in Ulm, Germany shows that 18 months of using the car-sharing service Car2Go, has led to a strong reduction of vehicle ownership of its users (Firnkorn and Müller, 2012). Kopp et al. (2015) conclude that a single car-sharing vehicle can replace 3 to 13 private vehicles.

Next to a decrease in ownership, another effect of car-sharing on its users is a reduction in transportation costs. Chen and Kockelman (2016) conclude that car-sharing users reduce their transportation costs, after an examination on car-ownership. Another study shows that households can save 500 to 5000 USD per year by using a car-sharing vehicle rather than owning one (Litman, 2000). Frost and Sullivan (2010) calculate these potential savings for car owners that drive 7460 km per year and estimate it to 1834 USD that can be saved by using a car-sharing service instead.

Several studies have also shown that travel behaviour of users changes after joining car-sharing services. The frequency of trips by car-sharing users who previously owned a private vehicle, decreases (Meijkamp, 1998; Pesch, 1996; Tsai and Cervero, 2004). This is the opposite for people who did not own a car previously, for them the frequency of trips increases. Overall the number of trips decrease after joining a car-sharing service. According to Levine (2009), car-sharing reduces the number of trips to 25-50% compared to car-owners. One of the reasons for this, is that car-sharing users arrange their trips more consciously, where they try to combine multiple tasks or trips in one (Kopp et al. 2015).

Next to a decrease in the frequency of trips, car-sharing also leads to a significant decrease in vehicle kilometres travelled. Sperling and Shaheen (1999) show a reduction of 30-60%, Frost and Sullivan (2010) estimate the reduction on 31% and Cervero et al. (2007) found a reduction of 67%. These reductions of travel frequency and kilometres travelled lead to the question of which modes of transport are becoming more frequently used by car-sharing members instead. This happens to be public transport and non-motorized transport such as cycling and walking. Meijkamp (1998) estimates an increase of 14% in bicycling and 36% in train usage among car-sharing members in the Netherlands. Cooper et al. (2000) reports a 25% increase in walking, 10% in cycling and 14% in public transport use after evaluating CarSharing Portland in the United States. Lane (2005) shows similar results after studying car-sharing member's changing travel behaviour in Philadelphia; 19% more walking, 8% more cycling, and 18% more public transport.

A concluding effect of car-sharing is a combination of above aspects; vehicle reduction, decrease of trips, increase of public transport and demotorized transport usage all lead to positive effects on the amount of emissions to the environment. There are several studies showing these positive effects, with similar results but different reasons for how they occur. Data from a survey shows that people reduce their emissions by 54% in Bremen (Germany) and by 39% in Brussels (Belgium) by joining a car-sharing service instead of using an own car (Ryden and Morin, 2005). They relate these emission reductions to the lowered kilometres travelled, increased fleet fuel economies and increase of public transport usage. Results from another study in the US suggest that car-sharing users reduce their average transportation emissions by 51% after joining a car-sharing service. They relate these reductions primarily to the shift towards other transportation modes, savings in parking infrastructure and decrease of fuel consumption. Another aspect that is not mentioned in these studies is the fact that car-sharing vehicles are more fuel efficient than privately owned vehicles. Ryden and Morin (2005) estimate that these vehicles are 17% more fuel efficient than private vehicles, which can be attributed to the faster replacement of car-sharing vehicles due to higher usage rates. These positive effects on the environment combined with a cost reduction and decreasing need for parking infrastructure make car-sharing an interesting service to develop further and to make it more attractive for people to use.

2.1.4 Challenges For Car-Sharing Service Providers

For car-sharing providers and car manufacturers like Volvo who want to extend their business focus to include car-sharing, certain challenges arise when entering the car-sharing market. One of these challenges is the overall lack of profitability of the car-sharing business (McKinsey & Company, 2018). We discussed the reduction of car-ownership earlier as a positive effect on the environment but it is a huge loss in terms of sales for car manufacturers. Therefore, car-sharing providers need to find new business and pricing models to cope with these effects. For station based car-sharing services, a potential solution described in a study combines vehicle distribution with changing prices for the usage of cars, which has a positive effect on the profit (Gambella et al., 2018) Since station-based car-sharing providers have more control over their fleet, such price mechanisms make sense, but free-floating services

still need to experiment to find a clear solution.

Another challenge in the car-sharing industry is the different value perception that people have of the shared cars compared to owning one. Firstly, instead of seeing the car as an extension of the self, which often occurs with owning a car, car-sharing, users avoid identification (Bardhi and Eckhardt, 2012) . They do not want to identify themselves with the car nor with other users and experience the fact that other users drive in the same car as contagion (McGrath, 2004). Secondly, the lack of ownership and temporality of the usage leads to opportunistic behaviour towards the car and other users. Users try to pursue their own interest at the expense of the company, car or other users. An example is that users leave trash in the car or leave it without gas. This negative reciprocity makes the users appreciate a governance model where surveillance and command controls, such as fining improper usage, are welcomed. According to McGrath (2004), these big-brother control models can in certain cases, like car-sharing, be beneficial for users.

2.2 Personalization

In this era of services, where users can switch to a competitive car-sharing service with one click and where the value perception of cars is altered by access-based consumption modes, car manufacturers need to find ways to tackle these challenges.

In the automotive industry, these developments in the service area can be related to the emergence of technology (Godlevskaja et al., 2011). Vandermerwe and Rada (1988) elaborates on this, stating that we have to look at the switching focus from hardware to software to understand how more companies are changing towards service offerings. These developments enable customers to access information, interfaces and responsiveness anywhere and anytime (Karmarkar, 2004). If this trend towards service offerings in the automotive industry is driven by software, we propose to look at a trend that has been unfolding in the software area over the past years; personalization. Personalizing a car-sharing service might be a potential opportunity to increase the competitiveness of the service, while increasing the value perception of it.

To create a common understanding about what kind of personalization this thesis will focus on, we will follow the definition of personalization as *"the ability to proactively tailor products and experiences to tastes of individual consumers based upon their personal and preference information"* (Chellappa and Sin, 2005, p. 181). This definition is in line with the definition of Forrester (2016), who elaborate that *"personalization is slowly evolving to individualization: engaging customers as a "segment of one" in real time by listening to, capturing, measuring, assessing, and acting on the customer's intent across every enterprise touchpoint"*.

This form of personalization consists of two sub-processes, learning and matching (Murthi and Sarkar, 2003). During the learning phase, user data is gathered by the service provider to learn about the users' preferences. This can be directly by asking for it or indirectly by collecting data from previous interactions with the service. Matching is the second phase, where these users' preferences are taken and matched to corresponding specific service offerings or customized offerings that are tailored to the users' needs.

2.2.1 Benefits Of Personalization

From The Users' Perspective

From the users' perspective, personalization often leads to better service experiences as the services accurately fulfil their individual needs. This can be derived from several studies that show the users' willingness for personalized services. Chellapa and Shivendu (2007) state that people are willing to exchange their personal data to a certain extent, in exchange for the added value of service personalization. Deloitte (2015) has found that 48% of their research participants during a study agree to wait longer for a personalized product or service, meaning that they appreciate it and are willing to offer their time in exchange for personalization. Secondly, with the growing access to information and services, personalization is a way to help users in filtering irrelevant content in order to reduce the cognitive effort in decision-making processes (Hong and Tam, 2006) Thirdly, there have been several studies showing that personalization of a service increases the perceived benefits for the users (Benlian, 2015; Xu et al., 2011).

From The Service Providers' Perspective

From the perspective of services providers, personalizing their service offerings lead to multiple benefits. First, they will be able to deliver additional value on top of their current offerings. As noted earlier, the servitization trend leads to more competition, so service providers need this in order to find ways to distinguish themselves.
This additional value can also be monetized, as shown by Deloitte (2015), concluding that customers are willing to pay 20% extra for services that are personalized. Secondly, it is found that personalization helps to retain customers and stop them from switching to competitive service providers (Chellappa and Sin, 2005). Using personalization for this purpose is a strategic decision when taking into account that acquiring new customers is found to cost much

more than retaining current customers (Ahmad and Buttle, 2002). Thirdly, personalization enables service providers to adapt to changing customer demands (Atasoy et al., 2015). In the context of car-sharing, this means that the more information the service providers have from their users and their intentions of using their services, the better they can adapt to changing demands. An example of this is the Dutch mobility provider Amber (Amber, 2019), who guarantees there will always be a vehicle available for their users. This is only possible if they have information about the intended use from their users.

2.2.2 Challenges For Companies Around Personalization

Next to the promising effects of personalized services, there are also concerns and challenges to overcome in this area. As these personalized services are heavily dependent on knowing the preferences and needs of its users, it's a challenge to gather this data from them. The users need to give up their privacy in return for a more personalized experience. These personalization–privacy trade-offs suggest that users are willing to trade their privacy if the perceived benefits of the personalized experience override their privacy concerns (Karwatzki et al., 2017). This results in challenges for service providers to either communicate the value of personalized services in such a way that potential users are willing to share their data or to use data indirectly from previous interactions with the service.

2.3 Service Prototyping

In order to find out if personalization can give companies a competitive edge and enhance the value perception of a shared mobility service, a method of testing these assumptions is required. Prototyping is an efficient way for organizations to learn from users and examine design ideas by failing early in the process (Coughlan et al., 2007). It is economical, which was seen as an experiment for examining the sufficiency for a proposed solution before further implementation and investment (Floyd, 1984). We assumed prototyping the service will be beneficial for us to test and validate our hypothesis by using a minimal budget within the limited time.

Service prototyping aims to explore the various possible solutions of a Service Design concept, to evaluate the feasibility of all of its alternatives and to enhance the communication between different stakeholders during the design of a new service (Blomkvist and Holmlid, 2010; Stickdorn et al., 2018). A service prototype is a simulation of the service experience (Stickdorn and Schneider, 2012b). It can be used as a way of ideation to discover variations in the service concept (Rodrigues and Holmlid, 2017). Through creating a prototype, it manifests the future situation of design ideas and makes their possibilities and limitations become measurable (Blomkvist, 2016; Lim et al., 2008). Furthermore, it helps the designers to better understand users' and stakeholders' intentions, at the early stage of the service development process (Blomkvist and Holmlid, 2011).

The process of prototyping is crucial to gradually reducing uncertainty and to refine the concept to a final deliverable (Stickdorn et al., 2018) . It is an iterative process that switches between different points of view, from as detailed as a single touchpoint to a wider holistic experience. Blomkvist (2016) proposed that a service prototype is clearly distinct from other types of prototypes since it contains several consecutive touchpoints in which artefacts are used in different contexts. It covers a wide range of aspects of a service which includes both tangible and intangible components, activities, and the various stakeholders involved(Razek et al., 2017). Therefore, service prototyping usually begins with exploring an initial idea, working on each specific parts of the service and examines the impact of their variations on holistic journeys (Stickdorn et al., 2018).

2.3.1 Two Types Of Service Prototyping Methods

The various service prototyping methods can be categorized into two types: the indirect imagination and the direct experience (Stickdorn et al., 2018).

Imagine-like prototyping aims to use a prototype to think through and trigger an imagination about an intended interaction when the actual interaction is not easily accessible (Stickdorn et al., 2018). These prototypes stimulate reflections, which are used by designers to construct, refine, and discover possibilities in a design space (Lim et al., 2008). The common tools that designers use to build up this type of prototype are storyboarding, filmmaking and the desktop walkthrough. Storyboarding refers to the making of a series of drawings that illustrate a sequence of events which may present the situation of a current service, or a future scenario of the new service (Stickdorn and Schneider, 2012). Filmmaking (El-Nasr, 2004; Raijmakers et al., 2006) can be seen as a more realistic type of storyboard. It uses video to depict a series of service processes. By adding sound or animation, the abstract and emotional part of the service experience can be better designed. The desktop walkthrough (Blomkvist, 2016) uses maps, small toys like LEGO, to build up a small-scale model of the service environment that is used to simulate the service experience from a holistic perspective.

Experience prototyping uses a prototype which allows the participants to experience it themselves, rather than observing from other's experience (Buchenau and Suri, 2000). The direct experience involves the physical participation of the users into the testing. Designers use prototypes to create an immersive experience, which aims to

provoke users to act in a future service scenario (Stickdorn et al., 2018). Role-playing and the Service Walkthrough are techniques that designers use for building up such prototype. Role-playing (Simsarian, 2003) is a theatrical rehearsal method for exploring and generating ideas by building up different roles and acting out scenarios. The technique enables users to experience the scenario by being directly involved in it and acting from their own perspectives. The Service Walkthrough (Arvola and Blomkvist, 2012) is different from the Desktop Walkthrough, as it combines experience prototyping (Buchenau and Suri, 2000) and bodystorming (Simsarian, 2003), which involve users directly in the prototype to experience the user journey.

2.3.2 Challenges Of Prototyping Personalized Services

The service prototyping tools addressed before are flexible and can be adapted to fit various contexts in Service Design projects in different uses. However, the current prototyping methods and tools may be challenging to use when prototyping a personalized service.

First, comparing to regular service prototyping, it takes more time and user's involvement in the process. The characteristic of personalized services is to expand the user's experience by learning individual needs and provide the offering that matches their preference. As explained earlier, the process of such services contains both a learning and matching phase. A personalized service prototype should have the ability to provide a prompt personal response after receiving users' requests to simulate a more realistic experience. In this case, designers need to know more about the users in advance to provide an immersive personal experience. This leads to a new challenge in the process for prototyping. It requires an additional preliminary learning phase which enables designers to transform those personal factors into a prototype.

Second, the cost of building up a personalized prototype is higher than a traditional service prototype. A traditional service prototype can provide the same content to all the users and get their feedback. However, a personalized service prototype needs to adjust the content to fit individual needs. This also leads to challenges for designers to create different versions for individual participants.

We assume that personalization will give companies in the automotive industry a competitive edge and enhances the value perception of car-sharing services in the future. What we found the current service prototyping tools have different advantages for partially building up a personalized service prototype. However, there is not yet a tool which is sufficient to support the process for building up a personalized service prototype, and lack of literature to support prototyping personalized service. Through building and testing various types of prototypes, we want to examine and how service prototyping tools can support the process for design better personalized services. Thus, we framed our research questions for guiding our research process as follow.

Research question:

How can service design tools support the process for prototyping new personalized services?

CHAPTER 3.

Methodology

This chapter presents the Double Diamond methodology which will be used to design a new personalized car-sharing service for Volvo, according to the design brief. Throughout this design process, which consists of the phases 'Discover', 'Define', 'Develop' and 'Deliver', the focus will be on the Develop phase. As the thesis will investigate how personalized experiences can be prototyped, the most time and resources will be put on this phase. Furthermore, this chapter explores the downsides of this methodology but motivates why is still chosen.

The following sections will be discussed in this chapter:

3.1 Design Process

For the design case for Volvo, we adopted the *Double Diamond* to structure our design process. The model was developed in 2005 by the Design Council, a British design organization (Design Council, 2007). The shape of the diamond presents the two divergent and convergent ways of thinking throughout different stages of the project, which are divided into the four phases, Discover, Define, Develop and Deliver (Figure 1).

Although the Double Diamond is a well-known methodology, design methodologies in general received several points of critique as described in the literature. Brooks (2010) states that the use of design methodologies is very limited, as they are perceived as idealistic models which do not represent real processes. Real design processes often do not follow such sequential progression and also include more contextual factors, such as available resources and management conditions, that are lacking in the models (Maffin, 1998). Macmillan et al. (2002) adds that models that describe a sequence of stages, do not include iteration between the stages, which is also the case with the Double Diamond. Although it is sometimes described as an iterative process, the model is clearly presented in a linear structure.

After taking these points of critique in consideration, it was still decided to adopt the Double Diamond as the methodology for this thesis. The main reasons for choosing the Double Diamond is its simple, visual and structured way of constructing the whole design process. This would help to plan the corresponding design activities in each phase at the beginning of the project. In addition, the model is well-known in the design field generally, which is not limited to Service Design. This helps to reduce barriers when communicating to our stakeholders and other employees at Volvo who might be from other disciplines. While using the methodology we have to be aware of the iterative aspect of design, so returning to a phase after a finding should be seen as iterative progression instead of seeing it as going backwards.

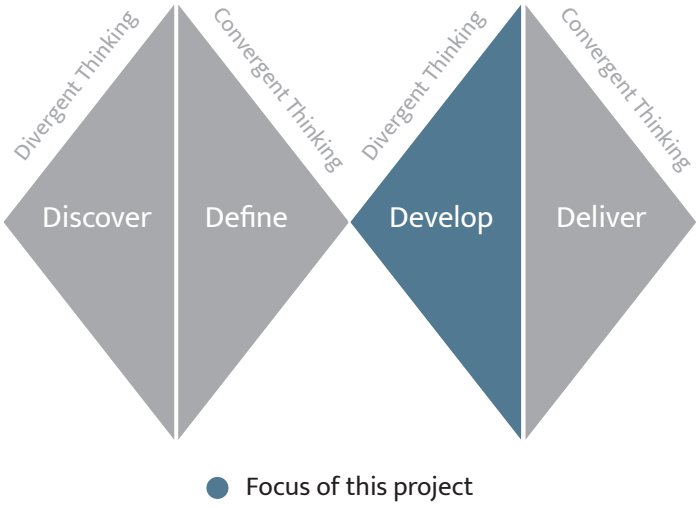


Figure 1: The Double Diamond (Design Council, 2007)

During the first stage, Discover, the objective is to use divergent thinking to gather new insights from users and their context. This allows to explore a broad range of possibilities around the initial theme and to get more understanding of the people who are being designed for, through a series of studies about market and user research. In the second phase, Define, the goal is to construct a clear brief where the design challenge is scoped more concretely and focused. The findings from the research that have been identified in the Discover phase are analysed and synthesized by using convergent modes of thinking. In the Develop stage, the aim is to develop solutions for the addressed problem in the previous stage. The design team practices divergent thinking to generate and test multiple design ideas. This is generally an iterative process which includes ideation, prototyping and testing. Our ambition is to examine current prototyping tools in Service Design that allow for testing personalization. Therefore, it is expected that we spend most of the time in this phase. The last stage, Deliver, is where convergent thinking is used to finalize the service concept and deliver it to the client for internal evaluation.

3.2 Academic Research Process

The design process for Volvo will be used as a means to explore the academic research question. Therefore, the Double Diamond can be seen as part of the bigger research process of this thesis, which is visualized in the timeline in Figure. 2.

As the research question is about prototyping, the Develop phase of the Double Diamond, where the prototyping takes place, takes the longest time and effort. Before the Double Diamond, the preparatory research and defining of the initial direction with Volvo are shown.

During the Develop phase, several prototyping techniques will be tested to explore the research question. It will start from an initial low fidelity prototype and gradually evolved into prototypes with high-fidelity along the process. The whole process will be thoroughly described in section 4.3.4 Prototyping Approach. This approach can be seen as a design experiment. According to Collins et al., (2004), design experiments were a way to conduct research to test and gradually refine designs in the real world based on the learnings from the prior research. This enables us to create a solution which will be closer to real needs.

By going through the research process, we aim to develop two project outcomes, one for Volvo and one for Service Design academia, which are shown in the timeline. The first is to come up with a service concept as a deliverable for Volvo after the design process is finalized. The second outcome will be the results of the prototyping process that show which methods are most useful when prototyping for personalized services. In the timeline, methods will be used throughout the process and critical activities are also shown.

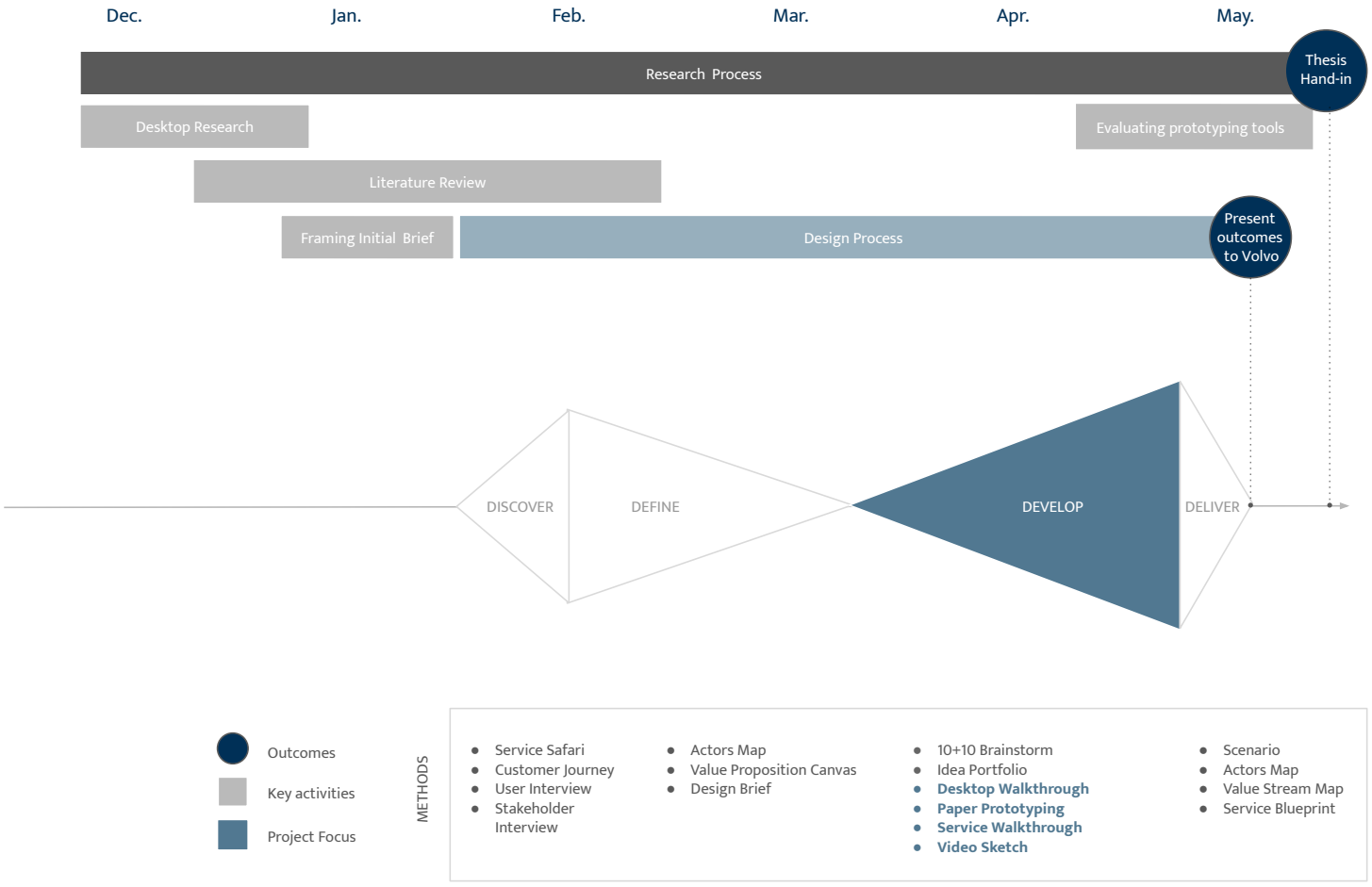


Figure 2: Research process and design process timeline

CHAPTER 4.

Design Case

This chapter documents and reflects on the design process, which is used to explore the academic research question. During the Discover phase, several methods of user research will be conducted to understand the context of car-sharing and motivations or frustrations of current car-sharing users. In the Define phase, these findings are used to narrow down to a specific focus area. During the Develop phase, which is the main focus of this thesis, several ideas will be thought of to improve a car-sharing service by using personalization. Some of these ideas will be prototyped and tested in order to learn about best practices in prototyping personalized services. In the Deliver phase, the findings of the user tests will be combined into a final concept. Here, the concept will be communicated to our stakeholders at Volvo through several representation methods.

As the Double Diamond consists of four phases, this chapter consists of the corresponding four subchapters:

4.1 Discover
4.2 Define
4.3 Develop
4.4 Deliver

4.1 Discover

The research question is about prototyping personalized shared services. In the Discover phase of the double diamond, we started to explore the current car-sharing services to figure out the potential areas that we can work on for personalization by using different methods. In this stage, we wanted to understand the current user experiences in car-sharing services, identify the types of users and explore various design challenges in a customer journey. This could be seen as the preparation step for framing a clearer focus area in the following Define stage.

We conducted the research for gathering information from both the users' and stakeholders' perspectives. It aimed to generate a more complete understanding of current car-sharing services. Since the focus of this thesis is on prototyping, only a limited amount of necessary research tools are used in this Discover phase to come up with a relevant problem and target group to focus on.

The following sections will be discussed in this subchapter:

4.1.1 Service Safari
4.1.2 Customer Journey Mapping
4.1.3 User Interviews
4.1.4 Preliminary Reflection

4.1.1 Service Safari

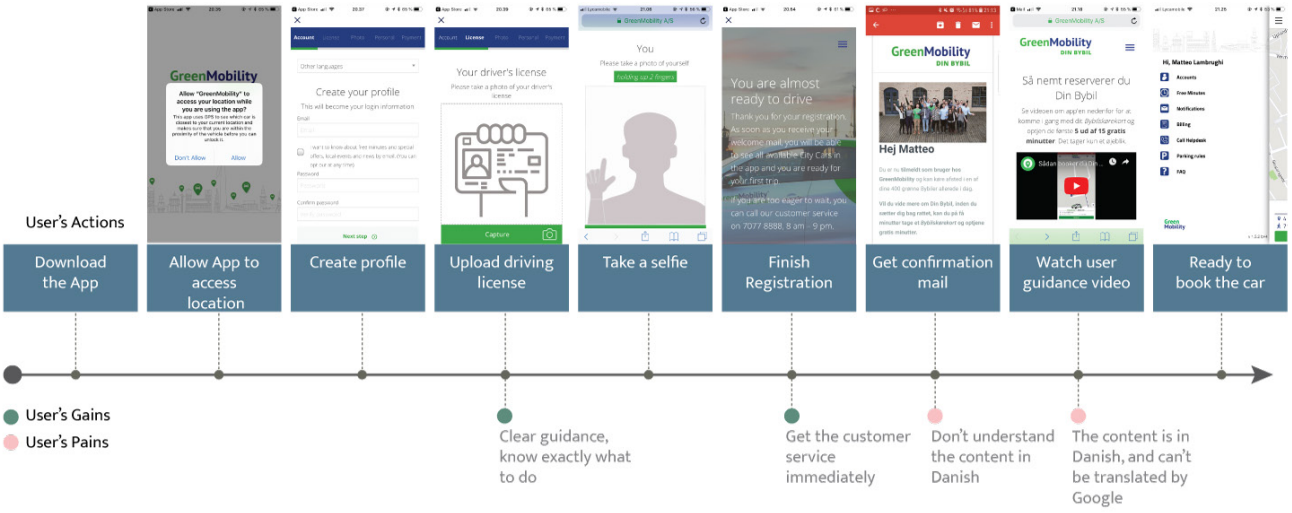
At the beginning of the design process, we used the Service Safari as a research tool to understand the car-sharing service experience. *Service Safari* is an approach where researchers immerse themselves as users to explore a service experience in a real situation and self-document this by using notes, audio recordings, videos and photos (Stickdorn et al., 2018) . It is an easy and economic method to use and helps to empathize with the customer (Design Council, 2015; Stickdorn and Schneider, 2012). Through using the service by ourselves, we want to identify the customer journeys of car-sharing services, understand common pains and gains in the journeys and different touchpoints.

We chose Green Mobility and DriveNow, two free-floating car-sharing services in Copenhagen, to conduct the Service Safaris. The main reason that we chose these two service providers is that they are leading companies in local. Green Mobility is a car-sharing platform, currently based in Copenhagen, operating with 400 cars used by 43,500 customers from 2016 (Clugston, 2019). DriveNow is operated by Arriva in Denmark, launched in 2015 with currently more than 60,000 customers (DriveNow, 2018). After deciding which services to research, we conducted the Service Safaris individually. One person was in charge of experiencing Green Mobility and the other for DriveNow. The purpose is to use less time to identify two customer journeys and compare the differences between the two brands. To make the experience closer to real user experience, we each set up a purpose of the trip for using the car. One case was going to a match in the suburb by using a car to get to the gym on a rainy day. The other one was going out with a friend and using the car to bring him back to his home. We documented our experiences of using the services by taking photos and notes. Afterwards, this information was used to map out the journeys, pains and gains experienced in the services. These findings were shared in the team, an example of a journey can be seen in Figure 3.

The rest of the information can be found in Appendix 1: Customer journeys: Green Mobility & DriveNow.

It was useful for us to have an initial understanding of how the services work by doing a Service Safari. For example, the process of using the service, touchpoints to interact with and some common pains and gains could be identified through this exercise. However, there are some limitations to this method. First, limited use cases can be discovered by doing this exercise. In our case, the two journeys went relatively smooth and nothing went wrong. Therefore we could not test out the support mechanisms of the service. Second, the changes in the services through a period of time cannot be identified by using this method. We only experienced the service only once, as new users, but it was not clear if the service may vary after using it for a while. Third, the method lacks ways to get information about the backstage processes of the service, even though this was not the primary aim of doing the safaris. Through the research, we captured most user's actions by interacting with the services, however, it is not possible to understand how the whole service system works by only researching from the users' perspectives. These limitations led to a need to conduct different research afterwards in order to figure out these unclear criteria.

Green Mobility: Onboarding



DriveNow: Car-Ride

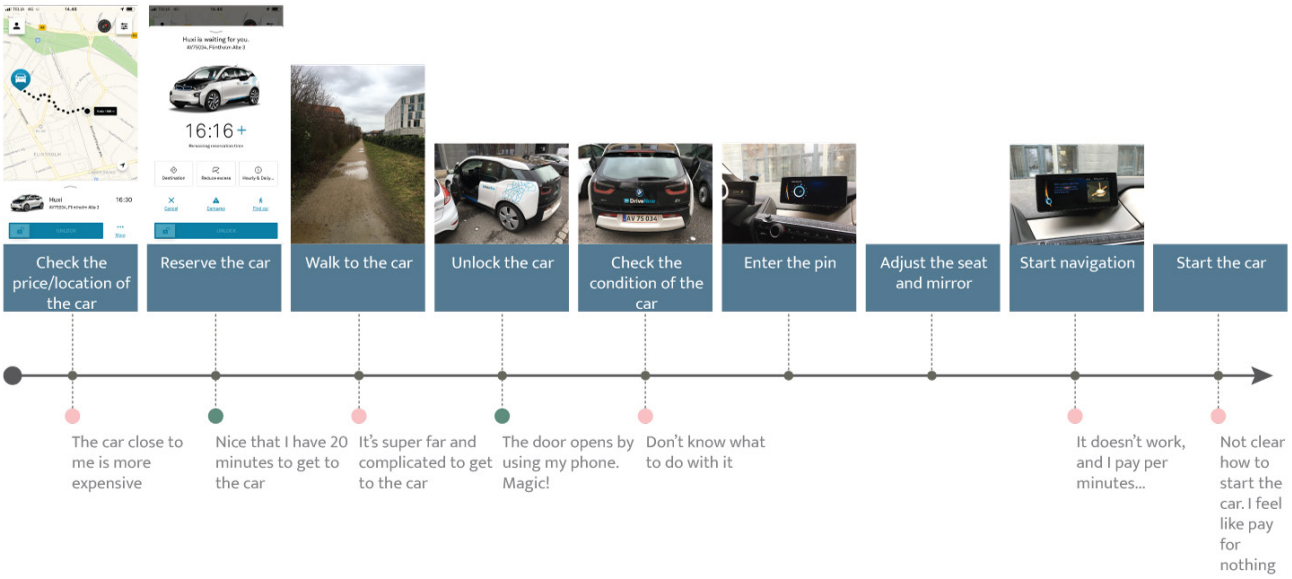


Figure 3: Customer journeys from our Service Safari: Green Mobility & DriveNow

4.1.2 Customer Journey Mapping

A *Customer Journey Map* is a visual representation of the customer processes, needs, and perceptions (Temkin, 2010). A Customer Journey can be constructed by mapping out the customer experience which is the result of several interactions with a company throughout multiple touchpoints (Lemon and Verhoef, 2016).

Mapping out the journey helps to understand and improve the user's experience in the services (Marquez et al., 2015). After comparing the two journeys from the Service Safaris, many common elements could be identified, so we combined them into one journey. The experiences, touchpoints, the process of interacting with the service, pains and gains are all shown in this journey (Figure 4), which represents our initial understanding of current free-floating car-sharing services.

The whole journey that we identified can be separated into six main phases; registering, reserving, preparing to start, driving, parking and returning. Since free-floating car-sharing services are self-service, there are only two main touchpoints in the journey; the car and the app. Most of the interactions are done in the app. To analyse the potential of personalization in the services, we identified what kind of data the user provides to the service. This data can be shared throughout multiple steps in the journey.

Mapping out a Customer Journey provided a basic understanding of current car-sharing services. Based on this first journey, it is possible to identify some problematic areas. However, the initial customer journey is formed by our own personal experiences, instead of using actual user's experiences. Therefore, we planned to conduct user interviews with participants who had used car-sharing services before, in order to construct a more detailed understanding from the actual users' point of view.

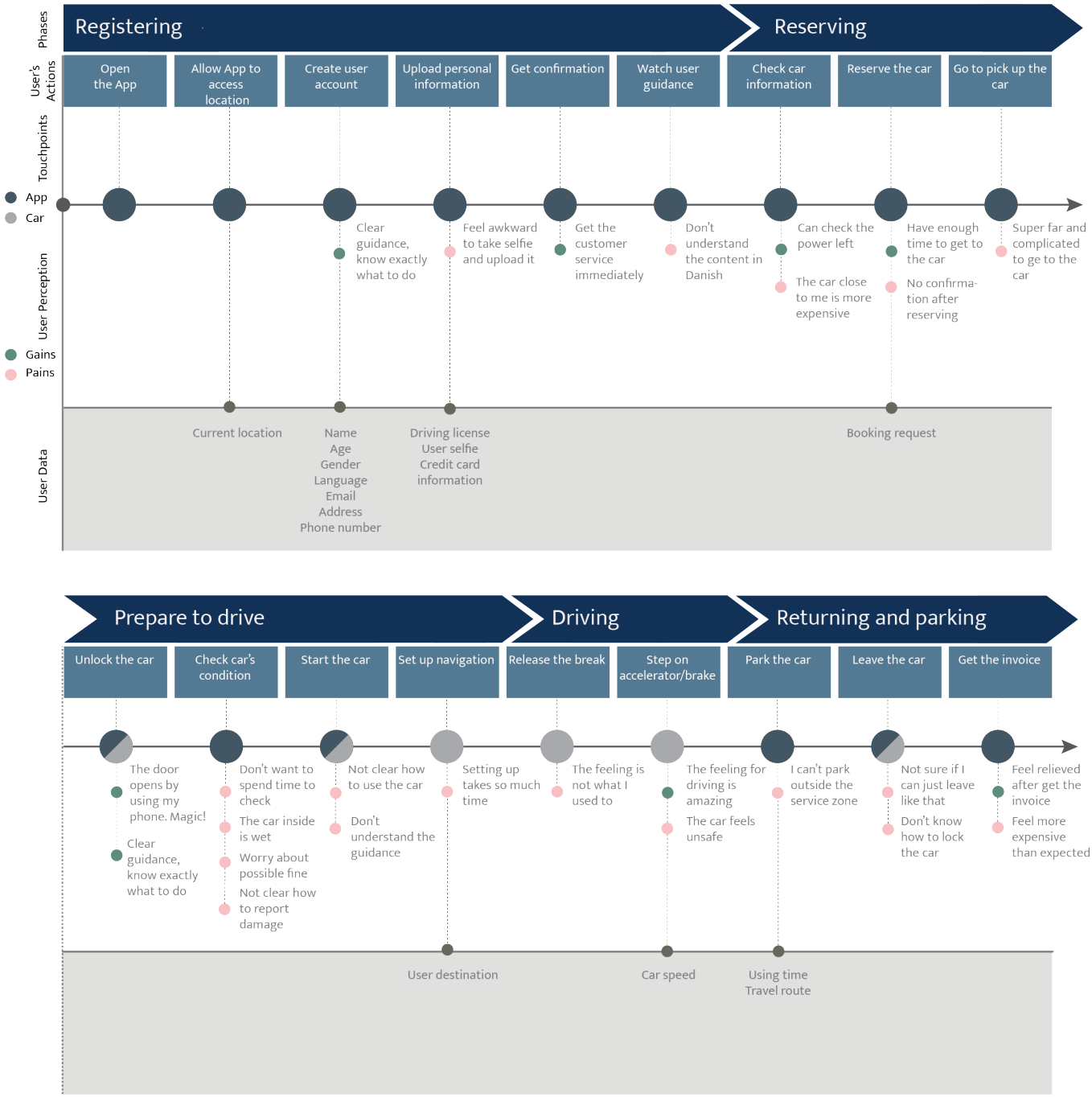


Figure 4: Initial customer journey of a car-sharing service

4.1.3 User Interviews

To understand various user experiences of car-sharing services, we planned to conduct several in-depth interviews with users who had used car-sharing services before (Figure 5). *In-depth Interviewing* is a common qualitative research method, which can give very detailed information, generates rich data and new insights (Bjørner, 2015). Through the interviews with users, we expected to understand their motivations, pains and gains of using the services. By this, we explore the opportunities or problems that can be improved in current car-sharing services.

Due to limited time and budget, we adopted the convenience sampling method for selecting the participants of the interview. This means choosing people who are easy to contact and respond promptly (Bjørner, 2015). Six participants were recruited from our own network, who had used any type of car-sharing service before. They are between 25 to 35 years old, 5 males and 1 female, currently all living in European cities. Each interview was around 30 minutes, which was separated into two parts. The first part was questions about car-sharing service usage, which included the type of car-sharing service, frequency, motivation, competitive solutions and satisfaction of using the services (Appendix 2). The second part zoomed in to a specific use case they had before, with reflections on the details of that experience. We provided a template to the participants and some sticky notes so they could write down how they felt, place comments on the template and construct their emotional journeys during the process. It aimed to help us sorting relevant information easier and shorten the process for data synthesis in the later phase.

In general, it was not challenging to gather information about the user's previous experiences but it was not always easy to retrieve data from a specific part of their journeys. One of the examples was an experience that happened several years ago. It was hard for him to go through the whole journey in chronological order, but he could only remember some key events which lacked the details in it. Another case was a user who had used different types of car-sharing services multiple times in various purposes, so the journey was mixed up and composed of several experiences instead of a single use case like we asked.

The template that we created for mapping out the users' journeys left a nice impression at the beginning, which helped to ease the mood and facilitated the conversation. However, the process of using the template was not so easy in some cases. First, there was an inconsistency between what participants talked about and what they wrote down, which caused some confusion. For example, some addressed an event in a positive way but left the note as if was a negative experience. Second, not all the participants were used to write their experiences on paper and felt more comfortable sharing them by talking. In these cases, we assisted them in taking the notes and constructed their emotional journey together. Nonetheless, it is not always easy for us to distinguish the differences in their emotions in the journey. By asking them how they felt at that moment, confirming if it's a positive or negative experience, interrupted the flow of their talking.

Despite these aspects, we still got fruitful results of the interviews with users. We collected key information we needed and identified their pains and gains that left a strong impression in their memory of the experience. This data would be analyzed together with the data from the Service Safari in the Define stage.

Figure 5: Interview with a car-sharing service user

4.1.4 Preliminary Reflection

In the Discover phase, we applied different methods for research purposes. It aimed to have an initial understanding of current car-sharing service experiences. Those preliminary findings were crucial to us for preparing the prototyping process later. We gained understanding about what kind of personalized experiences already exist in present car-sharing services and which parts of the services can be potentially redesigned.

Service Safari was found a useful tool for exploring service experiences at the beginning of a design process generally.

What we found particularly helpful is that the Service Safaris helped to capture experiences, pains and gains in each touchpoint which is hard to find by conducting other methods, like observations. Car-sharing is a self-service, so interactions are happening mainly on users' personal devices in a private space or in the car, making it hard to observe. Immersing ourselves into users' roles as researchers, allowed us to quickly understand the whole service within a short time.

Mapping out the initial customer journey for using the service provided a good base for developing the new service concept. It transformed research outcomes into a journey which presented an overview of car-sharing services in chronological order. The journey contained the process of the present service, a series of users' interactions with different touchpoints and how users feel in particular parts of the service. For developing a personalized service, we also included the aspects where the service can gather user data via interaction. The tool gave us the initial inspiration about what we can use to personalize further and helped to discover the undeveloped areas in car-sharing services.

4.2 Define

In the Define phase, the aim was to frame the right problem to tackle and identify a target group for the new personalized service. This process contained a series of methods through which we gradually narrowed down to our focus area. This started with synthesizing the data collected from the user research. The outcome was used to define our target group, which was summarized in a value proposition canvas. This Define phase further contained the creation of an Actors Map, for representing the current status of the mobility services ecosystem we focus on. By both considering the understanding of users and the systemic aspect, a new refined problem statement was formulated for developing the new concept. After deciding the direction of the project, a checkpoint meeting with our stakeholders was held to align on the process addressed above. Finally, a design brief was made for guiding us to the process of the coming Develop phase.

The following sections will be discussed in this subchapter:

4.2.1 Data Synthesis

We started with a session for synthesizing the qualitative data, aimed to interpret the information gathered from our user research (Figure 6). With this, we hoped to identify potential problems areas to develop a solution for. After the session, we planned to take the outcomes of both our research and our stakeholders' opinions into consideration when defining the target group.

In Figure 7 the key steps of the process through which we synthesized the research data are presented. We started by sharing the individual interview results in order to build up a common understanding between us. Both of us wrote the most important user quotes down and added them into the journey that we described in chapter 4.1.2 Customer Journey Mapping. The reason for this was to get an overview of the user's pains and gains in different parts of the chronological journey. Later, we added quotes that emerged from our Service Safari to have more data to work with.

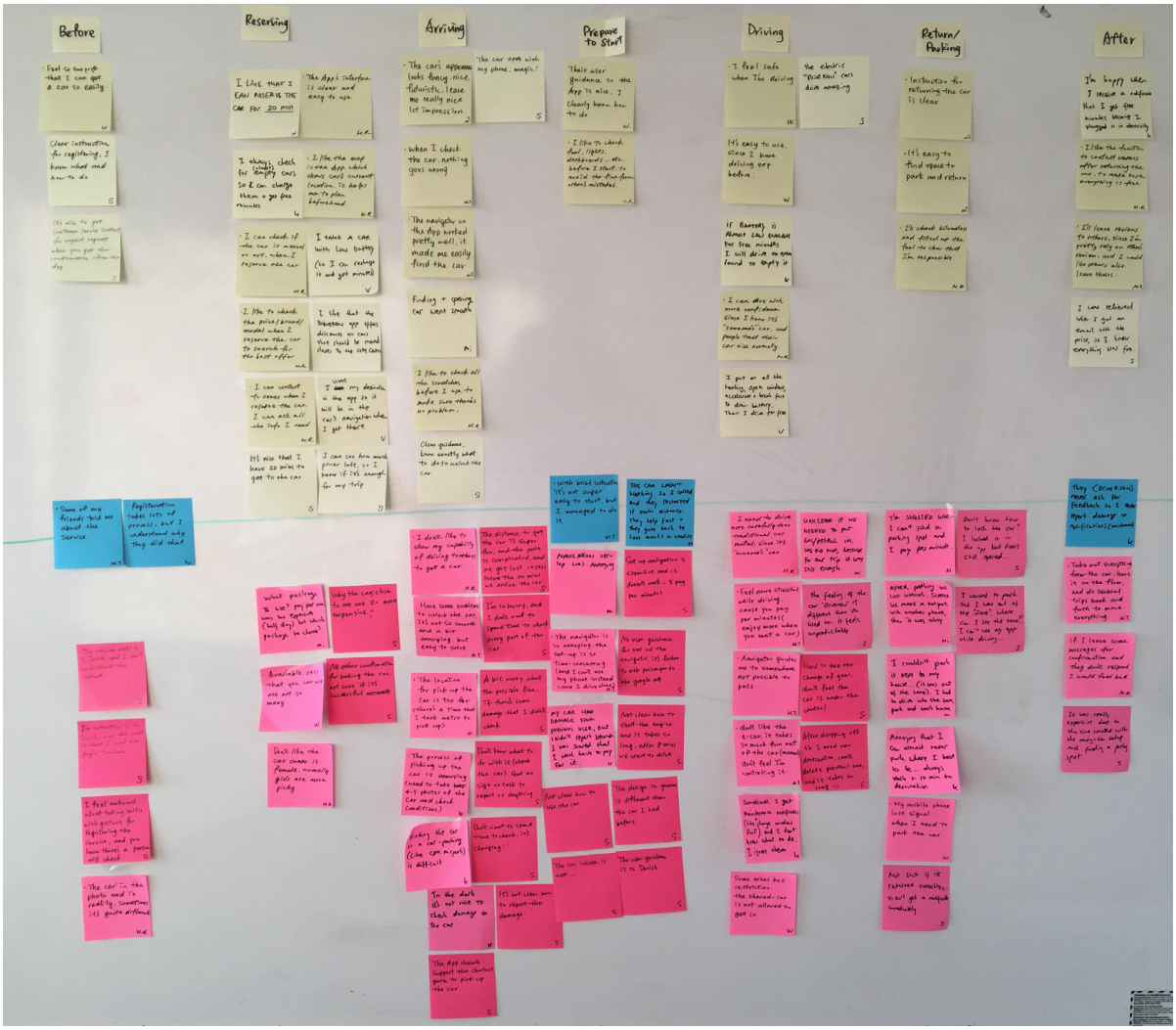
After we read the quotes from our user interviews in chronological order, we clustered them based on their similarities and from that concluded several findings. The clusters can be found in step 2 of Figure 7. The new findings were placed in a chronological journey, which helped us to find out some problem areas in existing car-sharing services. This chronological journey with clusters can be found in step 3. of Figure 7.

However, we noticed that not all problems have a strong connection to personalized services. Therefore, a polarization was used to evaluate the potential for personalization. The outcomes that we found were separated into three different levels, high, medium and low potential for personalization. The higher level means that we assumed a specific problem has more possible potential for developing a personalized service concept for. The polarization can be found in step 4. of Figure 7. The outcomes were brought to the next session where the initial problem statement would be refined.

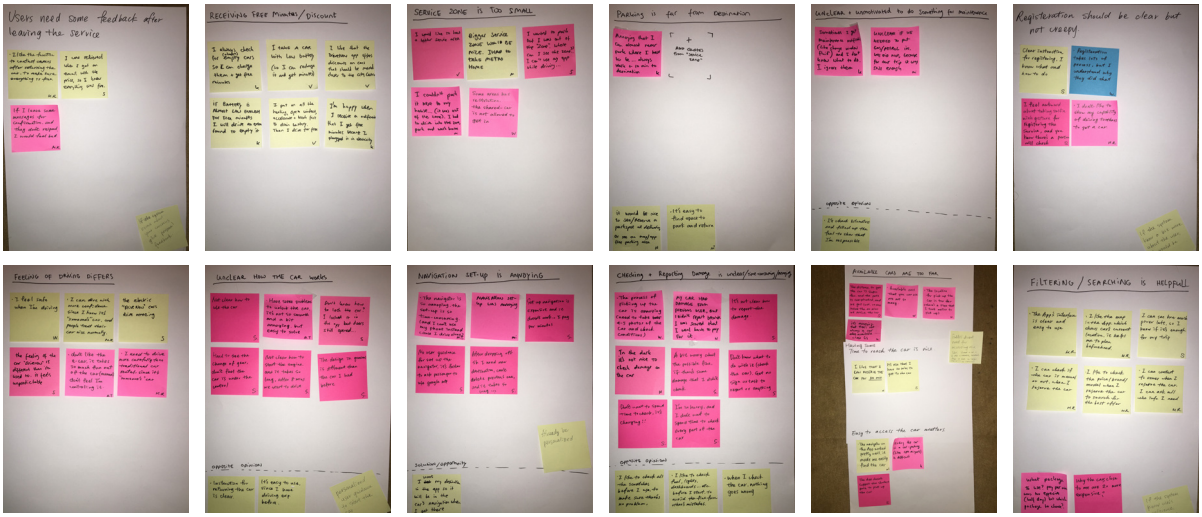
During the Data synthesis session, we found that the process for interpreting the participants' data may be biased, due to three reasons. First, for shortening the time spent to analyze their data, the quotes were taken from our notes instead of audio recording, so the content that we shared in the session was already presented in a filtered way of our personal understanding. Second, when we were transforming our notes to sticky notes, we may have filtered some information unconsciously that we thought was not relevant before sharing in the group. Third, we also noticed that we were biased by the process itself because we prioritized the experiences of the participants we individually interviewed. We assumed the reason behind it was that this information that was generated directly by facing the participants in the interview, left a deeper impression comparing to the information that came from the other team member's interviews.

Figure 6 A selection of current users' quotes from the interviews

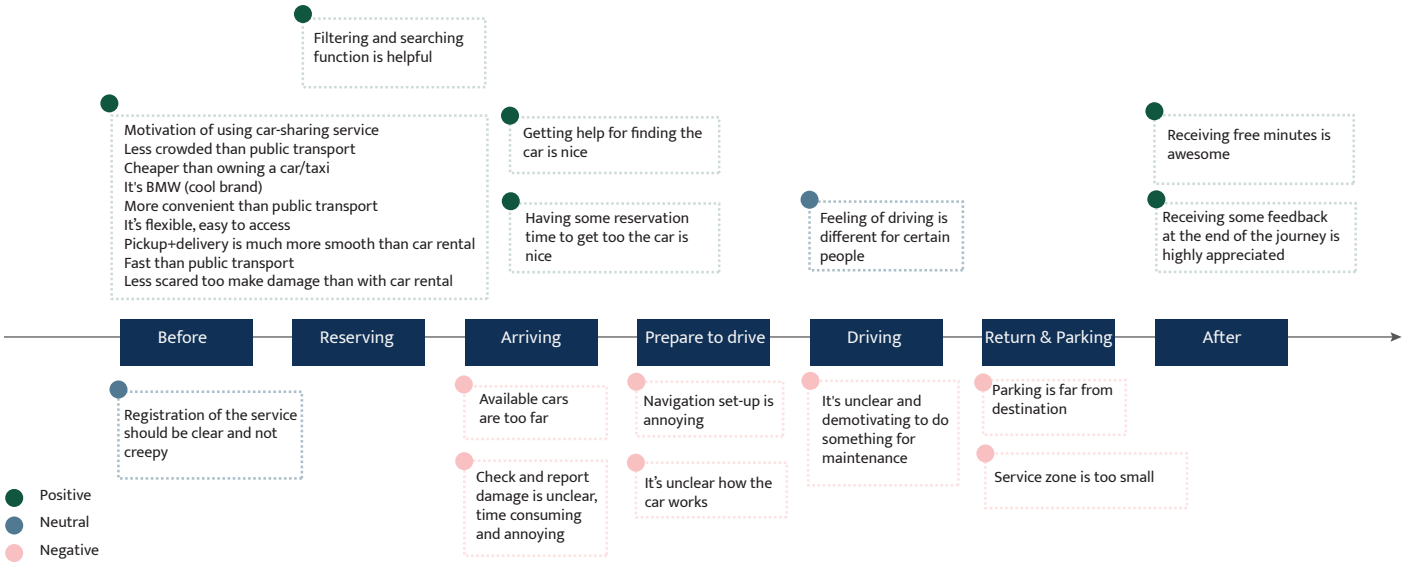
Step 1. Place all user's quotes in a chronological journey
(Yellow: user's gains, Blue: neutral comment, Pink: user's pains)



Step 2. Cluster user's quotes to find patterns



Step 3. Summarize the findings in the customer journey



Step 4. Finding potential areas for personalization

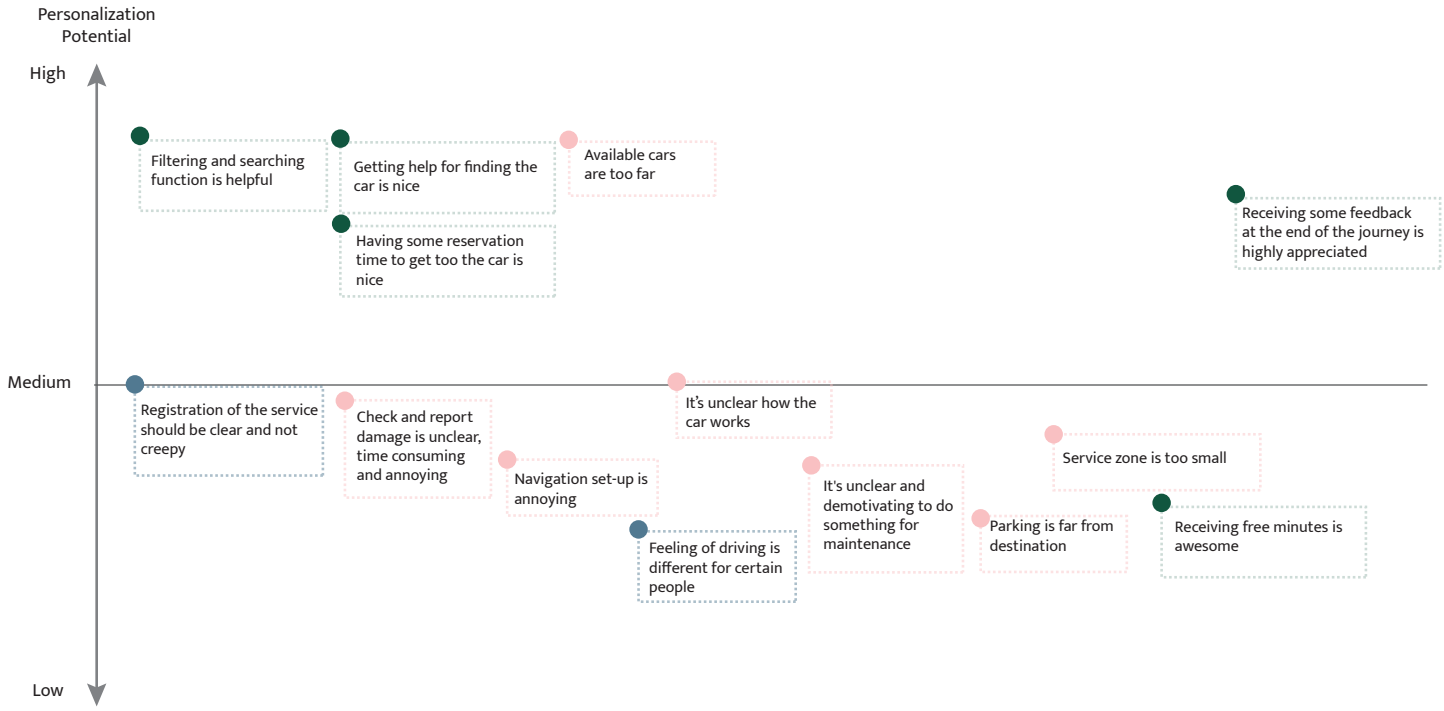


Figure 7: Process of data synthesizing

4.2.2 Target Group

This section describes a group of people who share similar needs and who are potential users for car-sharing services. The description of these people is formed by previous research, which included our user research and car-sharing literature review. We narrowed the target group to people between 25-35 years old, who live in Copenhagen, who are at the end of their study or beginning of their career. They do not own a car yet and have an open attitude towards technology. More information to describe our target group can be found in Figure 8. The main reasons for selecting these people as our target group are the following. First, these potential users have occasional needs to use a car but they do not own one yet. This motivates them to sometimes use car-sharing services to fulfil their needs. Second, as they are open towards new technology, they are not afraid of trying out a new car-sharing service, which involves using such new technologies. Third, it is easier for us to search for participants who are willing to test our coming prototypes, as they are similar to most of our peers in our own social networks.

The way we could have described our target group differently, is by using personas. According to (Cooper, 1999), personas are fictional people defined by their personal and practical goals, in relationship to the product that is being designed. Our motivation for not focussing our efforts on creating such personas was twofold. First, a common pitfall for using personas is that they are often not based on data (Pruitt and Grudin, 2003). The target group that was derived from our research is built on research data, but to add the refined characteristics that are required for a persona, more research data would be needed. Since the focus of this thesis is on prototyping, it was decided that the target group gave sufficient direction to start the prototyping, so the effort to make a persona could be put into the prototyping instead. Second, according to Pruitt and Grudin (2003), personas' greatest value is providing a shared basis for communication throughout a whole organization but since we are a two-man team, this communication was not needed. We both had a clear idea whom to design for, so time and effort to build up personas as communication material was saved.

Late Student
Recent Graduate

Young Working
Family

Demographics

- Between 25 - 35 years old
- Live in densely populated urban areas (Copenhagen)
- Higher educated

Characteristics

- Care about the environment
- Tech savvy
- Not owning a car

Use Behavior

Use Cases

- Transport large goods
- Transport to/from airport or train
- Pick up people
- Unplanned quick errand

Usage

- 1-5 times per month
- Short trips between 10-30 minutes

Motivation

Short Journey

- Shorten travel time
- Direct trip to destina -tion

Accessibility

- Quickly accesible
- Use the car without time limitation
- 24/7 accessible

Price

- Discount rewards
- Competitive price for premium experi -ence

Others

- private space
- Less pressure due to less damage control

Barriers

- Limited service area
- Hard to access the available car
- Far from parking to final destination
- Too expensive for constant use
- Feel confused about using the car
- Checking car condition is time-consuming

Figure 8: Target group description

4.2.3 Value Proposition Canvas

The *Value Proposition Canvas* was introduced by Osterwalder et al., (2014), as a tool to visualize the value of a product or service in relation to the needs of a customer. Therefore, it makes it easier to discuss and manage the value derived from a product or service. The canvas includes two parts; a customer profile, which represents the understanding of a group of users who use a certain product or service, and a value map, which shows how the designer intends to create value for the specific users. The goal of the method is to find a match between the two when they are considered together.

In the Define phase, we built up a user's profile in the value proposition canvas (Figure 9) for representing a set of characteristics that we discovered in current car-sharing services from the users' perspectives. It shows the benefits that users expected and the obstacles that they find by interacting with present services. The value derived from the new service concept we are developing should be able to help improve some of the critical drawbacks, and also preserve what users perceive as important advantages in the existing services.

After analyzing the user's pains and gains, we identified five key factors: price, time, flexibility, accessibility, and new technical features, which may affect their service experience.

- **Price:** The current price of car-sharing services may be a barrier for student users to use the service more frequently.
- **Time:** The users perceive that a higher price is a trade-off for saving their time. Comparing to public transportation, the service has to be significantly efficient.
- **Flexibility:** comparing to a traditional car-rental business model, the flexibility of the current services is satisfying.
- **Accessibility:** For some users, it is quite challenging to access to the car. The location of picking up the car is too far from their starting point.
- **New technical features:** The new technical features in cars are noticeable. They cause both positive and negative experience.

In this stage, the map is useful for us to sum up the findings from the user research and also to detect key factors for developing the concept. Those key factors were used as principles to guide us when we started to design the solution.

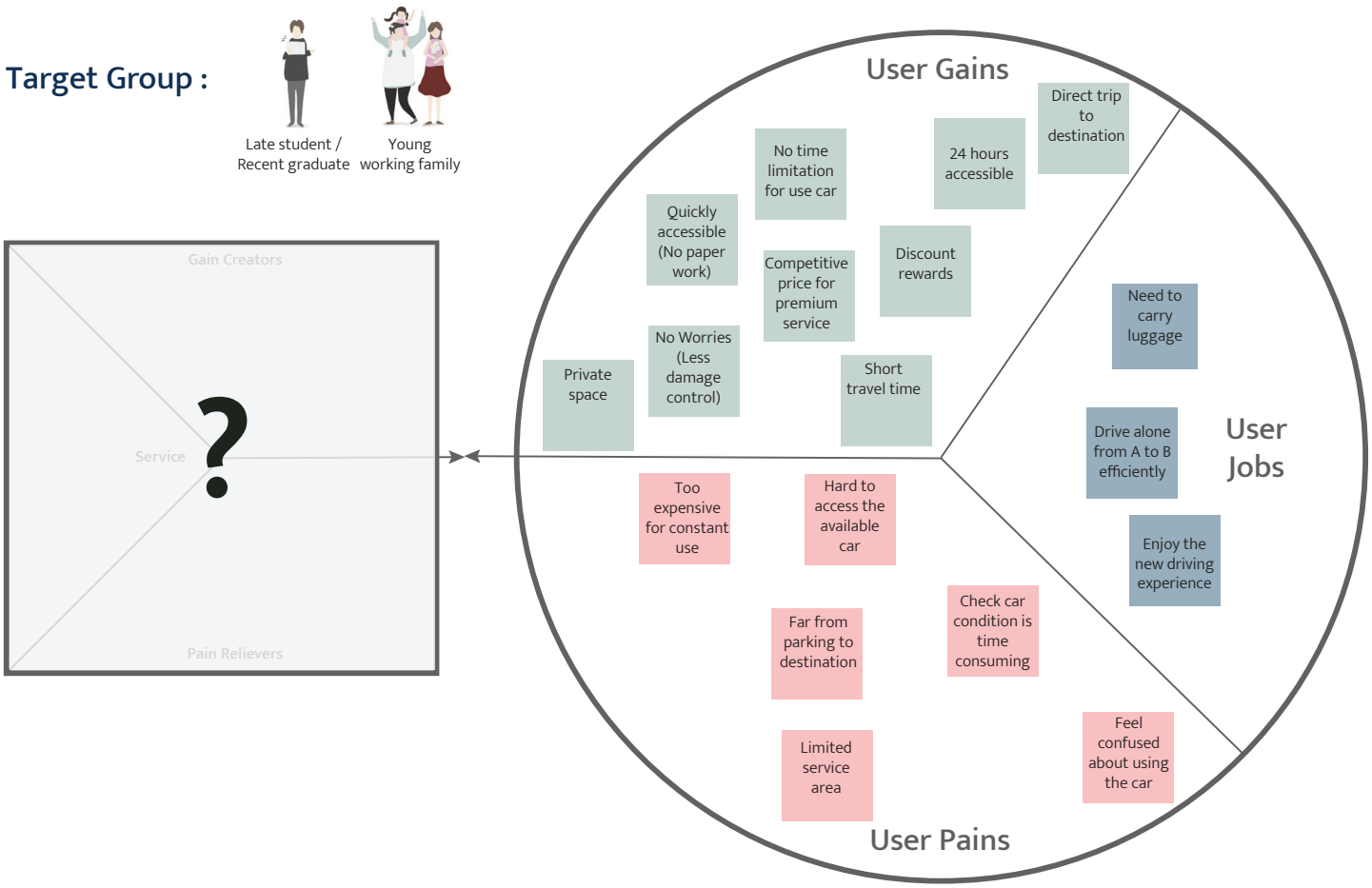


Figure 9: Value Proposition Canvas: user profile of current car-sharing services

4.2.4 Actors Map

The *Actors Map* was introduced by Morelli and Tollestrup (2007). It is a visual representation tool which aims to give an overall picture of the actors and the components in a system, by mapping out the actors, grouping them by their functions, and identifying the relations between them. We can get an understanding of who are the relevant actors in the current mobility ecosystem of Copenhagen. This helped us to have a clearer scope of the project. In addition, this map can be used during the coming ideation phase, by combining different groups of actors or involving new ones. The way we made the map was through observations on the streets to find mobility services that can be identified and research online. By merging the outcomes from the observations and online research, the most common and noticeable services are added on the map. In Figure 10 we show the outcome of the mapping exercise.

The users are in the centre of the map since we considered them as the most important actors in the ecosystem. They are the reason that keeps the ecosystem to exist, by keeping interacting with various services components in it. The users can be defined as follows. Locals, who are people who live in Copenhagen. Tourists/ visitors, who are people from other places that come to Copenhagen for leisure. Commuters, who are people from outside Copenhagen, who come to the city on a regular basis for work. The second layer of the map consists of all the direct mobility service providers. These are the service providers with whom the user has direct contact when using a service and they include both digital and physical services. The third layer consists of hidden stakeholders with whom the users do not have direct interactions, but they are key to maintain a functioning mobility ecosystem.

The Actors map gives a good overview of the present state of the ecosystem that we are focusing on. It consists of many service providers, pointing out its complexity and richness. When designing a new service, it is crucial to closely look at the systemic level in its entirety and identify if there is any gap which is not yet been taken care of by other providers. The map also provides a starting point for ideating possible solutions, by evaluating the current functions of the actors in the macro system. This helps us to explore the possibilities to combine existing resources or reshape services which are not active, thereby add new value to the ecosystem.

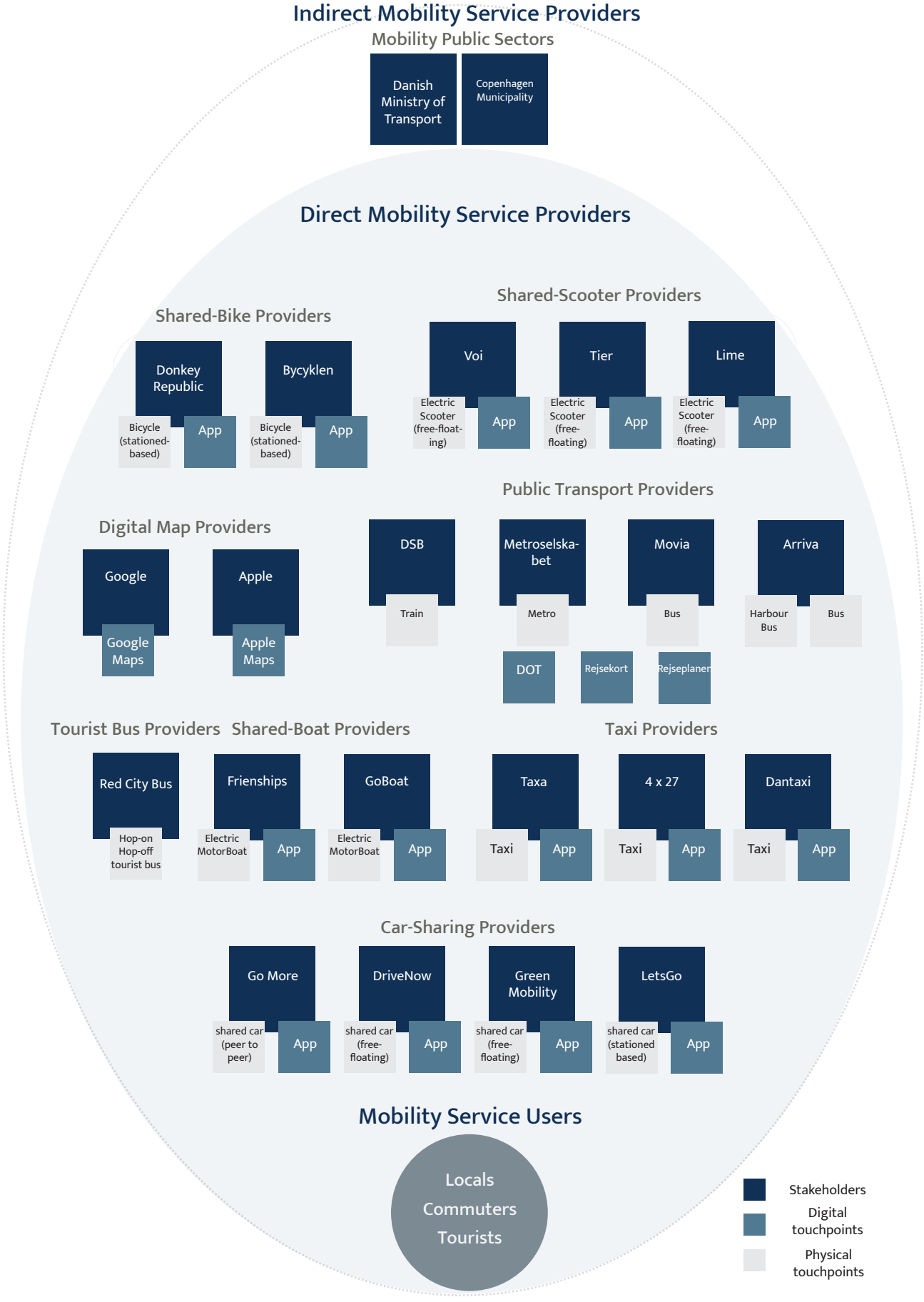


Figure 10: Actors Map of mobility services providers in Copenhagen

4.2.5 Refined Problem Statement

After the Discover phase, we identified various potential areas to develop our concept for. In the Define phase, we analyzed these areas and transformed them into several design challenges. Based on this understanding, we reformulated our problem statements in order to have a proper scope for ideating a new service concept. A group session was held for refining the new problem statement, following the process described as following.

Firstly, we individually brainstormed three problem statements based on the outcomes from the user research and the stakeholder interviews that we collected in the Discover phase. Secondly, we shared our problem statements and explained each other the ideas behind them. Thirdly, we grouped similar problems together and then categorized them chronologically into a customer journey. Therefore, this process allowed us to check if any problem connects or overlaps with another one, pointing out the need to merge them. Fourthly, in order to reach an agreement more efficiently, we silently voted for selecting three favourite problem statements. After we made the decision individually, we elaborated the reasons behind our choices. Lastly, we merged the selected problem statements (Figure 11) for which we identified tight connections and refined them to come out with the final problem statement .

Initial problem statement:

How might we design for a personalized experience of a Volvo car-sharing service?

Refined problem statement:

How might we personalize a car-sharing service to make it easier/quicker to get to a car-sharing vehicle?

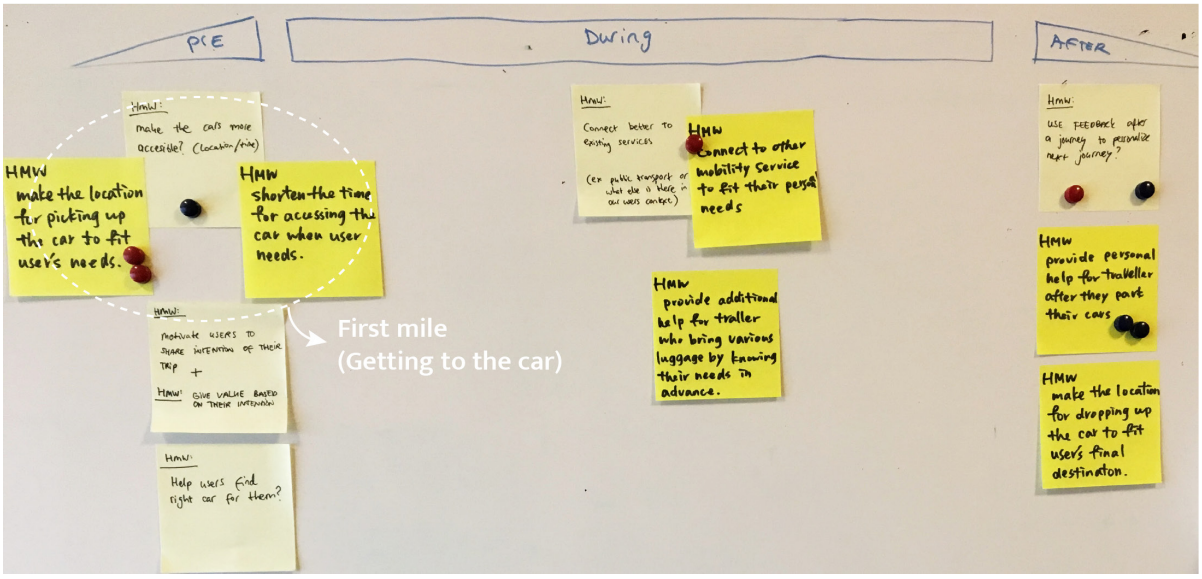


Figure 11: Selected problem statements for forming the refined problem statement

4.2.6 Stakeholder Checkpoint Meeting

In order to reach a common ground with our stakeholder, to align how the refined direction of our project fits their interest and to request support for prototyping the concept, we arranged a checkpoint meeting with Volvo to present our findings from the Discover and Define phase. The main topics that were discussed can be split up to three parts, which included our findings and process of user research, the target group that we defined, and the refined problem statement that we would like to tackle.

In general, we received positive feedback in the meeting and our current direction has been approved as a promising way to develop further. First, the target group is relevant to Volvo, but they suggested that the details of the target group can be further polished. For example, to specify the region of the target user, since the stakeholders in the company were used to have a clear market segment and capable to distinguish the regional difference. In addition, to give a name or photo to the users, which may help to feel more relatable to this group of people. Second, they evaluated that our new problem statement is very pragmatic. If we can add more emotional factors to it, it would be better. For example, filtering a car is interesting, and especially how to filter a car that fits the users' personal needs. Third, they thought it is good that our project have different directions with Volvo, so we can complement our research and our findings might be interesting for them as well.

This meeting gave us many constructive suggestions from the stakeholders' point of view. Besides, it was a great confirmation for us that the current direction of the project would be relevant and interesting to our stakeholders.

4.2.7 Design Brief

A design brief was used to summarize what we have identified from the previous research, in order to have a clearer focus for the next phase of developing the service concept. It included the problem we want to solve, the goal that we want to achieve, the target group that we are designing for, and what we need to consider as well as what should be avoided in the concept.

What We Know

- Car sharing users' characteristics
- Their motivation for using the car
- Use cases for car-sharing service

The Problem

In current free-floating car-sharing services, the journey for accessing a car sometimes is quite challenging, especially for users who have luggage. There is no fixed location for users to pick up a car. Thus, the distance is unpredictable for users before booking the car. Users may need to go to a location, which is quite far and not familiar, to search for the available vehicle. This may take them quite a lot of time and effort before they are able to start using the car.

The Goal

The goal is to propose promising ways of prototyping a service that can be used by Volvo when building up a new personalized service.

Competitive Analysis

- Competitive car-sharing services in Copenhagen that we have identified are listed below:
- DriveNow (free-floating car-sharing service)
- Green Mobility (free-floating car-sharing service)
- LetsGo (stationed-based car-sharing service)
- GoMore (peer to peer car-sharing service)

Those services are currently available in Copenhagen, but none of these services has been highly personalized. We identified them as key stakeholders in the mobility service ecosystem since we have similar target users, but we did not exclude the possibility that they could also be potential collaborators.

Whom Are We Designing For

- 25-35 years old people
- Live or stay in Copenhagen
- Student/Young working family

What We Want To Include

The current direction is rather practical, however, we also want to add the emotional aspect.

What We Want To Exclude

A solution that can only solve the problem for accessing the car easier or faster, without considering personal needs.

4.2.8 Preliminary Reflection

During the Define phase, we gradually narrowed down the scope of our project, clarified the problem areas and defined a target group. By mapping out the Customer Journey, it helped us to identify the problems which existed in specific parts of the service. During the process, we found that not all the problems have strong connections to personalization. The current Customer Journey Mapping tools did not provide the ability to evaluate the possibilities of personalization. Therefore, we added an additional process for evaluating the potential for personalization. This step allowed us to have a clearer scope for the ideation in the coming phase.

4.3 Develop

As the research question is about prototyping personalized services, the Develop phase of the Double Diamond, which includes prototyping, is the most important and extended phase of this thesis. The previous Discover and Define phase were required to frame the right problem and target group, now the aim is to try out different prototyping methods and find out which ones are most appropriate to be used when prototyping for personalized services. First, a round of ideation and idea selection will be discussed, after which one idea will be selected to develop further. Then, a prototyping approach will be explained, that will guide the prototyping and testing process. Through this prototyping, which will be done in four rounds, several answers to the research question will be explored.

The following sections will be discussed in this subchapter:

4.3.1 10 Plus 10 Brainstorm

In order to start the prototyping, a wide range of ideas needed to be thought of first. Of these ideas, one or a combination of them would be chosen to develop further. For this ideation, we chose a method called "10 plus 10", that would enable us to come up with ideas in a structured way and to find different variations of the ideas. *10 plus 10* is similar to brainstorming, where you generate many ideas, but is more structured and contains parts of both individual brainstorming and group reflection (Greenberg et al., 2011). The goal is to first come up with ten ideas individually (Figure 12), after which the ideas are shared in the group. The ideas are narrowed down to one or two, which will be used as a starting point for the second round, where ten different variations of the chosen idea will be thought of individually. The method was new for us, but due to its simplicity and slight changes compared to ideation methods used before, it was easy to understand and execute.

After the first round, that led to ten ideas, it was found that most of the ideas lacked the aspect of personalization. Therefore, it was decided to change the execution of the method slightly so the second round of ideation could be used to come up with variations of each idea, that would include more personalization. Also, in this stage, we wanted to ideate openly and to wait with narrowing down ideas until we showed all of them to our stakeholders at Volvo. The second round of ideation led to ten personalized variations of the previous ideas, resulting in a total of twenty different ideas.

The fact that the chosen direction of the project was about accessing the car, limited the range of possible opportunities greatly. This made it hard to come up with ideas that are significantly different from each other. Although the first round of open ideation felt a bit difficult and unstructured, the second round of variations enabled us to come up with many different ways of personalizing the concepts. Looking back, the 10 plus 10 method helped us to generate lots of ideas in a short time (Figure 13).

Figure 12: Ideas after the first round of the 10 plus 10 method

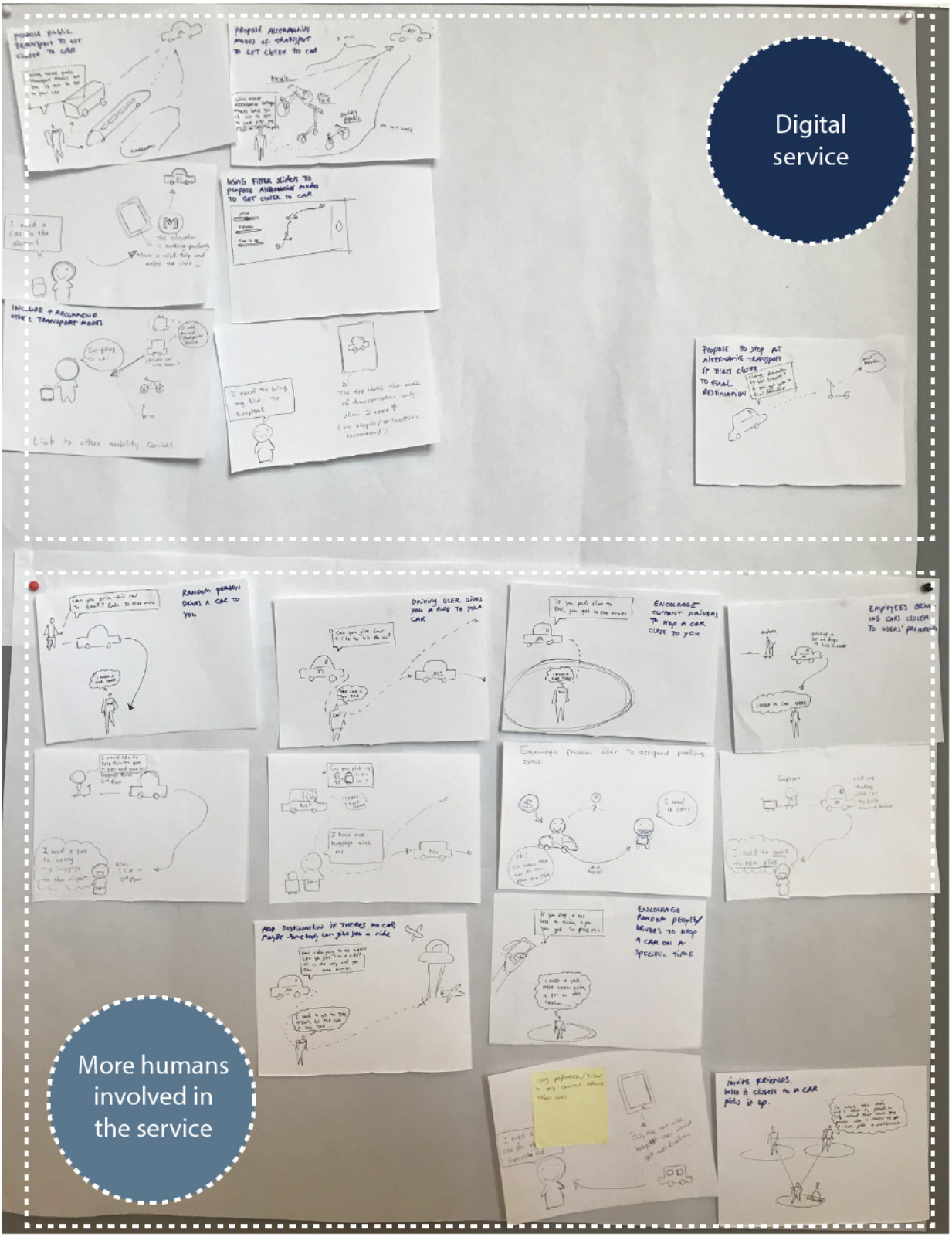


Figure 13: Total amount of ideas after the 10 plus 10 method

4.3.2 Idea Portfolio Evaluation

The next step after generating ideas was to narrow them down in order to have a small selection that could be presented to the Volvo stakeholders. To avoid spending a lot of time on discussions and being biased towards our own ideas, it was decided to use a method that could help us in this idea selection process. We chose the "Idea Portfolio" as our decision method. *The Idea Portfolio* helps teams to arrange and rank all their ideas according to two variables (Stickdorn et al., 2018). Because the variables can be selected by the members themselves, it's a flexible method that can be used in many different cases. Often the variables are "Impact" and "Feasibility". Ranking all the ideas along these variables often gives an objective view on which ideas are easiest to implement with the greatest impact.

As we have never used the Idea Portfolio before, we decided to follow the common-used variables "Impact" and "Feasibility" and find out in what conclusions that would result. The ranking of the ideas according to these variables went quickly, but it can be argued how thoroughly the feasibility and impact of the ideas are measured. We quickly evaluated each idea on technical feasibility according to our own knowledge, instead of researching this thoroughly by looking for similar concepts that are proved to be working already. Also, the impact appeared to be hard to evaluate, since the impact can be defined on many different levels; the impact on the user experience, environment or business for the service provider etc. We chose to focus on the impact on the user experience, because stimulating car-sharing itself has already a positive impact on the environment, as explained in chapter 2.1.3, and we think that improving the user experience has a positive impact on a business. We decided to add small notes with comments that showed the positive and negative arguments for ranking the ideas, which later helped us to remember our motivations for the evaluation. The Idea Portfolio resulted in a clear area of five ideas that scored the highest on both impact and feasibility (Figure 14).

The method succeeded to eliminate long persuasive discussions about which idea should be selected and gave us a systematic way of going through the process of evaluating and ranking ideas. It also helped to create an objective atmosphere in which we felt both equally involved and valued in the decision-making process. It can be argued that the method is an oversimplification of the idea evaluation and that there should be multiple iterations of ranking with different variables. This way the selected ideas would not only be chosen according to impact and feasibility but also other criteria that could be relevant in this project. Even though it could have been better to iterate on the process multiple times, we both felt satisfied with the outcome, equally valued and confident that the selected ideas could add significant value to Volvo.

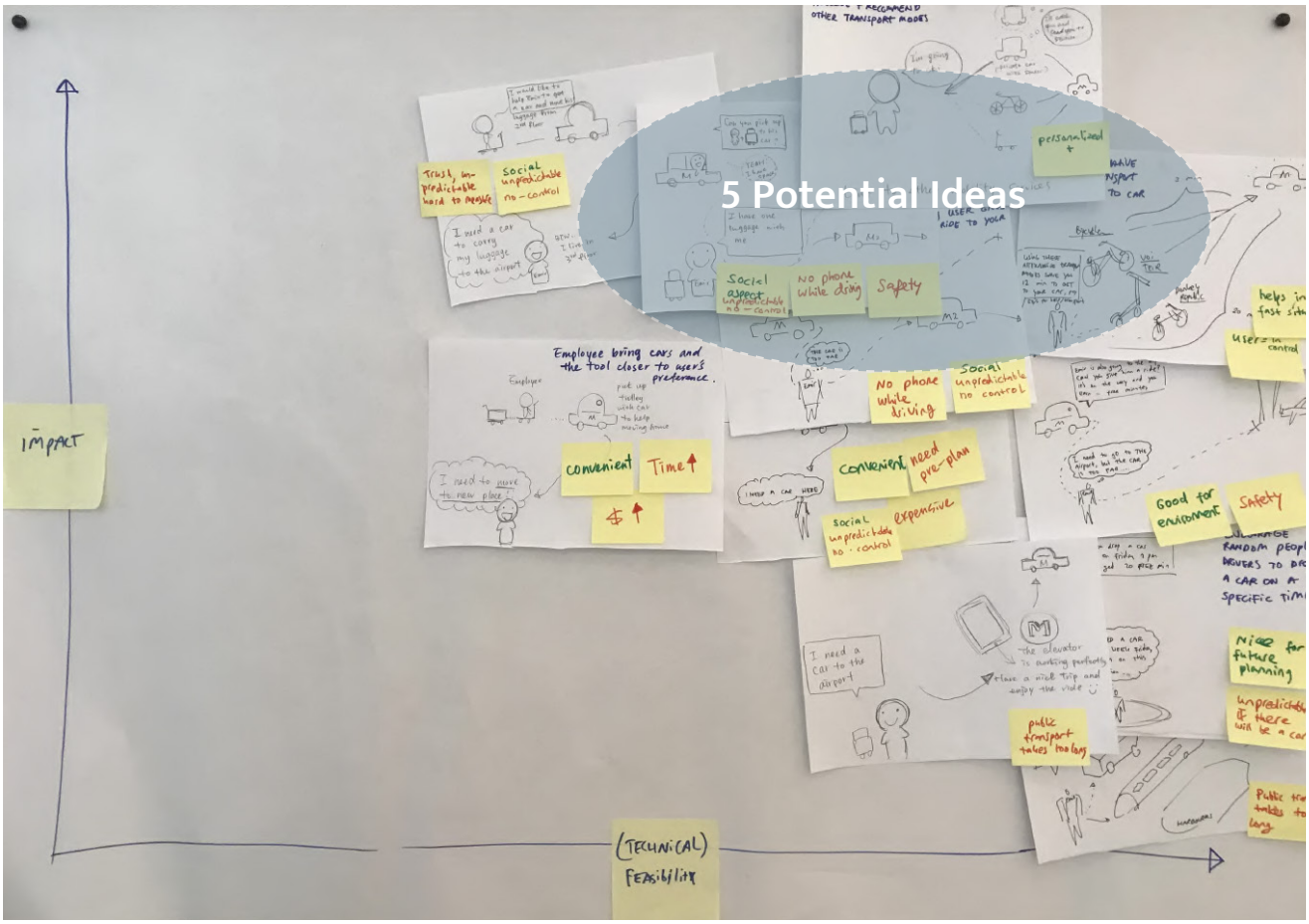


Figure 14: The five ideas that came out of the Idea Portfolio as most impactful and feasible

4.3.3 Stakeholder Feedback

In order to involve the stakeholders from Volvo in the idea selection process, a feedback session was scheduled. The reason for having the session was to validate our quick evaluations of the ideas and discuss which ones could have the most potential for Volvo. Also, we wanted to know what prototyping methods they had experience with so these could be taken into consideration for testing the ideas in the coming prototyping phase.

The ideation process was communicated by presenting the steps of the brainstorm, supported by showing pictures and visuals gathered in our digital workplace. Throughout the presentation, discussions emerged from critical questions and feedback on the ideas. This feedback and critical perspective helped us to evaluate the relevance of the ideas for Volvo. The points we identified as the most important feedback are listed below, the rest of the feedback can be found in Appendix 3.

- Knowing the user's intention" could be interesting for Volvo when thinking about possible future car-sharing services.
- A short trip can be hard to personalize, longer trips have more touchpoints and thus opportunities to personalize
- It can be sort of "trade-off", where not only the nearest car is shown, but also the user's most suitable or preferred car
- Try to use different prototyping methods to test the concept from different perspectives. A Desktop Walkthrough has a more holistic perspective of the whole city including other actors, while a Paper Prototype is more focused around the interaction of a single touchpoint

The session helped to refine our evaluation of the ideas according to more criteria, on top off "impact" and "feasibility" that was used in the previous Idea Portfolio Evaluation. After the session, it was decided to continue with the idea of recommending alternative transportation (Figure 15), like e-scooters and shared bicycles, to users if the car-sharing vehicle would be far to walk to. This concept scored highest on both impact and feasibility, fits the most crucial need derived from our user research and fit's Volvo's current challenge of enabling people to access the car-sharing vehicles. It was also decided to include the stakeholder's feedback to emphasise the personalized aspect; through gathering information about the user's intention, an alternative mode could be proposed that would fit their current scenario.

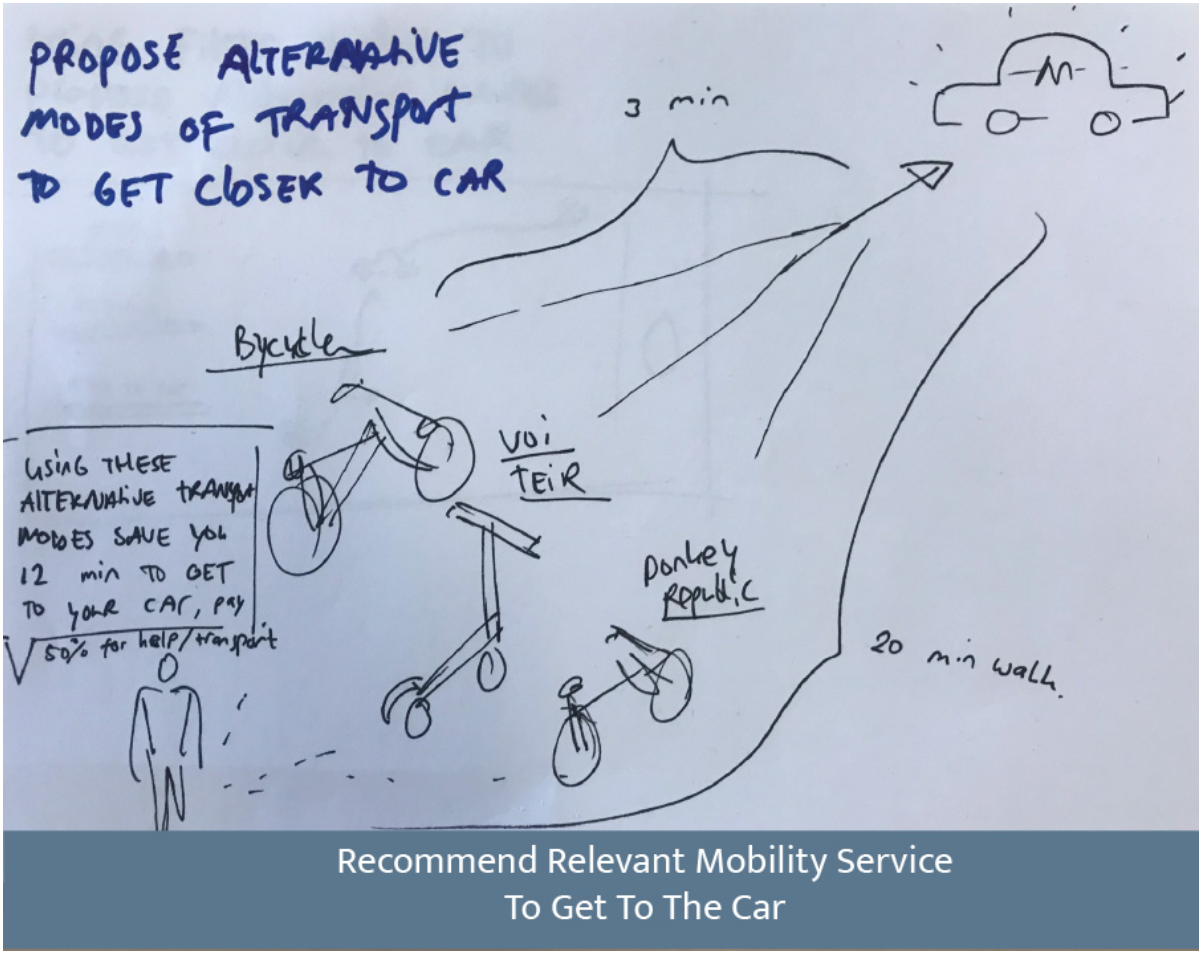


Figure 15: The idea that was selected after the Idea Portfolio Evaluation and Stakeholder Feedback Session

4.3.4 Prototyping Approach

After the idea was selected that seemed to have the highest potential of enhancing the user's experience in accessing a car-sharing vehicle, a logical next step is to convert this idea to a prototype and validate our assumptions. According to Buchenau and Suri (2000), a prototype enables designers to make more precise predictions about how a service will be experienced, which we need to make informed design decisions and convince our stakeholders at Volvo.

Next to testing our assumptions in the design case for Volvo, prototyping is also the focus of this thesis that aims to answer the research question: "How can service design tools support the process for prototyping new personalized services?". Therefore, the prototyping for the design case will here be used as a means to explore possible answers to this question.

The idea that is being prototyped follows a definition of personalization, that consists of the sub-processes "learning" and "matching" as explained by Murthi and Sarkar (2003). In such a personalized process, a system needs to gather user data (learning) that will be transformed to add value to the user (matching)(Figure 16). Our idea consists of both the elements learning and matching. The learning includes the aspect of understanding the user's needs. This can be for example where they want to go or what kind of vehicle they need. This learning can be done through direct input, like clicking on icons, sliders, texting with a chatbot or talking with a voice UI, or it can be indirect input like previous preferences. The idea also includes matching, which is the recommendation of using alternative transportation to get to a car quickly if it's too far to walk.

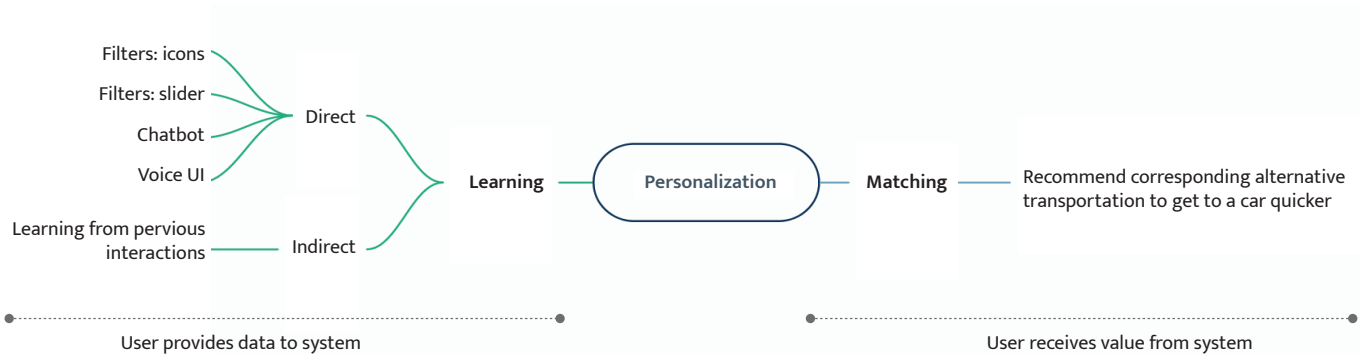


Figure 16: Schematic representation of the chosen idea according to the sub-processes "learning" and "matching" (Murthi and Sarkar, 2003)

In order to approach the prototyping phase in a structured way, it was decided to create a polarization that categorizes different ways of prototyping. The axes for this polarization are chosen to follow commonly known perspectives in academia, to make sure the results of the thesis are easily understandable and applicable for other Service Designers. As discussed in the literature review chapter, a common way of categorizing prototyping methods is to differentiate between indirect imagine-like prototypes and direct experience prototypes (Stickdorn et al., 2018). This categorization separates the techniques that focus on the simulation of a service experience from techniques that allow participants to experience the service itself by interacting with it.

Another way of categorizing prototypes is looking at the level of fidelity. Fidelity can be seen as the degree of detail in a prototype, sometimes called resolution or precision. It relates to how much of the final design the prototype represents(-Blomkvist, 2014). Prototypes that include few details are considered low fidelity and require a short amount of time to make, while high fidelity prototypes with a high level of detail require a longer time to make. Therefore, the level of fidelity is often related to the design phase, where low fidelity prototypes develop and become more detailed throughout the project (Blomkvist, 2014). Combining these two polarizations lead to a classification of possible prototypes, as shown in Figure 17. By testing prototypes in all of the four quadrants, we hope to find patterns that show which prototypes lend themselves best for prototyping personalized services.

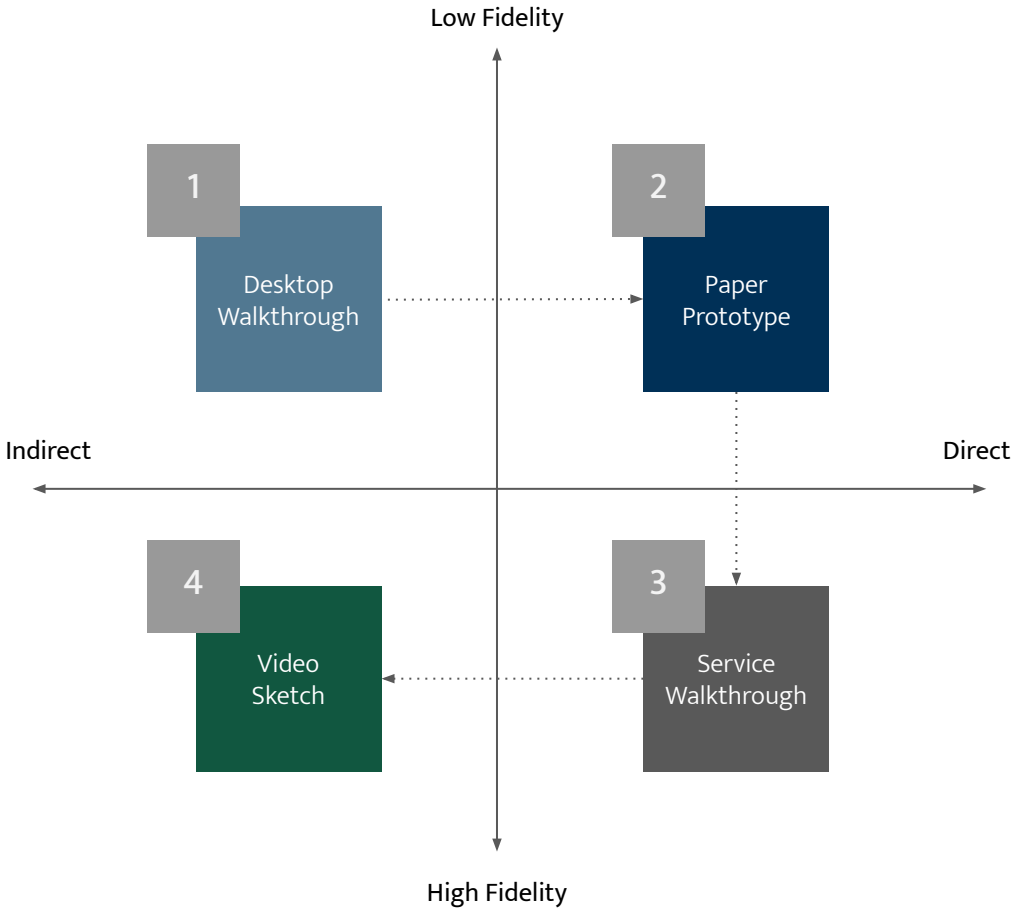


Figure 17: A classification of different prototyping methods

4.3.5 Prototype 1: Desktop Walkthrough

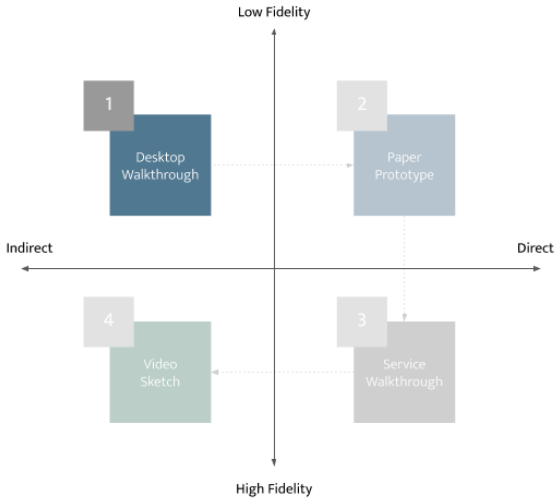


Figure 18: A classification of different prototyping methods: Desktop Walkthrough

The method that was chosen to be used for the first prototype was the *Desktop Walkthrough* (Figure 18). It is a method to communicate and test various aspects of a service concept, described by practitioners as a simple exercise in imagining a service experience (Blomkvist et al., 2016). By using materials like toys, LEGO and paper models, a scene can be played that enacts the walkthrough of a service, often including a customer, staff, an environment and some paper touchpoints. The Desktop Walkthrough was chosen as it is a quick and easy way of showing an initial idea to get the first user or stakeholder feedback. Due to its low fidelity, participants are invited to look at the holistic experience during the service instead of focusing on the detailed interactions. These details will be tested later on in the process through different prototyping methods. Another aspect that makes the Desktop Walkthrough suitable for the first round of testing, is the fact that it tests both the side of the user's experience and the impact for Volvo, who is the potential provider of the service.

Prototyping Purpose

The reason for making the prototype was to get insights and test our assumptions on several elements of the concept. Our first and most crucial assumption was that the concept would add additional value to the user and thus improve their experience of using the car-sharing service. Next to that, we wanted to test if the participants could relate to the scenario, validating that the use case is realistic. In terms of personalization, we wanted to know what the participants think about the learning phase of the service and the recommendation that follows. As the prototype allows to gather feedback from the stakeholder's perspective as well, another assumption that needed testing was the feasibility and impact for their business.

Prototyping Process

The process for building up the prototype and using it for testing was as follows. First, the prototyping purpose was clarified, which resulted in the testing of assumptions as described above. Second, a scenario was picked to seemed realistic for potential users. It was decided to use a real scenario, told by one of the participants during one of the interviews. In the scenario, the participant uses a car-sharing service to drive to the IKEA to pick up some furniture. Third, the scenario was enriched by including our concept and adding elements of personalization. Fourth, the scenario was transformed into a story with physical components, like a printed map of Copenhagen, with an actor and IKEA made of LEGO and printed cars and e-scooters (Figure 19). The story consisted of two parts; during the first part, the participants are introduced to the actor of the story and the problem he encounters. The full written story can be read in Appendix 4. During the second part, the service is acted out by using the physical components, demonstrating the whole journey from beginning to end. Fifth, several car-sharing users were invited to participate in the prototype test. Eventually, the Desktop Walkthrough was tested with three users and three of our stakeholders from Volvo (Figure. 20). They were all told the story, after which the prototype was shown and questions were asked.

Figure 19: Explaining the concept through the Desktop Walkthrough

Figure 20: A stakeholder discussion after showing the Desktop Walkthrough

Prototyping Results

The results of the testing can be categorized in findings from the potential users and findings from the stakeholders. From the user's perspective, an alternative way of reaching a car-sharing vehicle is more than welcome and the problem is something they have encountered. Their first thought was that they would prefer to use their own bicycle, but later they realized they need to leave it somewhere in the city which has to be picked up later on. Using an e-scooter or shared bicycle would solve this problem. Another finding is that the service should not cost too much and should not exceed the price of using public transport, as it's merely an addition to the main service. Adding to that, knowing what the total price will be beforehand is preferred over paying per minute, as this is considered stressful. The participants were a bit hesitant about sharing the intention of the trip but this is justified if the value they get in return is beneficial for them. The personalized recommendation makes them more motivated to use the service. A concern for using it is the fear that there are no e-scooters or e-bikes around.

From the stakeholder's perspective, the integration with other service providers, like e-scooters and shared bicycles, is feasible. Other platforms, like Google Maps and Rejseplanen are also starting to integrate more diverse mobility providers. Like the participants, they pointed out the fact that it's hard to ensure a good recommendation, as the service relies on two unpredictable free-floating services. They also noted the price aspect, stressing the fact that our target group is not necessarily having a lot of money. Next to that, they proposed to look at more types of transportation, so maybe also including public transport, taxis or carpooling. In terms of personalization, they noted the fact that weather and other data sources, like chat conversations, could also play a role in the recommendation. They concluded that the Desktop Walkthrough worked great in communicating the concept from a holistic perspective and proposed that the next prototype could zoom in more on a detailed level.

4.3.6 Prototype 2: Paper Prototyping

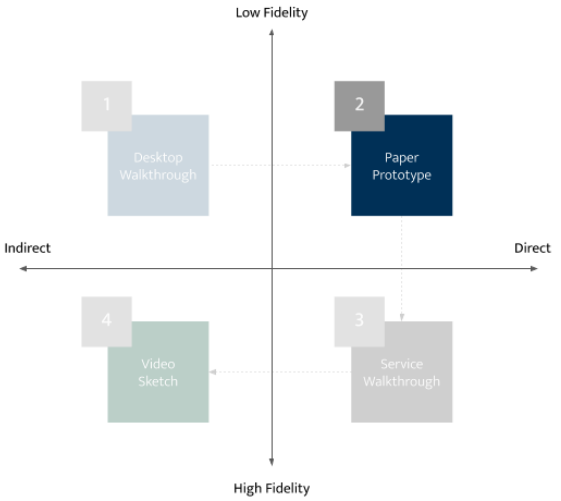


Figure 21: A classification of different prototyping methods: Paper Prototyping

After receiving confirming feedback on our assumption that there is a need for personalized transportation recommendations when getting to a car-sharing vehicle, the second round of prototyping needed to focus more on the interaction details. According to our prototyping approach, this should again be a low-fidelity prototype so there would not be much time and effort invested in an idea that could be discarded if the feedback would be negative this time. Following our prototyping approach, the method should include direct interaction of the participants with the prototype, instead of imagine-like prototypes like the Desktop Walkthrough. A prototyping method that is low-fidelity, direct and enables the testing of detailed interactions, is "Paper Prototyping" (Figure 21). *Paper Prototyping* is a technique where the intended interface of a website or application is sketched on paper, presented to users who interact with the application (Snyder, 2003). As this is not a working application yet, the researchers simulate the device's response. The method enables the researchers to test the functionality of an application without requiring specific programming skills and is quick to execute.

Prototyping Purpose

The purpose of this prototype is to understand if the personalized aspect gives value to the car-sharing service and to identify the value of the recommendation in relation to the effort the users have to put into during the questions they have to answer. Also, the prototype enables us to test the concept in a new use case. As the first prototype focused on a pre-planned journey, this test could focus on a more impulsive scenario. Next to that, the focus with this test would be on the interactions with the application when giving information about the trip and their needs. It is an opportunity to test how much information the participants are comfortable with sharing and which input methods they prefer.

Prototyping Process

The steps of building this prototype included the analysis of the insights of the first test and a selection of changes to implement in the coming test. The insights from the first test were divided into three categories; First, insights that are possible to include in the second prototype. Second, insights that are not possible to test. Third, insights that do not affect the second prototype (Figure 22).

The insights from the second category were prioritized according to the impact on the service concept. For this test, it was decided to focus on the four insights that would impact the service the most, as can be seen in Figure 23.

STAKEHOLDER FEEDBACK	USER FEEDBACK
Possible To Refine	
May take other means of transportation into consideration (ex. Public transportation)	An alternative mode to get to car is than welcome, but it shouldn't cost much.
Include weather (you don't want to recommend e-scooter when it rains)	A fixed price suggestion would be nice, it's annoying to calculate by myself, and compare these prices compared to other modes of transportation.
This prototype was great to communicate the concept and as conversation starter. Next one could focus more on the detailed interactions.	If the value users get in return is very clear, they are willing to share some information
Try out a different use case (scenario), one that's more flexible	The personalization makes them more motivated to use the service
Not Possible To Refine	
How can we ensure that a good recommendation will happen?	First reaction, they would prefer using own bike to get to a car, but getting it back is annoying.
Will the service become more expensive with the integration of other services? User group is not having a lot of money.	What happens when I'm with my family or other people?
Calendar can be difficult to integrate. Are there other sources we could use? Chat/messenger with friends?	
Comments Does Not Affect Prototyping	
The integration with other service providers is very feasible (other platforms are also doing it)	They are afraid that there are no e-scooters or e-bikes around as well, so it feels unsecure
It's interesting to look in the integration of different free-floating services.	

Figure 22: Insights of first usertest divided into three categories

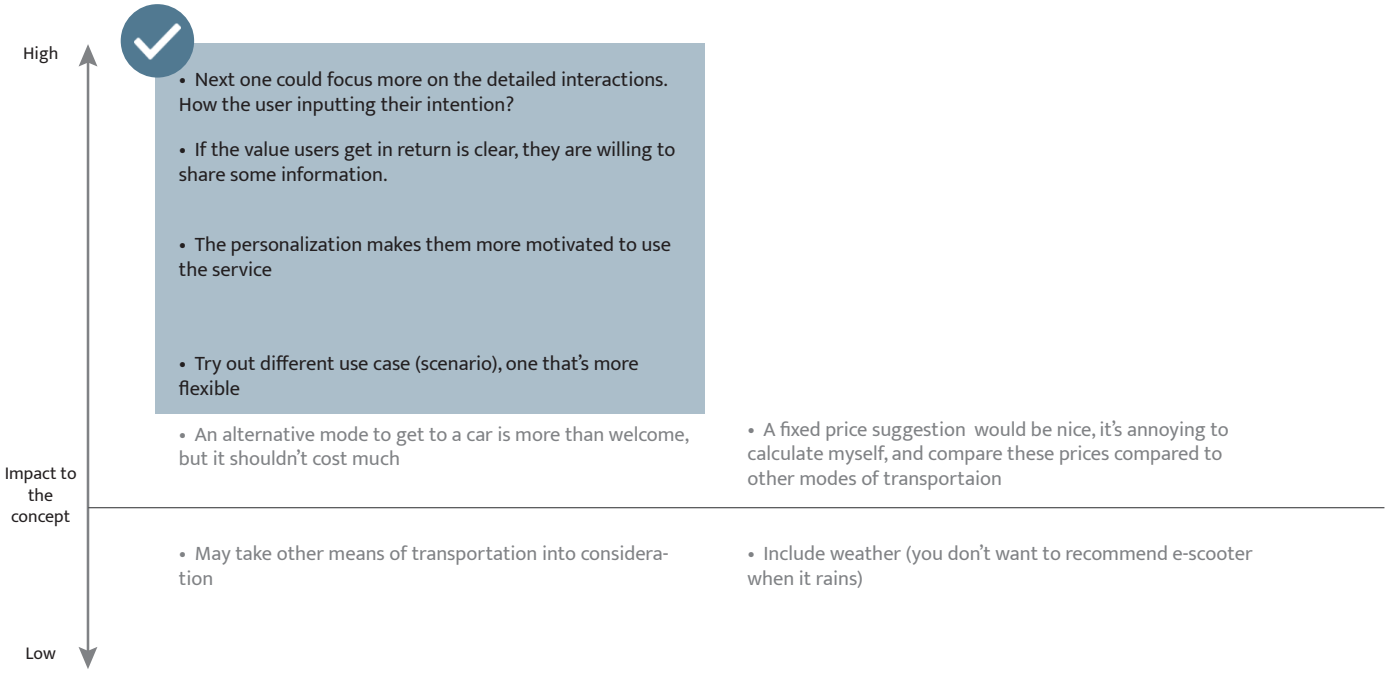


Figure 23: Insights ranked according to impact on the service concept

The next step in constructing this prototype was to come up with a new scenario that was more impulsive than the one during the first test. It was decided to follow a similar story but altering it by swapping the IKEA to a person who sells a sofa on second-hand selling platform DBA. To engage the participants more into the story, it was decided to use the participants as the main actor in the story. The scenario starts with the participant seeing a nice design chair on DBA which is given away for free to the person who comes and picks it up immediately. As the participant could be interested in getting design furniture for free, the trip has a more impulsive nature than shopping at IKEA. A screenshot of the DBA page with the furniture, an avatar and name of the participant, and chat conversation with the seller were photoshopped to create a realistic experience. The screenshot can be found in Appendix 5. To test the added value of the personalization, two variations of a car-sharing application were made; one including our personalized concept and one comparison that imitates the current non-personalized car-sharing service DriveNow. We brainstormed about what questions could be asked in the paper prototype to gather input about the intention of the trip, like the number of passengers, destination, the purpose of the trip etc. We also thought about different interactions with the application to share this information, like clicking on icons, sliders a chatbot, voice UI etc. The last step in making the prototype was to sketch the two applications on paper, as shown in Figure 24. The prototype was tested with three new participants who previously used a car-sharing service. First, the story was told by showing the screenshot of the DBA page with the chair (Figure 25) after which the users could interact with the two paper (Figure 26) prototypes. Afterwards, the participants were asked questions about their experience with the two applications.

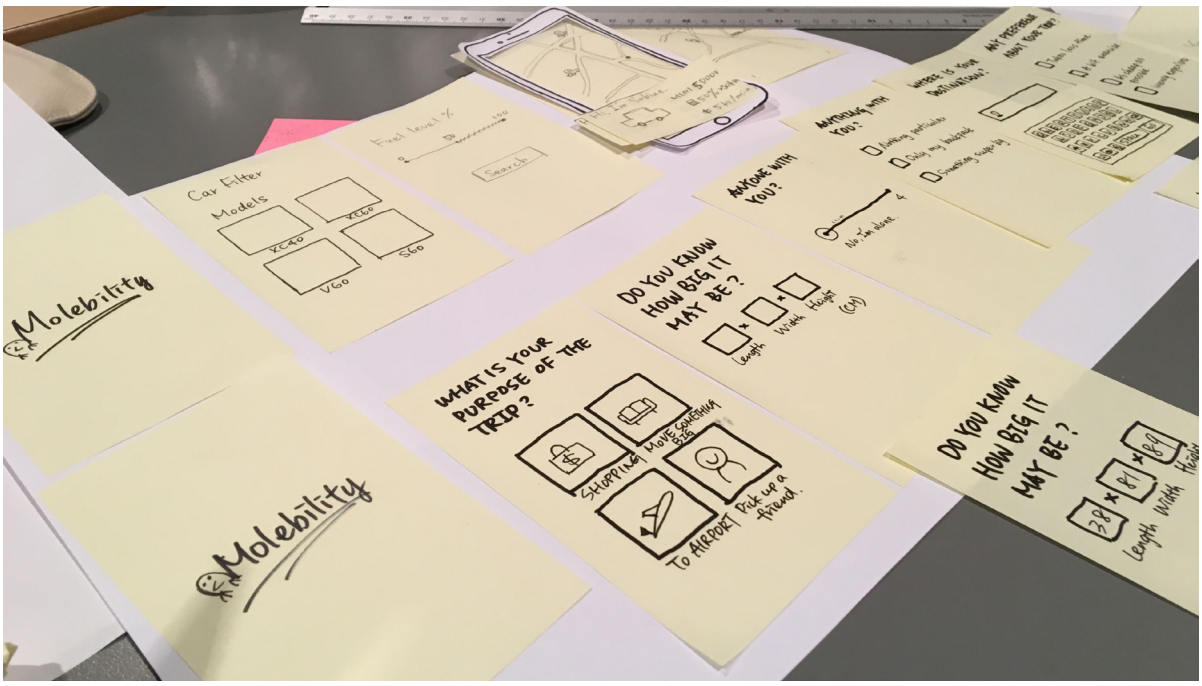


Figure 24: Sketching out two variations of the Paper Prototype

Figure 25: Researcher introducing a scenario during the usertest

Figure 26: Participant interacting with the Paper Prototype

Prototyping Results

The outcome of the three tests was the following. The participants agreed that the personalized application saved them time during the service, although they need to invest a little bit of extra time beforehand when answering the questions. The questions make it easier for them to make a decision, as they are quick and can be answered without any mental effort. In the existing DriveNow application, some questions like "fuel amount" and "car model" require the user to think and calculate which option serves their personal need. In our prototype, these questions are swapped by entering a destination, after which the app calculates if the fuel level is sufficient, picking a purpose of the trip and saying with how much luggage and people you are, after which the app recommends a suitable car model.

The aspect of using other transportation like e-scooters was perceived valuable and could be extended with more options, like shared bicycles and public transport. One participant suggested that when he does not need a special car or when he would travel alone, the questions make it long-winded; the current DriveNow app would be faster to fill in. This is correct, although spending 1-2 min to fill in the questions, could save him more time when getting to his vehicle as he could get a nearby e-scooter or bicycle recommended. Perhaps the value of getting alternative transportation recommended was not clear or not needed.

A suggestion on which the participants agreed, was that there could be easier ways of filling in the information. Icons to click on and slider-bars to indicate a number do not require any typing or mental effort. Also, preferences could be saved to speed up the process in a future occasion of using the app. The amount of information could be decreased slightly to make it feel less effort when filling in.

4.3.7 Prototype 3: Service Walkthrough

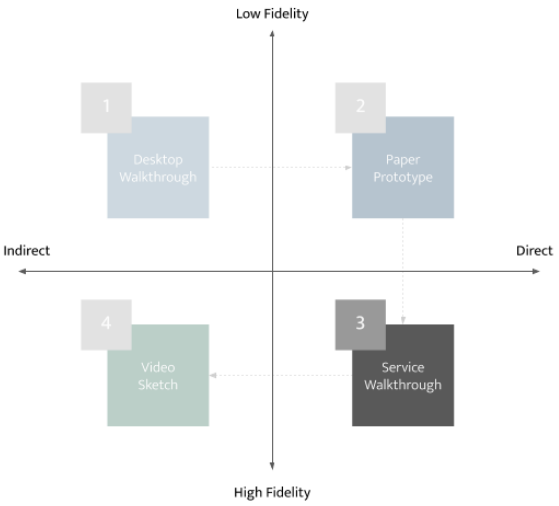


Figure 27: A classification of different prototyping methods: Service Walkthrough

After testing the Desktop Walkthrough and Paper Prototyping, both low fidelity methods, the planned approach suggested to increase the level of detail and develop the concept through higher fidelity prototypes. Following the approach, the next segment to be tested was direct experience and high fidelity. The method that seemed useful in the current design stage was the Service Walkthrough; it includes direct experience, can be high fidelity and allows for testing all touchpoints of a service during one test (Figure 27). The *Service Walkthrough* is a holistic approach used to represent a whole service, instead of separate parts. Whereas most prototyping methods focus on the testing of a single touchpoint, the *Service Walkthrough* supports learning about the interplay between different touchpoints (Blomkvist et al., 2012).

Prototyping Purpose

There were several aspects of the service that the Service Walkthrough could help explore. First, we needed to understand how a single touchpoint, our application, affects the rest of the journey. We assumed that by investing some time, filling in questions about their journey, participants would be enabled to get to a car quicker, resulting in less time spent. Connecting to this, we can test whether participants are willing to invest their time to get this personal recommendation or not. Secondly, the prototype could help identify missing parts of the service and potential risks in the journey. An example is the connection of the different transportation options in a busy city, that could result in unforeseen problems. Fourthly, the Service Walkthrough allows to test new scenarios that are closer to the participants real life instead of imagined scenarios. In the previous tests, the participants were introduced to a story that they had to imagine, whereas in the Service Walkthrough they can create their own. Our assumption is that by using the service in a real scenario gives more detailed feedback and uncovers needs that were not thought of beforehand.

Prototyping Process

The building of the prototype consisted of two parts; the planning of the walkthrough and the making of a clickable mockup application. The planning started by finding participants who have used a car-sharing service before and needed a car in the near future. They were asked some questions about the intention of the trip, destination and luggage so we could make a personal application for them that included this information. As we wanted to test different scenarios, the participants were selected on having varying needs for the car. Participant A needed a car to go to the airport with a small suitcase. He wanted a car as is it more comfortable and faster than taking public transport. Participant B wanted a car to go shopping in an outlet. As the outlet was located in a suburban area, it was hard to reach by public transport. Participant C needed a car as she was helping a friend move her belongings. The belongings were not heavy but they were many, so public transport was not an option. After recruiting the participants, a car needed to be arranged for the days they needed it. The last step of the planning was to make a detailed time-plan for each participant because the car and other modes of transportation, like an e-scooter or bicycle, had to be placed in a strategic

place, close to the starting location of the user test, see Figure 28. The second part of the preparation was the making of the clickable mockup. As it needed to be high fidelity, the mockup required to look like a real application. The findings of the Paper Prototype were used to implement in the clickable mockup; the amount of information was reduced, questions were rearranged based on the user's preference and the interactions were simplified. New aspects that were included were the personalized information, like the participants' name, location of the closest e-scooter or bicycle and destination. Through this, the participant does not actually have to type the destination but only has to click on the text input field and the destination would be automatically pop-up. Also, new screens, like a screen to navigate to the car or unlock it, were made so the application could be used as it would be in reality; throughout the whole journey. During the testing, the participants used the mockup to find the closest car and got an e-scooter or bicycle recommended which they used to get to the car. Then they used the car after which they were asked questions about their experience.

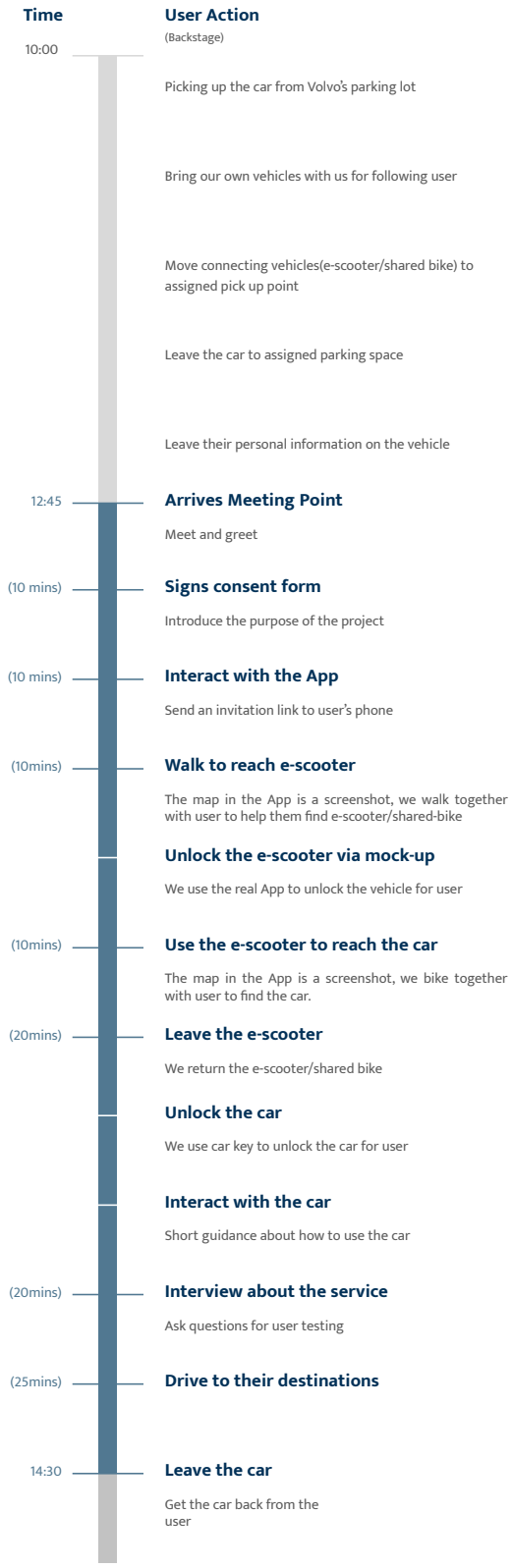


Figure 28: Timeplan of actions required during user test

Figure 29: The participants during the Service Walkthrough

Prototyping Results

The tests resulted in a great amount of detailed feedback, both confirming assumptions and points of improvement. The participants agreed on the additional value of integrating other modes of transport to get to a car-sharing vehicle; it saves them time and increases their motivation for using car-sharing. Currently, they tend to use public transport if a car is too far. The value of the recommendation is more obvious when the participant has special needs, like carrying belongings or when more passengers are joining the trip. When the participants are travelling alone for a short trip, they don't feel the need to find the "right" car for them; any available car is fine. Also, the concept fulfils the need for a traveller with small luggage, like a backpack, but does not cater for transporting larger luggage. This became clear when a participant got the recommendation of taking a bicycle to the car, while she had a small suitcase with her. Although the bicycle could fit the suitcase on the front carrier, the participant was not comfortable with carrying it, so one of the researchers had to carry it. The photos which show participants' interactions in the user testing can be seen in Figure 29.

On the personalized aspect, the participants were willing to share their intention of the trip through the questions asked in the mockup which did not feel invasive to their privacy. On the contrary, the proposed to include data from other platforms, such as Facebook events, to speed up the answering of the questions. Two participants approved that the personalized recommendation added value to the car-sharing service and provided a better experience for choosing the right model fits their needs. An aspect that needed improvement was the relation of the questions to the personalized recommendation. The participants need more clear guidance that by answering the questions, they would save time later on with the recommendation. Also, the app could save the answers to some questions to save time in a future interaction with the application. Connecting to that, the participants felt forced to choose the recommendation instead of having the option to browse other cars or ways of getting to the car. In the real application, it should be a recommendation where they still have the flexibility to filter information and choose differently if they prefer. It should also show more information about the car, like the model, price and gear system.

Through the testing of three different scenarios, it became clear that the concept worked best in single destination trips. This was concluded as users sometimes have no luggage from a to b, but have luggage from b to c. In the app, this would become difficult to fill in, as the list of questions would become longer and less intuitive. One participant also noted that the recommendation of the car was not fitting to his needs. As he needed a car to get him quickly to the airport, the e-scooter to the car was helpful but the car was too big and luxurious for his selected purpose. An important learning was that connecting other vehicles may not be as flexible as expected. For example, using an e-scooter feels safer when using a helmet but users generally do not carry one with them. Also, the pricing seemed a critical aspect; the recommendation and use of alternative transportation to reach the car should not cost more than 5-20 Dkk.

4.3.8 Prototype 4: Video Sketch

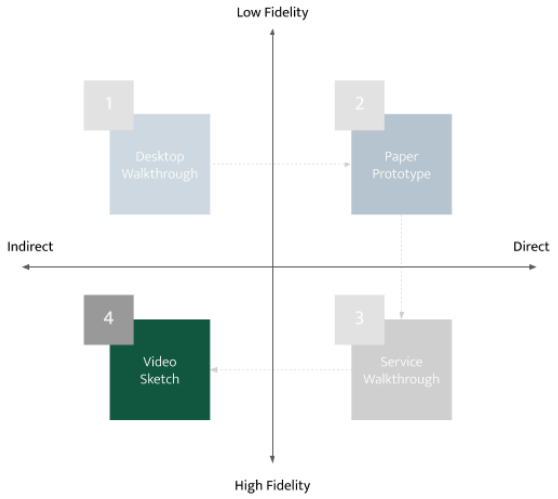


Figure 30: A classification of different prototyping methods: Video Sketch

According to the prototyping approach, the last segment that still needed to be tested was a high fidelity and imagine-like prototype (Figure 30). In previous tests, it appeared hard to find participants willing to join who also have car-sharing experience. For the last prototype, it was thought of to find another low-threshold and less time-consuming way to reach participants. A method that lends itself perfectly for this would be a Video Sketch, where a story is created that potentially could be shared online to reach a big audience.

Löwgren (2004), states that a *Video Sketch* can be used as a representation technique that is able to create fictions while being sketchy in its expression. As the story needed to become to a high-fidelity prototype, transforming it to a video seemed like a means to reach the online community. Since we want to use the method as a prototype, we have to clear about our intentions throughout the making of the video in order to receive the feedback we want. According to Buxton (2007, p. 249), [...] how a technique is used is the ultimate determinant of whether one is sketching or prototyping." Vistisen (2017) elaborates that the label of a method is not defined by anything in the technique itself but by what it is used for, so we assumed that although the method has the "sketch" element in its name, it could be suitable for prototyping purposes as well.

Prototyping Purpose

The purpose of this prototype was to expand the reach of participants beyond our closest social network and also expand our participants to include them who not have any car-sharing experience. In this way, feedback could be gathered about the feasibility of the concept and it could possibly interest people to consider car-sharing as a potential option instead of owning a car. Also, the act of sharing a video to evoke an online discussion could uncover new aspects that were not thought of before.

Prototyping Process

The process of making the video was first to come up with a relatable scenario for the audience and then the shooting and editing. A scenario that emerged from the previous user test was going to the airport. To enhance a sense of urgency and include the aspect of finding a suitable car, this scenario was extended by adding the element of picking up family from the airport. In this scenario, the actor is in a hurry and quickly needs a car to pick up his family from the airport. Normally public transport could be sufficient, but he is in a hurry and on the way back they will have much luggage with them. The actor uses the app to find a car and get the closest car recommended that suits his needs. As the app knows he is in a hurry, it recommends him to take a nearby e-scooter that saves him 16 minutes to get to the car. He uses the e-scooter and arrives at the airport on time. This scenario was acted out and filmed by ourselves using a real e-scooter and car. A voice-over was added to explain crucial parts of the story.

The testing was done both in a workshop and online trough commenting on the video. The initial idea was to only place the video online via our own Facebook and Linkedin to see what feedback people would comment, but it was decided to also conduct a feedback workshop to enrich the feedback. It was thought of that it could be hard

to control the direction of the feedback online and an in-depth discussion would not be possible. Also, time-pressure limited the time to gather the online feedback, so there was no time to wait long to collect all the comments. The workshop was conducted during a 'thesis-checkpoint' at the university, where we were given 20 minutes with peer students from Service Systems Design and teachers to collect feedback on the project. We chose this opportunity to use as a feedback workshop on the video. First, the video was shown to 7 participants, after which they were asked to leave comments about positive and negative aspects of the service. After that, the group was split into two; potential users, meaning people who have a driver's license and have used a car-sharing service before and non-potential users, meaning people who don't need or use any form of car-sharing. The two groups were each given a template with specific questions about the concept (Figure 31). The templates can be found in Appendix 6. The participants were asked to write down their answers to the questions and leave the feedback for us to analyse further.

Figure 31: The participants filling in the feedback templates during the feedback workshop

Prototyping Results

The results of the testing can be divided into results of the workshop and of the online comments. The workshop revealed a clear difference between feedback from non-potential users and potential users. The test was the first time that non-potential users were asked to give their opinion about the concept and it showed that it's extremely difficult to give feedback on a concept you have no affinity to in combination with a prototype that doesn't allow for direct interaction, like a video. The feedback from the non-potential users was not revealing any new value or challenges of the concept, as it was limited to general comments about the scenario envisioned in the video. The potential users, however, provided detailed new insights that were not discovered in the previous three tests. In general, the potential users agreed that integration of multiple transportation providers is adding value to the service, they recognize the problem and see scenarios were the solution add value. There are doubts regarding the competitiveness of the service, as big players have an advantage when it comes to the ability of integration. Adding to this, the concept cannot be protected by Intellectual Property meaning that it can easily be replicated by other competitive services. Another challenge mentioned was the difficulty of assuring consistent quality throughout the service. When relying on other service providers, it is hard to control the quality of the parts of the service where there the users interacts with touchpoints of these other service providers, like the e-scooter. Volvo's reputation could be damaged by weak service delivery of these partnering providers. The written answers of the participants can be seen in Appendix 7.

After two weeks of gathering the comments online, we summarized them in the following four main results. First, overall, the comments from the participants are more compliments than critiques about the concept. One of the possible reasons could be that the people giving the comments were coming from our own network. Since we have close relations with these participants and we also acted out the whole scenario by ourselves, it is reasonable for them to reflect not only on their real opinions about the service concept but also on their positive feeling towards us.

Second, the capability for gathering people's opinions through online discussion was satisfying but highly depended on the platform we used. In total, we gathered 32 participants opinions in two weeks, and there were still a few more people who replied after we stopped counting. However, the numbers of people involved were significantly different between Facebook and Linkedin. We gathered 25 replies from different people via Facebook, but only 7 replies on our Linkedin. This could be derived from our inactive level of participation on LinkedIn.

Third, even though the numbers of replies were satisfying, the comments were really diverse and sometimes not strictly relevant to the concept itself. For example we asked the question: "would you use this service or not?" and some of the comments obtained were: "the age and physical ability of the people you are travelling with would be important information to include", "the button of the interface is patented which may derive extra cost to the concept", "the acting in the video was cute", "in one part of the video the volume was lower than the rest". These results showed one of the limitations of an online discussion where we could not direct the viewers to give only relevant and direct answers.

Last, we found that the feedback from the participants has a strong connection to where they currently live. This reflects the different mobility service systems in different areas. For instance, one participant pointed out that the availability of using e-scooter may be an issue since it is not so common to see them in her city. Another one addressed that it is not common to use the scooter in Philippine in general, although the concept itself looked interesting. We think this issue can be improved by limiting the audience based on their current living cities to get a more precise outcome.

4.3.9 Preliminary Reflection

In the Develop phase, four different prototyping methods were used, following our approach of testing low fidelity, high fidelity, direct and imagine-like prototypes. These methods each approached the aspect of personalization in different ways. From our tests, the direct prototypes (prototype 2: Paper Prototyping and prototype 3: Service Walkthrough) engaged the participants the most, as they could experience the invested effort and received value of the personalization directly. Of these two, the high-fidelity Service Walkthrough was the most realistic and simulated a real experience, allowing the user to reflect during the whole journey and resulted in extremely detailed feedback. This prototyping method also required the most time to build and test; each participant needed a personally made clickable application, a car and e-scooter at specific times and location. The imagine-like Desktop Walkthrough also provided value in the prototyping for personalized services, as it allowed for quick feedback from both users and stakeholders without much time and effort invested. The Desktop Walkthrough and Video Sketch lacked the direct experience that is crucial when testing the value of personalization; it is possible to imagine the needs from somebody else to a certain extent, but interaction with a prototype directly results in more realistic and detailed feedback.

4.4 Deliver

The last phase of the Double Diamond is Deliver, where the final concept is transformed into deliverables for our stakeholders at Volvo. Several representation methods were used to communicate the service from different perspectives. The outcomes of the project were merged with learnings from the prototyping research that form the final deliverable, a product report (Appendix 8). Later, a final presentation was given where the outcomes and learnings were presented to Volvo, marking the end of the collaboration.

The following sections will be discussed in this subchapter:

4.4.1 Deliver Approach
4.4.2 Scenario
4.4.3 Actors Map
4.4.4 Value Stream Map
4.4.5 Service Blueprint
4.4.6 Final Concept Presentation

4.4.1 Deliver Approach

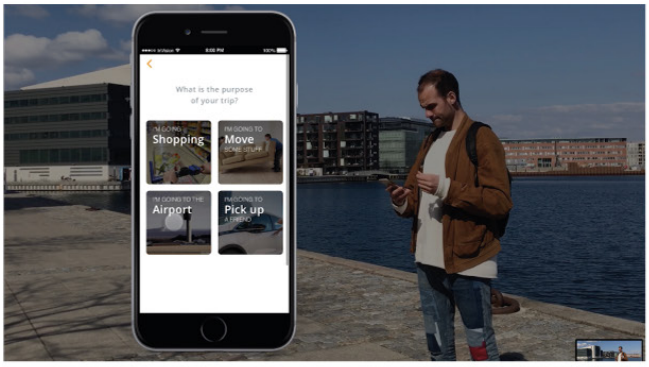
To present the final outcomes of the service concept to our stakeholders at Volvo, an approach has been thought of that includes different levels of detail in explaining the service (Figure 32). To understand the value of the concept and the steps involved, a scenario in the form of a storyboard was chosen. This would focus on representing the concept from a user's perspective. To understand the concept in the bigger context and the technical details, three representation methods that communicate different levels of detail were found. These were the Actors Map, Value Network Map and Service Blueprint. Starting from the Actors Map, which gives the most high-level perspective of the actors involved, the Value Network Map zooms in deeper to the value flowing between these actors. The Service Blueprint is the most detailed level, showing all the technical aspects of interactions happening between the user and the service.

Figure 32: A visualization of the Deliver approach

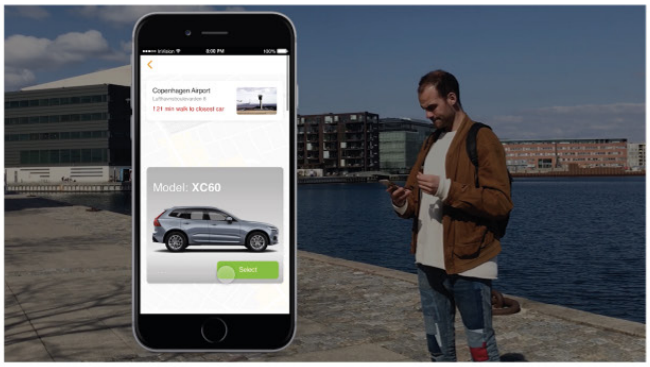
4.4.2 Scenario

The first representation method used to communicate the new service from a user's perspective was a Scenario. The example can be seen in Figure 33 and Figure 34. *Scenarios* are stories about fictional people and their activities, they include a setting, actors, goals and actions (Potts, 1995). A Scenario can make the use of a service explicit by showing a set of interactions the actor has with a product or service and can be visualized in the form of a storyboard (Carroll, 2000). As the video prototype earlier was positively received, it was decided to make a storyboard of shots in the video, allowing readers to understand the content of the video on a paper format.

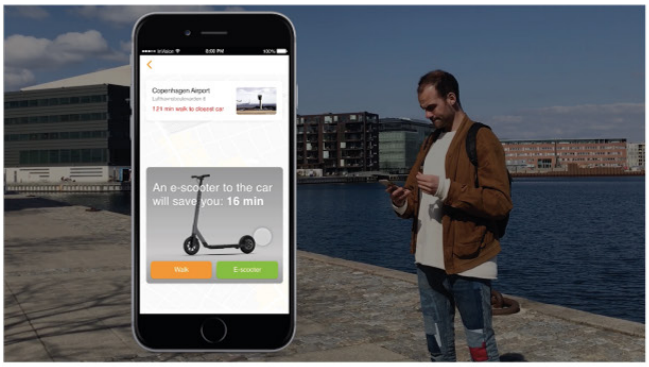
This is Pieter. He needs to go to the aiport to pick up his family. He is a bit late, so he needs to hurry!



He opens the car-sharing app and answers a few questions about the intention of his trip, amount of people, luggage and destination.



The app calculates a personal recommendation for him, and suggests that he might need a bigger car because he will pick up 4 other people and some luggage.



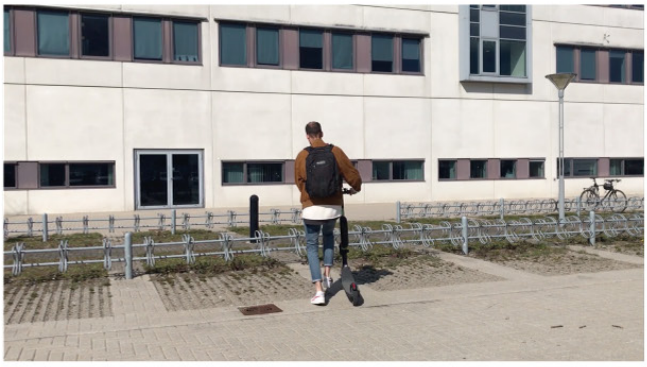
The app knows he is in a hurry and suggests to take him an e-scooter that is standing nearby. The e-scooter will save him 16 min to get to the car

The app helps him to navigate to the e-scooter.

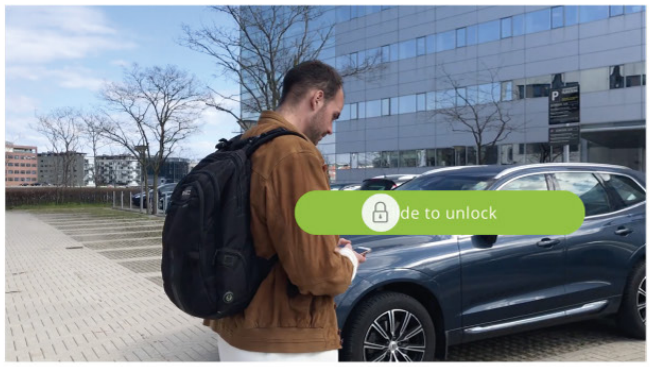
He opens the e-scooter with the app by sliding the unlock button.

Figure 33: A Scenario showing the service in use (a)

He uses the e-scooter to get to the car.



After arriving, he parks the e-scooter next to the car.



He uses the app again to unlock the car.

The car is opens and he is allowed to use it now.

He drives towards the airport and picks up his family right on time!

Figure 34: A Scenario showing the service in use (b)

4.4.3 Actors Map

The Actors Map was picked as the second representation method to communicate the new service (Figure 35). The method was chosen as it shows a high-level network of actors and components in a system (Morelli and Tollestrup, 2007), without going into too many details of how all the service interactions precisely work. It allows for grouping the actors in terms of roles or functions in the service. As it is a user-centered concept, it was chosen to group the actors around the users in the core. The second group is the main service provider Volvo, with their car-sharing vehicles as physical touchpoints and application as digital touchpoint. The third group consists of the partnering service providers, the companies who offer shared-bicycles and e-scooters. Their touchpoints are limited to physical touchpoints including their bicycles and e-scooters.

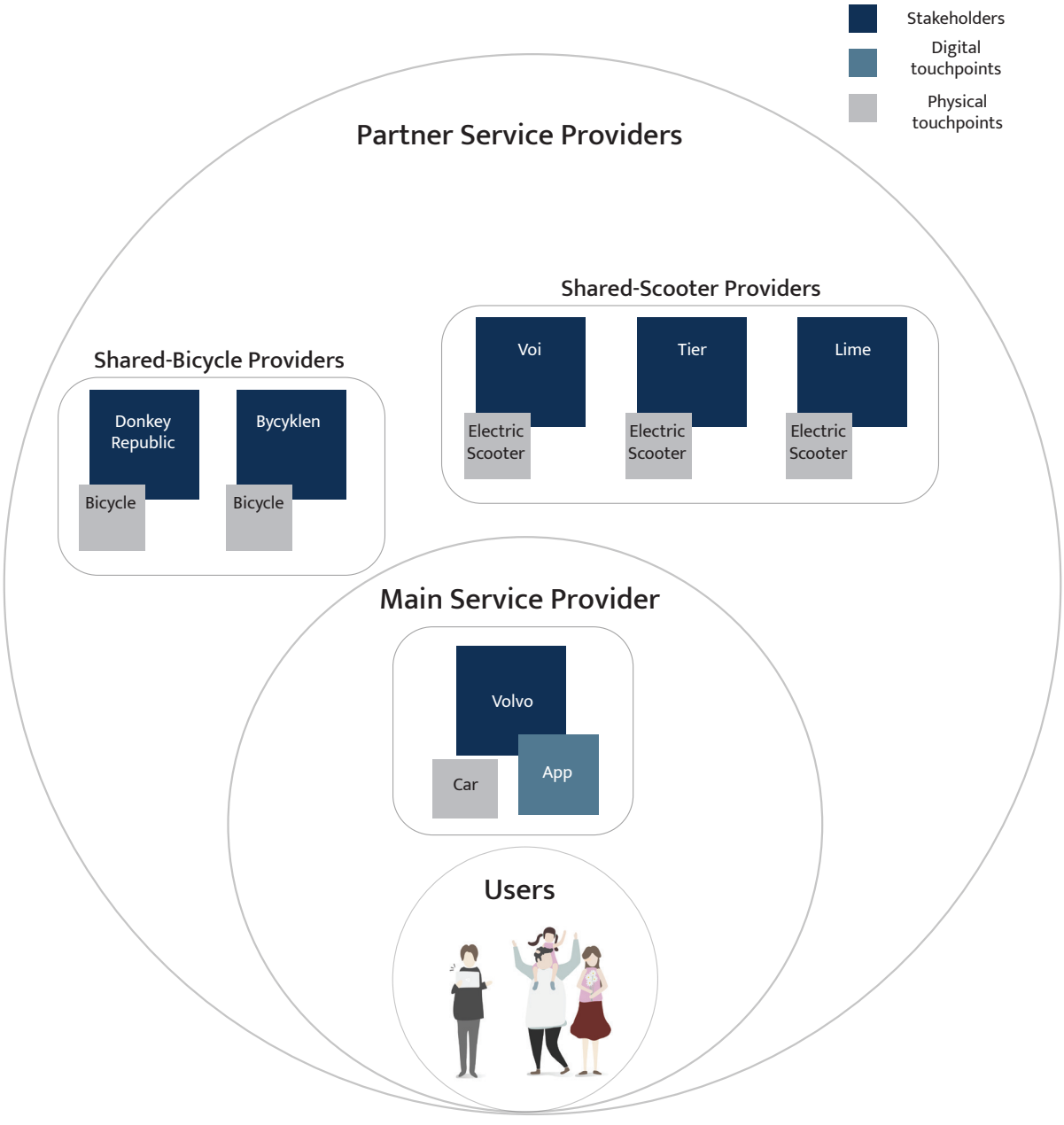


Figure 35: Actors Map of the new service

4.4.4 Value Stream Map

The third method of representing the new service is the Value Stream Map (Figure 36). *The Value Stream Map* originates from improving manufacturing processes, which is a tool to show the flow of material and information needed to deliver a product or service (Rother and Shook, 1999). The method was chosen as it shows the similar actors of the Actor Map but included more levels of detail about the relations of these actors and the value they exchange.

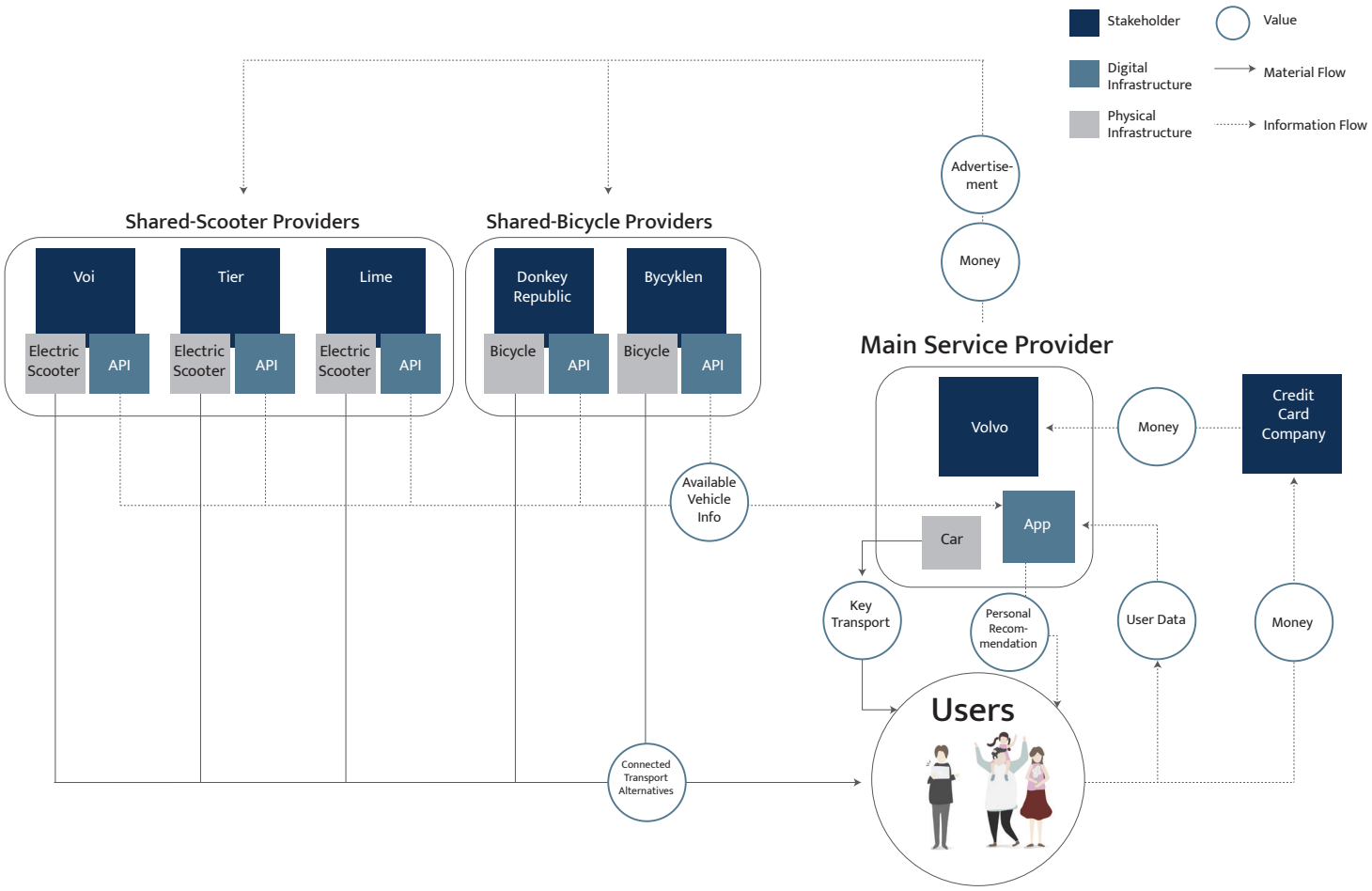


Figure 36: Value Stream Map of the new service

4.4.5 Service Blueprint

The fourth method chosen to represent the new service is the Service Blueprint. *The Service Blueprint* provides the most detailed level of interactions within a service, both visible front-stage and invisible back-stage interactions (Shostack, 1982). The method provides a visual description of a service which eliminates misinterpretation and provides technical information about the specific interactions. The Service Blueprint in Figure 37 and Figure 38, shows the different phases of the service, the touchpoints, user actions, frontstage actions, backstage actions and support processes. The length of the journey in this blueprint is set to be to the moment where a user opens the app to when the car is parked and the rental is ended. The phases are split into a 'learning-phase', where the service learns about the user's preferences and a 'matching-phase', where it recommends a suitable car and way to get there, in this case, an e-scooter. Afterwards, the 'getting to the car-phase' is where the alternative transport used to reach the car and 'using the car' is the phase where the user is driving in the car.

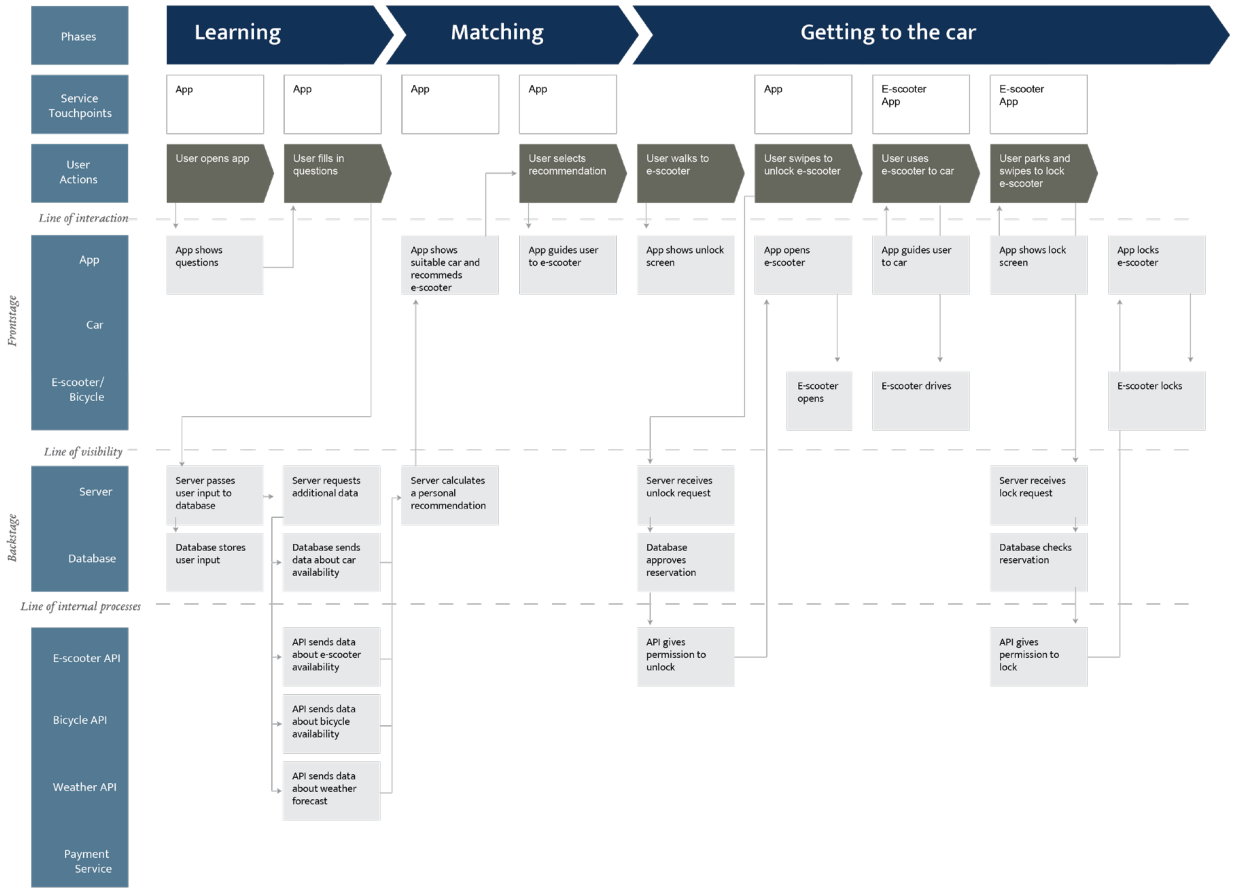


Figure 37: Service Blueprint (a) of the new service

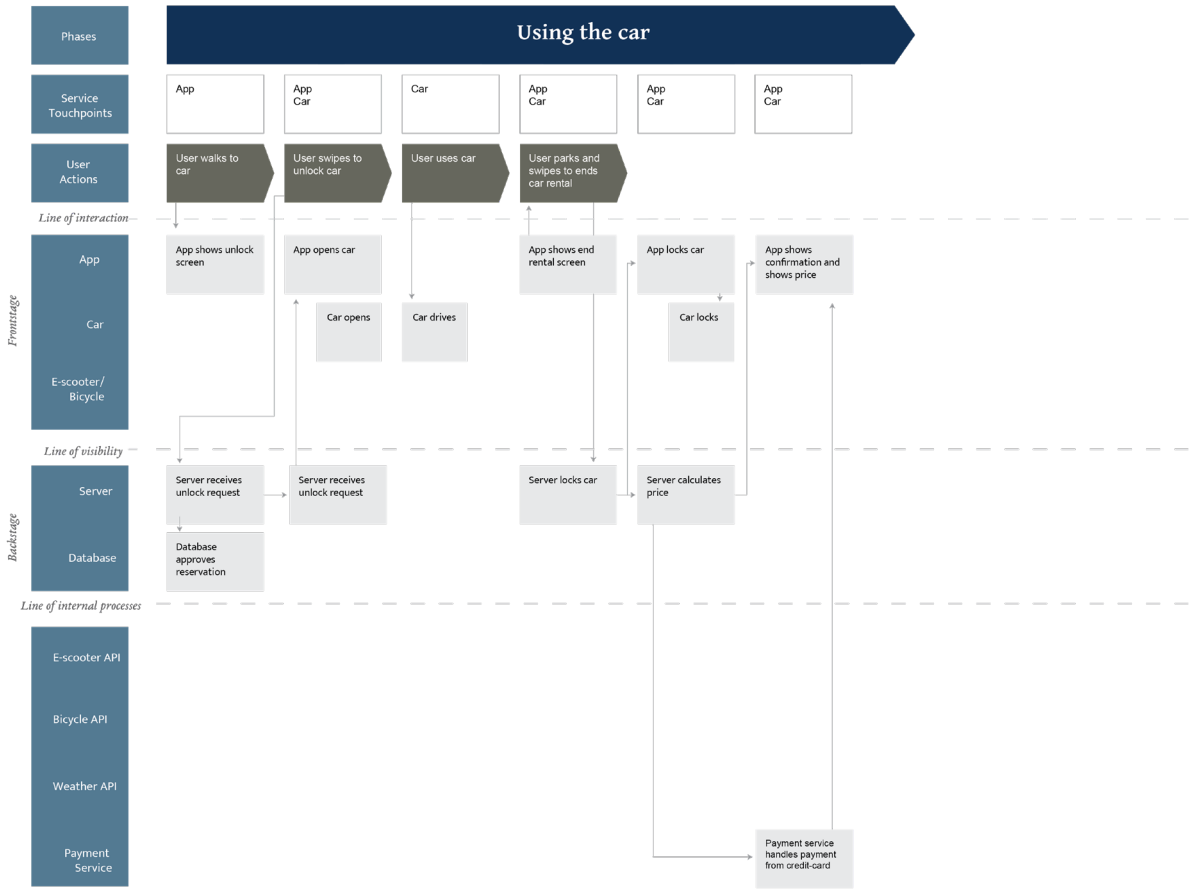


Figure 38: Service Blueprint (b) of the new service

4.4.6 Final Concept Presentation

A final concept presentation was given to our stakeholders at Volvo, which marked the end of our collaboration (Figure 39). In this presentation, the new concept was presented and thoroughly discussed. Also, the prototyping learnings were shared, as they could be beneficial for them as well.

In general , the feedback was that the concept had potential. The target group was realistic and their needs seemed believable. Some technical questions arose, regarding the integration of apps from other service providers. The use of the different layers to represent the concept was complimented, since it gave an understandable explanation of the concept, allowing for more detailed discussions throughout the presentation. The prototyping learnings were found interesting, although the graphics supporting the findings could be improved. Overall the stakeholders were enthusiastic about the process and outcomes of our thesis, which might be presented another time to their manager in Gothenburg, Sweden.

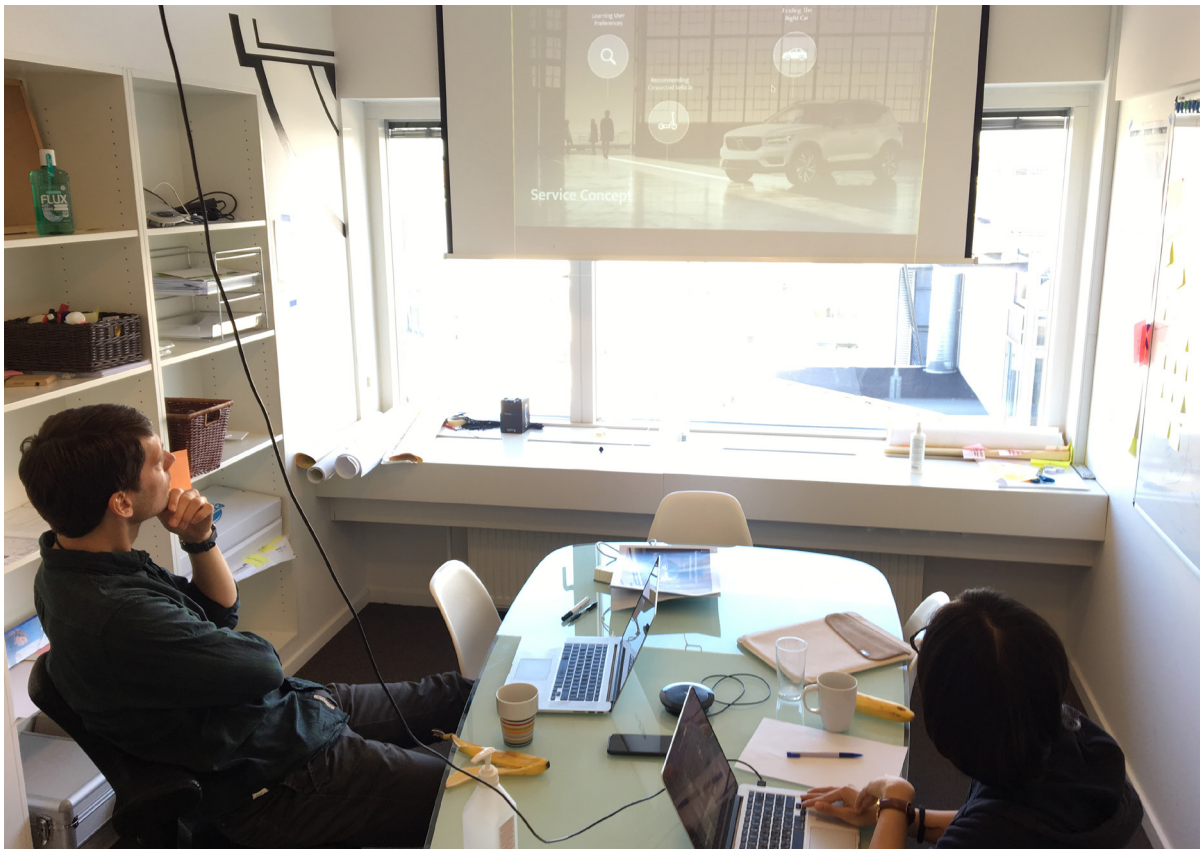


Figure 39: Final concept presentation at the Volvo office

CHAPTER 5.

Discussion

This chapter presents a discussion on the key findings of the case study in relation to the academic research question. It contains reflections on various aspects of the design process, including the building, testing and results of the several iterations of personalized prototypes.

The following subchapters will be discussed in this chapter:

5.1 Reflecting On The Prototyping Process

5.1.1 Research And Preparation For Building Up The Prototypes

Finding Realistic Prototyping Scenarios

Before starting to build up the prototypes, initial research was required to find the right problem and target group to prototype a solution for. In this aspect, the Discover and Define phase were indirectly related to the prototyping. Therefore, these phases were condensed and only the most crucial steps were done to find an existing problem and target group. During these phases, one method has been used that was crucial for this framing but also added direct input for the prototyping of a personalized concept, which was the User Interviews. While doing the interviews, several scenarios were described by current car-sharing users, in which they used an existing service where they encountered some problems. These scenarios were later used during the prototyping, to make sure the prototypes were built around a relevant and existing use case. The idea with this was that the participants would experience the concept as tailored to their specific needs, which can be seen as a light form of personalization.

During the Desktop Walkthrough, Paper Prototype and Video Sketch, these scenarios were used, which often resulted in the participants identifying themselves in the enacted story. It can be argued that this does not follow the full definition of personalization of Chellappa and Sin (2005, p. 181), who state that it implies to "proactively tailor products and experiences to tastes of individual consumers based upon their personal and preference information". The used scenarios could potentially be close to their individual taste, preference and information, but the fact that we classified the participants as part of a social segment with self-defined parameters does not automatically lead to identical scenarios for using car-sharing.

Including The Aspect Of Learning

The aspects that were in line with Murthi and Sarkar's (2003) personalization approach, stating that it should consist of the sub-processes learning and matching, was a more crucial aspect that was presented in the prototypes. In ascending degree of learning amount incorporated, the Video Sketch contained the least amount of learning, as it was in the form of a video that was similar for all viewers who found it on Facebook or LinkedIn. To be able to reach this bigger audience, it was decided to make a general prototype that included a story of a service that was personalized to the actor in the video instead of basing it on the needs and preferences of the viewers themselves.

After that, the Desktop Walkthrough included the shortest learning phase, where only the participants' residential location was used to change the starting point of the scenario. From the location of their own home on a printed map, a fictional story derived from a story of an earlier user interview was enacted.

The Paper prototype included a little more learning, where the names of the participants, an avatar and a fictive chat conversation were made to engage the participants more into the story and make them feel like the service is tailored to their specific needs. It can be argued how much these details added to the experience of the participants, but as the prototypes were made and tested in the earlier phase of the design process it was decided to do quick test rounds and iterate instead of going into detail immediately.

These details came after the concept showed to have potential, in the form of the Service Walkthrough. This prototype included the longest learning phase, where the participants were asked to provide information prior to the testing of the prototype, such as starting location from which they needed a car-sharing vehicle, destination, purpose of the trip and size of their luggage. This information was used to build up a highly personalized prototype, including a personalized mock-up application, were the answers to the questions would appear after the participants interacted with the mock-up. The information from this learning phase was also used to place a car-sharing vehicle on the right location and

alternative transportation method, such as an e-scooter or bicycle, close to the starting point of the test.

Time And Skill Requirements

The prototypes can also be categorized according to the amount of time and skills required to build them. The order of these prototypes follows the chronological order of the design process exactly, where the earliest prototype, the Desktop Walkthrough took the least amount of time to make. This prototype was made using LEGO, a printed map and printed e-scooters and bicycles, which did not require any technical skill and time-wise it took only one day. After that, the Paper Prototype was made, which took two days to make as it needed an understandable application flow and detailed screen drawings. These two prototypes were made in low fidelity, meaning they included few details and did not resemble the final design accurately and the skills required for this method are limited to rough sketching.

The Service Walkthrough took more time to build, as it needed a clickable realistic mock-up application, car-sharing vehicle and thorough planning, which took four days. The making of the mock-up required more technical design skills in the form of digital software like Adobe Illustrator, Sketch and Invision.

The Video Sketch required the most time to build, as the video would be everything of the prototype the participants would see. In previous prototypes, the building only referred to the props required which the participants would be interacting with, staging a real service experience. Because the video itself would be the whole experience and the viewers would not be able to ask clarifying questions, it needed to be extremely clear. Also, the video needed to be checked by our stakeholders to make sure it follows the confidential guidelines we agreed on. In the end, the building of this prototype took 6 days. This prototype also required the most design skills, as it needed both know-how of design software required for the previous mock-up that was used and video-editing software like Adobe Premiere.

An overview of the findings from the building of the prototypes can be seen in Figure 40.

Building the prototype

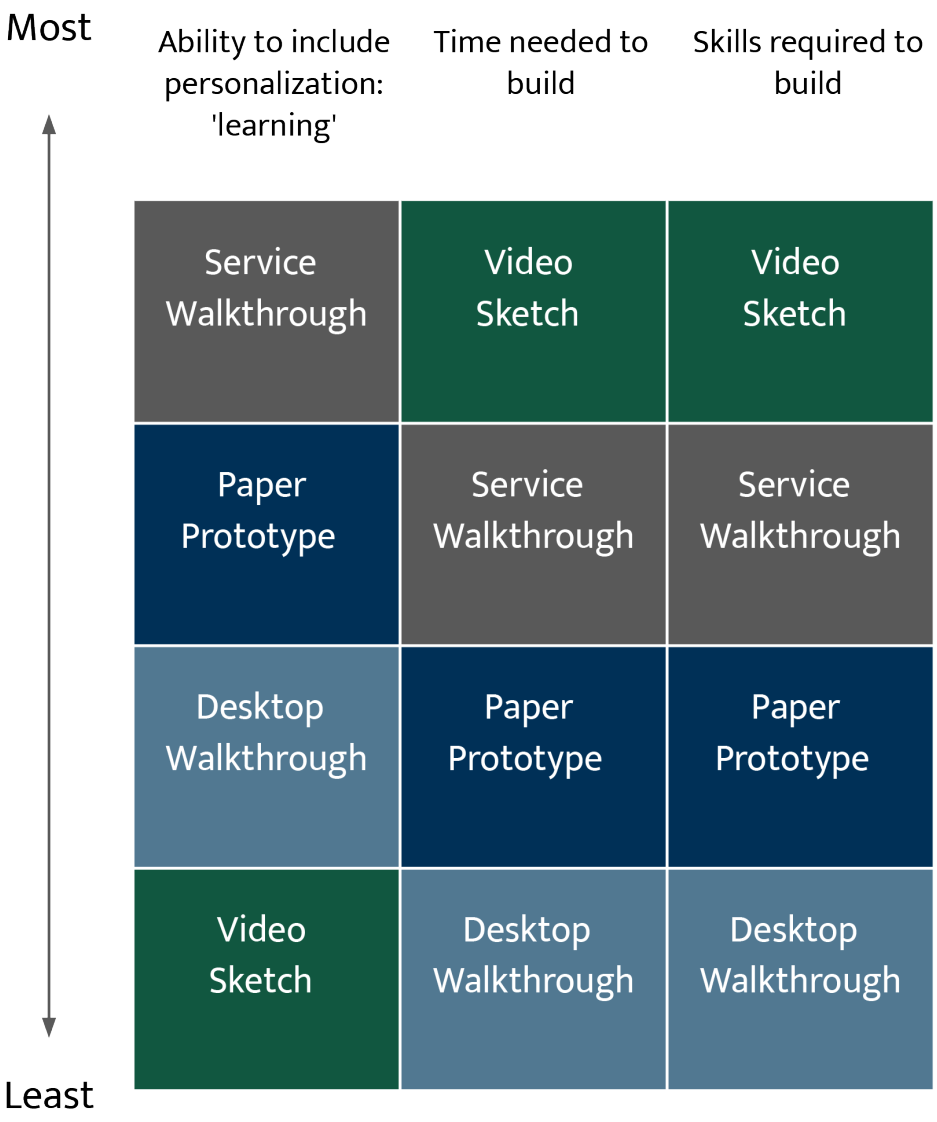


Figure 40: Overview of findings from four different prototyping methods of the building phase

5.1.2 Testing Different Prototyping Methods

Including The Aspect Of Matching

After the building of the prototypes, the testing played a crucial role in finding out which methods lend themselves best for prototyping personalized services. An overview of the findings from the tests can be seen in Figure 41. Following Murthi and Sarkar's (2003) approach on personalization, the learning phase should be followed by a matching phase, where the user's preferences and information are transformed into personalized offerings. The better the recommendation fits the preferences and information of the participants, the more potential the method has in testing the added value of personalization. As explained in chapter 4.3.4, the four prototyping methods were chosen as they could be categorized along the axis of low-fidelity vs. high fidelity and indirect imagine-like vs. direct experience. The ability to match the participants' preferences can be linked to the direct way of testing, instead of the imagine-like.

In direct experience prototyping, like the Paper Prototyping and Service Walkthrough, the participants interact with the prototype directly, making them the main actor of the scenario. This gives the researchers the opportunity to change the narrative of the enacted story and make it match the participants' preferences. With the imagine-like prototypes, the Desktop Walkthrough and Video Sketch, matching also occurred, but the participants had to imagine the needs of the actors in the story, instead of experiencing it themselves directly. It can be argued how much that follows the definition of matching, as the participants' own needs are not taken into consideration. After the testing, it was found that the imagine-like prototypes could be set-up in a different way, which would increase the matching aspects and would make them more valuable in testing a personalized service. In the Desktop Walkthrough, where a scene was enacted by using LEGO, we could have made multiple scenarios of which the participant could choose one that is closest to their personal needs or co-create a story together with them. This way, it would still be an imagine-like prototype, but the participant would feel that prototype is solving an actual problem for them and gives them a personal solution. With the Video Sketch, this aspect could also be included, by giving the user the ability to make decisions during the video. It's technically possible to automatically pause the video if there is a decision that needs to be made, after which the viewer selects his or her preference. This would create a more personal story where the service offering is closer tailored to the viewer's personal preferences. As the available time for making and testing the prototypes was limited, these extra iterations were not executed during this project.

Researcher Involvement

Another aspect where the four methods approached the testing in different ways is the researchers' involvement during the test. This ranged from no involvement at all to high involvement, where the researchers simulate the working of the prototype. From ascending order of involvement, the Video Sketch included no researchers during the testing. As it was an online video, the researchers were not there to ask questions or observe. In this case, they were only present as actors in the video but were not in the position of influencing the testing process or opinion of the participants. The only impact of being the actors in the video is that the viewers could feel the social pressure to respond more positively than when the actors would be unknown to them. On the other side, it could be argued that the viewers felt more at ease by knowing the actors personally and knowing that critical feedback is also welcomed.

The prototype test that needed more involvement of the researchers was the Service Walkthrough. Although the prototype was made with the aim that the researchers would merely observe and ask clarifying questions during the test, it appeared inevitable to explain or help during some parts. The mock-up application needed little explanation as it was well designed and gave clear instructions. At points, the participants asked confirming

questions to make sure they are doing what they are supposed to. An example is when they found the e-scooter and swiped the screen to unlock it. Although the e-scooter had a paper attached to it, with the participant's name and a welcome note, they still wanted confirmation that they are allowed to take and use it. Also, when entering the car, they needed an explanation on how to use it as it was a new car to them. This explanation could have been part of the mockup-application but because it was not an important aspect to test, it was left out intentionally.

The prototype test that needed more involvement from the researchers, was the Paper Prototype. During this test, the participants were able to click on application screens made of paper, whereby the result of this interaction was simulated by the researchers showing the corresponding next screen. This involvement of the researchers was crucial and the participants also needed to be helped sometimes by answering clarifying questions. Also, the researchers were required to set introduce the participants to the scenario.

The prototype test that required the most involvement from the researchers was the Desktop Walkthrough. As this prototype was made in the lowest fidelity, LEGO and paper, the props itself did not convey any message or story. During this test, the researchers needed to act out all the different steps and guided the participants through the story.

Throughout these tests, we found that higher fidelity prototypes generally require less involvement from the researchers during the testing. This sounds logical when looking at the Blomkvist's (2014) definition of fidelity, meaning the degree of detail, resolution or precision of a prototype. We found that the better the prototype resembles the final design, the easier it is for the participants to go through the whole prototype without being helped. We argue that less involvement of the researchers results in less influencing of the participants' opinion and less steering of the direction of feedback. In the following paragraph, we reflect on the advantages and disadvantages of steering the participants' feedback.

Steering Of Feedback

With steering is meant the act of deliberately or indeliberately directing participants to give their opinion about specific parts of the prototype. This can be done by asking questions about specific aspects, by acting out certain parts and neglecting other parts or simple by the researchers' presence. This steering was mostly occurring during the tests that required the researchers' involvement most. On the one hand, the steering was necessary to get straight to the point and force the participants to give answers on certain aspects that needed to be investigated. Each prototype had a clear purpose, connected to a set of assumptions that required validation. Without steering the participants to answer in the direction of these hypotheses, the feedback would be unfocused, broad and partially unusable. During the first three prototypes, the prototypes had a clear purpose and the steering during the test helped to find answers to validate our assumptions. On the other hand, steering might distract the participants to focus on certain aspects of the prototype, while the real problems or unforeseen feedback could be neglected. When the participants are welcomed to give feedback without any direction or constraints, unexpected findings can occur. This was shown during the Video Sketch, where the viewers online could give their opinion openly, without the interference of the researcher, without given direction or time-pressure. This resulted in many unforeseen insights, although we expected that by the fourth prototype we would not receive many new insights anymore.

Testing The Whole Journey

During the testing, another aspect that is worth mentioning is the differentiation between testing a single touchpoint within a service journey or testing a whole journey. When testing a prototype for a personalized service, isolating one part of the journey could make it hard to evaluate the added value of the personalization. During the testing, three prototypes have been used that tested the whole service journey, namely the

Desktop Walkthrough, the Service Walkthrough and the Video Sketch. These tests enabled us to see the impact of the personalization during the beginning of the journey, on the rest of the journey. On the other hand, isolating the single touchpoint of using the Paper Prototype mockup enabled us to explore the detailed interactions within the app. This was useful to find out which interactions the participants prefer to approach the personalization but it neglected testing the personalized recommendation that would result from these interactions. Concluding, we found that testing one part of the journey enabled us to investigate detailed interactions but only the testing of the whole journey results in findings of the added effect of personalization.

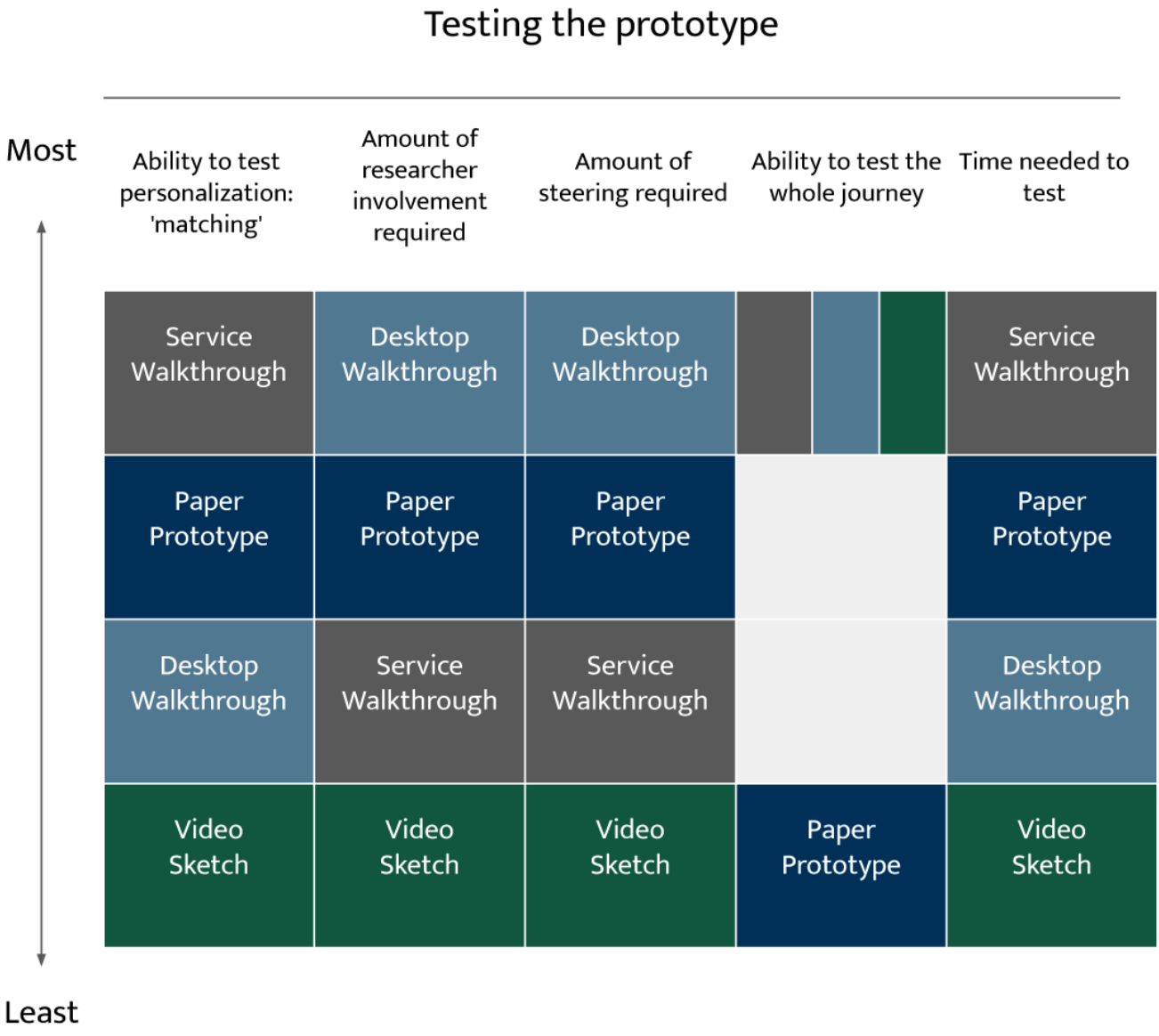


Figure 41: Overview of findings from four different prototyping methods of the testing phase

5.1.3 Comparing Outcomes Of Different Prototyping Methods

Level Of Feedback Detail

After the testing of each prototype, the outcomes were analysed and summarized in short key findings. The prototypes each resulted in different kinds of feedback from the participants, which can be categorized into detail of feedback and amount of feedback. An overview of the findings from the outcomes can be seen in Figure 42. When looking at the detail of feedback, it is important to first define what is meant with 'detail'. In this paragraph, we refer to the level of detail as refinement, precision, level of zoom in each touchpoint. This is contrasting to general feedback, which is more holistic and based on general stories. One thing that could be concluded from the outcomes was the fact that the higher fidelity prototypes, like the Service Walkthrough and Video Sketch, resulted in more detailed feedback. This was shown by the comments of participants, which were zoomed into a detailed level of each touchpoint and revealed unforeseen problems of the service. An example is that during the high-fidelity prototypes, new details were revealed such as the fact that users cannot attach their phone to the e-scooter, making it hard to navigate. Another aspect is the safety aspect when users are recommended to take an e-scooter, while they probably will not carry a helmet with them. These points are important to ensure a high quality of the proposed service and they were not found during the first two tests of the low-fidelity prototypes. Feedback during those tests was more focused on the whole journey and the basic user needs it fulfils. It can be argued that this level of detail is not required during the first tests, making low-fidelity prototypes mostly suitable for early tests, whereas high-fidelity prototypes uncover more specific details in the touchpoints, making them more suitable for later in the testing process.

Amount Of Feedback

Another aspect worth reflecting on is the amount of feedback that resulted from each prototype. Here, the high-fidelity prototypes score the highest again, although it cannot be derived from the level of fidelity. The Service Walkthrough resulted in the largest amount of feedback, mainly because the time it took to test the prototype was the longest, resulting in the most opportunities to ask contextual questions and engage in discussions. During this prototype, participants interacted with multiple touchpoints, during which questions could be asked. Also, during driving in the car together with the participant appeared a great moment to reflect upon the prototype. After that, the Video Sketch also resulted in a lot of feedback. This can mainly be derived from the fact that people can easily leave a comment without investing much time. So, the Service Walkthrough resulted in a lot of feedback from only three participants, whereas the Video Sketch resulted in many comments from thirty-seven viewers. When connecting these findings to findings from the building and testing of the prototypes, it can be concluded that the high-fidelity prototypes result in the biggest amount and most detailed feedback. Also needs to be taken into account that detailed feedback is often only needed in the later stages of the testing process and it requires significantly more time and skills to build these prototypes.

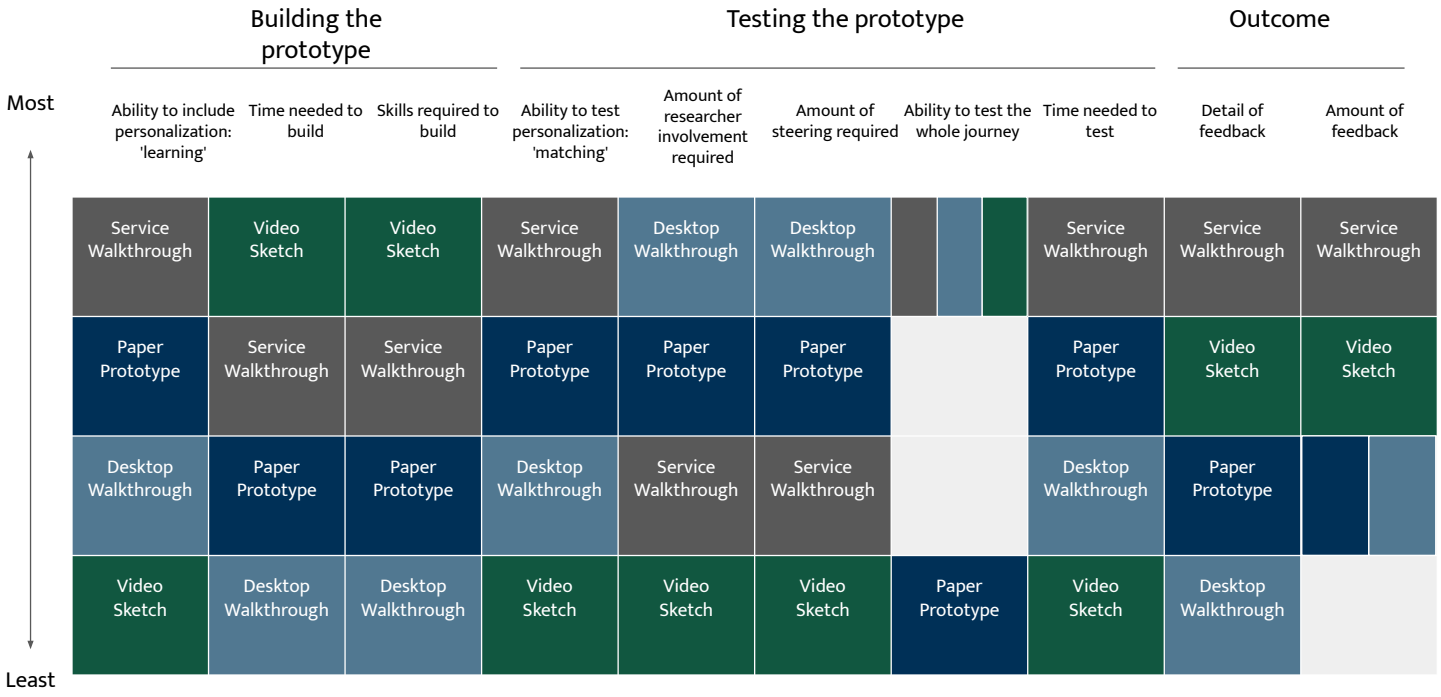


Figure 42: Overview of findings from four different prototyping methods of the building, testing and outcomes

5.2 Reflecting On The Learning Objectives

5.2.1 Official Learning Objectives

This master thesis in collaboration with Volvo allowed us to practice a methodological design approach to a relevant case study in the automotive industry. Both known and new methods were used throughout the project, demonstrating our abilities in the Service Design field. The know methods helped us to speed up the process and made us more confident while planning and executing the design process, whereas the new methods helped us to expand our skill set and experience as Service Designers. The focus area of mobility, and more specifically car-sharing, added complexity to the project because of the interplay between digital and physical touchpoints and because of the many competing alternatives in the mobility system. This complexity also enabled us to integrate several service providers into a new service system.

Another learning was the fact that we had to plan and execute the design process in such a way that the problem and target group definition would not take too much time, as the focus needed to be on prototyping. In previous projects, we noticed it is easy to get stuck in research because there are always new angles to approach a problem area and it is hard to validate that the problem you select to design for is the most relevant. This time we had to focus our efforts to only use a few research methods in order to find a focus for the prototyping. Because of this, we managed to do four iterations of prototypes, which was an achievement for us. In previous projects, where we spend too much time on research, there was often not much time for doing several prototyping iterations. We also learned that prototyping itself is a way of researching the problem space, making it an alternative way of doing user research.

The collaboration with Volvo helped us to gain knowledge about the mobility industry, both by accessing information as well as the helpful feedback sessions. It helped us to work together with people from different disciplines to get a more complete view of the difficulties of developing a new service in the area of mobility. The fact that the opportunities we identified were seen as potential interesting areas for Volvo gave us a lot of motivation and inspiration to explore them further and come up with a concrete solution.

5.2.2 Personal Learning Objectives

One of the main objectives of this thesis was to master new prototyping tools, especially ones that could be used for testing both physical and digital components of a new service. As mentioned above, the prototyping process allowed us to test four different prototyping methods, of which two of them were new to us. Since the thesis focus was on prototyping for personalized services, these methods were all thoroughly explored, tested and analysed afterwards. This process gave us a better understanding of the advantages of each method, both in regards to personalization as well as other aspects like time efficiency, detail of feedback and researcher involvement. The thesis also helped us to better understand the benefits of personalization and which mechanisms are required to have a successful personalized experience. Through studying academic literature, multiple definitions and approaches to personalization were studied, which then were applied to the case itself. A third objective we aimed for, was to promote more sustainable ways of using transportation. We learned that it is hard to validate if a new mobility service is better for the environment than current ones. Although in literature the positive environmental effects of car-sharing are thoroughly described, if a new car-sharing service that includes e-scooters like our proposal becomes successful, it might decrease car ownership but could also impact the use of cycling and public transportation. In a complex ecosystem like mobility, it is hard to validate the positive or negative environmental effects of the introduction of new service.

CHAPTER 6.

Conclusion

This chapter concludes the three key findings from examining four prototyping methods through a case study. It also presents the limitations and possible future research for this thesis.

In this thesis, different prototyping tools were explored to find out which of them could support the process for prototyping personalized services. A study for Volvo Cars to design a new personalized car-sharing service has been used to examine different prototyping methods. For this case, the Double Diamond has been used as methodology, which included research in the Discover phase, defining a problem statement and target group in the Define phase, brainstorming ideas and testing prototypes in the Develop phase and handing over the outcomes to Volvo in the Deliver phase.

Within the Develop phase, four different methods have been used and tested to explore their potential for prototyping personalized services. The outcomes of these tests were compared to find patterns in their effectiveness for prototyping personalization. From these patterns, we concluded several findings.

The first finding is that from the four methods, the Service Walkthrough and Paper Prototype have the highest ability to test personalized services. Both are direct prototypes, meaning that test participants interact with the prototype directly instead of imaging a scenario. They are also both able to include the 'learning' process of personalization and the 'matching' process, which effects can be tested by directly interacting with the prototype.

Another finding from this thesis is that personalizing a prototype, meaning a prototype tailored to the information, preferences and needs of an individual participant, leads to the most detailed feedback. These prototypes resemble the real service the closest, which results in the most convincing results. The downside is that these methods also take the longest time to build, requiring a significant investment of time and effort.

A third finding that can be derived from the tests is that it is important to test the whole service journey instead of a single touchpoint when prototyping personalized services. The personalized impact caused by a single touchpoint can sometimes be felt throughout the whole rest the journey. With this is meant that in our service, users have to invest a small amount of time to answer some questions in an application. If only the touchpoint of the application is tested, it is hard to examine if this time investment is rewarded properly in later phases of the service. Some prototyping methods, like the Service Walkthrough, Desktop Walkthrough and Video Sketch, are better able to test a whole service journey than others, like Paper Prototyping, which most often focuses on testing a single touchpoint.

Through our research process, some critical limitations and suggestions for future research on the topic are summarized as follow. First, a limitation can be derived from the nature of design experiments, which consisted in this case of the practical design case and the academic research. By studying prototyping for personalized services, the feedback received from participants on the prototypes was a mix of opinions about the service concept in general, and the personalized aspect. As the personalized aspects of a service cannot be isolated, it becomes hard to differentiate between the two and thereby prove the added value of the personalization itself.

Second, due to the limited time and budget, the way for sampling could lead to biased results. We recruited the research participants from our social network. Most of them have similar educational backgrounds, which may not be the ideal composition for representing the target group.

For conducting further research on this project, it will be interesting to test out the same settings for other groups of users, in order to specify potential user profiles under the target group. Next, we can alter different use cases to keep validating the feasibility of the concept for examining if there are other critical factors which may affect the outcome. Last, for evaluating the possibility of scaling up the service concept, the research could be conducted in other cities' mobility ecosystem.

CHAPTER 7.

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CHAPTER 8.

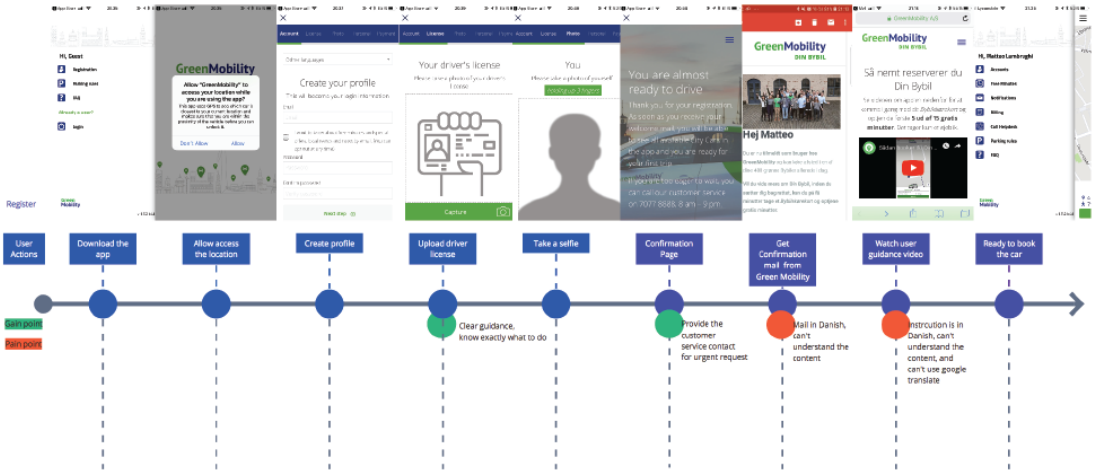
Appendix

Here the following appendices can be found.

- Appendix 1: Customer Journeys
- Appendix 2: User Interview Questions
- Appendix 3: Stakeholder Feedback Summary
- Appendix 4: Scenario For Desktop Walkthrough
- Appendix 5: Digital Prop For Paper Prototyping
- Appendix 6: Templates Used In The Workshop
- Appendix 7: Participants' Workshop Answers
- Appendix 8: Product Report

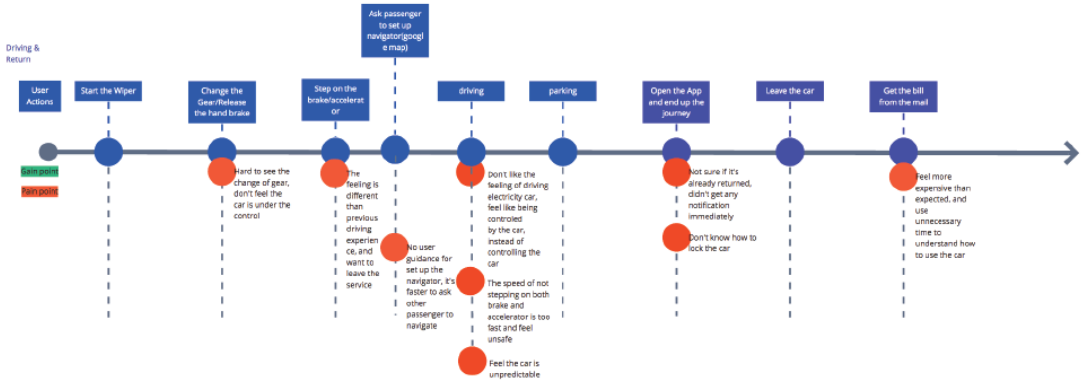
Appendix 1: Customer Journeys

Green Mobility: Onboarding

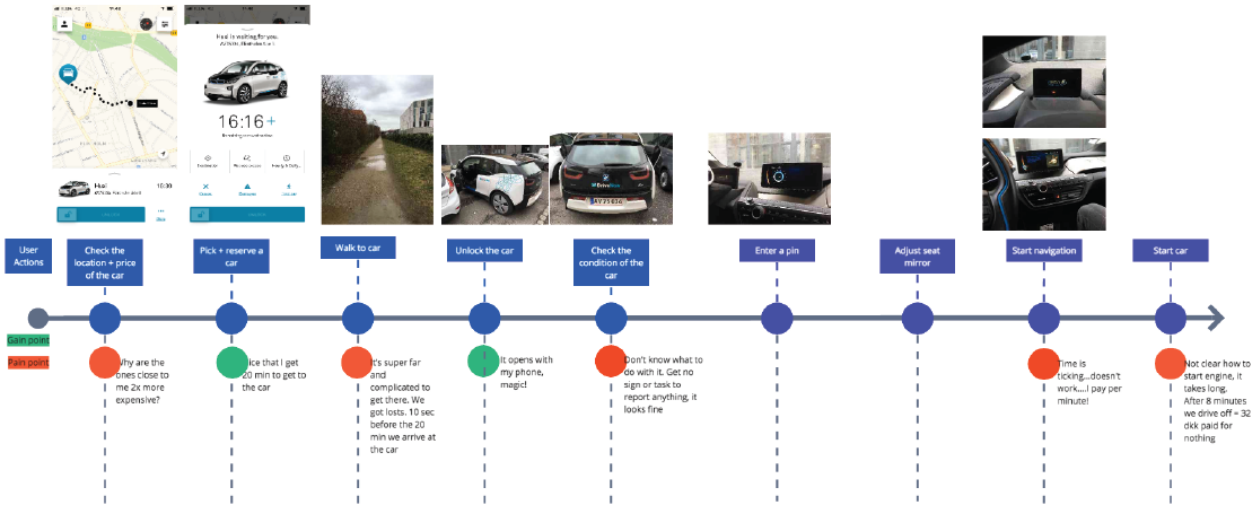


Green Mobility: Get to the car

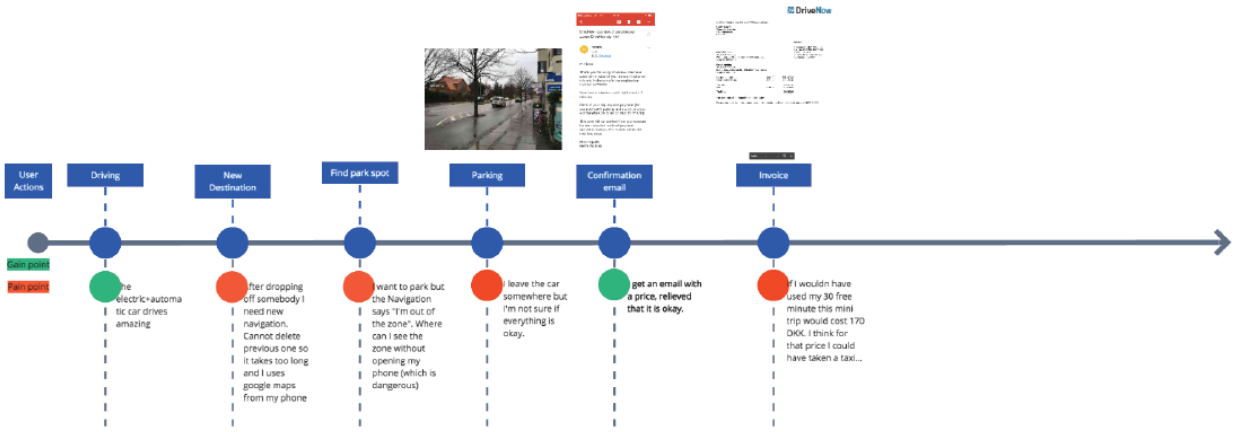
Green Mobility: Driving & Return



DriveNow: Get to the car



DriveNow: Driving & Return



Appendix 2: User Interview Questions

User Interview: Car-sharing Experiences

Length: 30 mins, Participants: Current car-sharing users/People have the previous experience for using car-sharing service

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Request to sign "Consent Form" + permission to record audio

Questions:

Background Information:

Gender
Age
Occupation
Years of driving license
Owning a car before (now)
Nationality
Family/Kids/Pets

Shared Car Usage (In General):

Which car-sharing service have you used before?
How often do you use them?
Why do you use it?
What do you like about it? Why?
How do you normally get there (to the car-sharing car)?
Would you recommend your friends/family to use it? Why?
How would you rank the services: Taxi/car-rental/car-sharing? Why?

Map The Customer Journey Together (1 Specific Use Case):

Where did you use the service? (Country/City/Place)
Why did you use it/purpose of the trip?
Did you use the service with others together?

Do:

Map out the steps for using the service
Is there any special story links to this action that you can remember?
How do you feel about it? (Ask participants to post the sticky notes on the emotional journey, write notes on the post its)
Which part of the service do you think can be improved, to make it more attractive to you?

Appendix 3: Stakeholder Feedback Summary

Ideation Feedback:

- It can be sort of "trade off" not only showing the closet car to be quicker to get the car but most suitable car
- Free- floating, short trip can be challenging to personalize
- "Intention" would be interested, they mentioned it's quite challenging to gather people's intention before the trip, they just show they need a car
- Gather intention "BEFORE" the trip maybe challenging, people are more willing to show what they have done "AFTER"
- We can try out crowd-sourcing ideas, "other people also like", tweak the popular recommendation (location, time)..."Sunday afternoon, this type of the car is the most popular type, you may also like..."
- The first part of asking user's input looks more like "customerized", but not "personalized", can use more "automatic" recommend the things that user like (ex. if people's type "ikea" into their calendar, then recommend the car they need to go to ikea)

Prototyping Feedback:

- We can try out different scripts and fake the machine interaction (one is more "robotic", and the other is more "intentional")
- We can consider do more iterations between differen "perspective" prototype, and see how they affect each other
- Service walkthrough (you look at the city and have a more holistic point of view)
- Paper prototype (ser's perspective they directly involve in the prototype)

Appendix 4: Scenario For Desktop Walkthrough

Introducing The Story

You are about to move to a new apartment, and need a new sofa in your place. You asked your friend Emir, who lives close to IKEA, to go with you to and help bring the sofa back home. You found a sofa you liked on the website and made an appointment with Emir at 10:00 Saturday morning at IKEA.

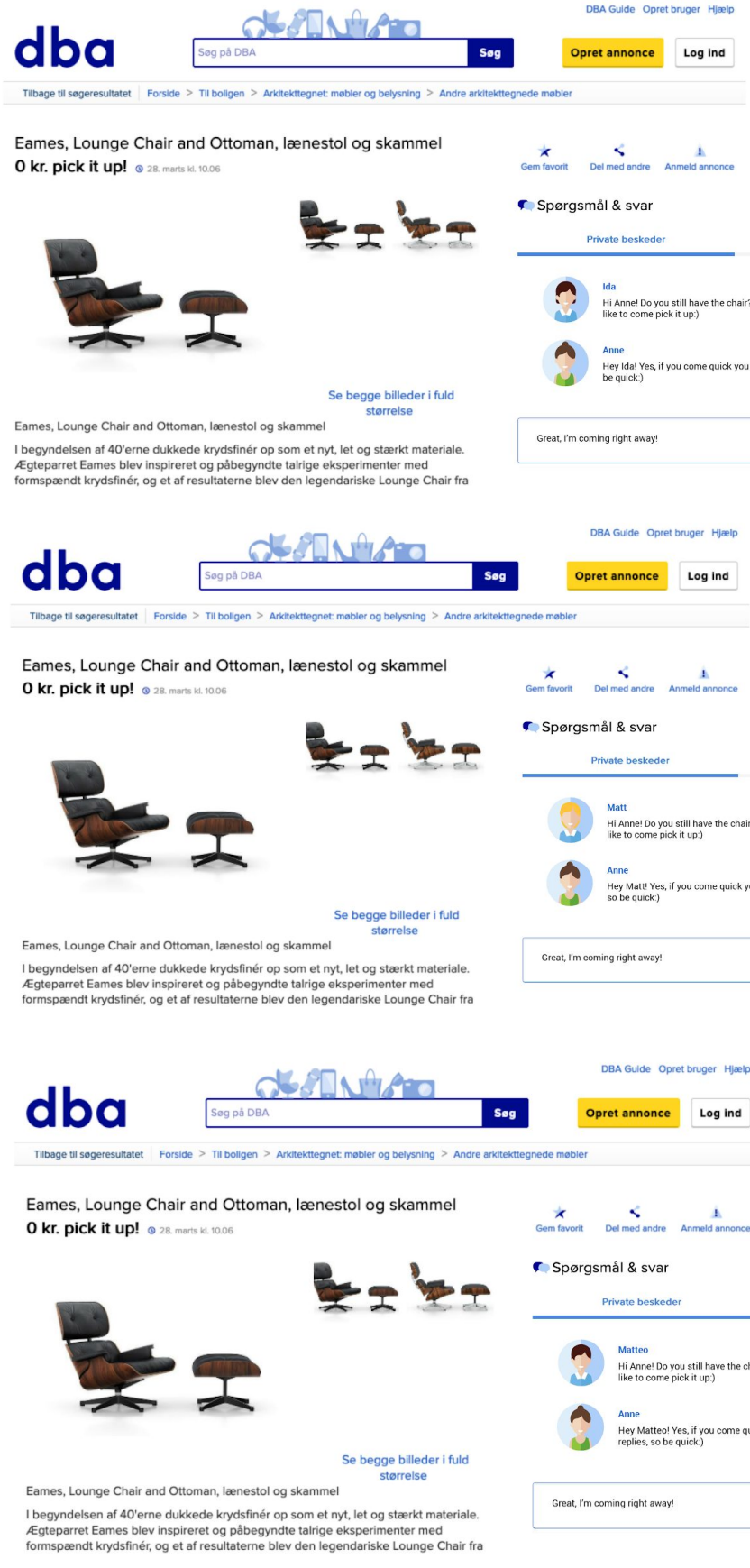
Story

It's Saturday morning at 9:30.. You open the car-sharing App and searches for a car close by, the App asks you the intention of using the car. You answers: " I want to go to Ikea, buy some furniture and drive back". The App proposes several IKEA's close by and asks your destination. You choose "Gentofte". "The App lists different sizes of furniture for you to select. You choose"sofa" The App reads your calendar and asks if you have an appointment at IKEA at 10. You answer "Yes". The App reads your request and searchs for the nearest car which can fit with the sofa.

The closest car is located 20 mins by walk. The app notices that you are not able to be there on time by walk, so it proposes another way to reach the car: Use an e-scooter around the corner, to reach the car in 4 mins, with additional price of 10 kr. You don't want Emir to wait for too long so you choose to pick up the e-scooter close by that get's you to the car.

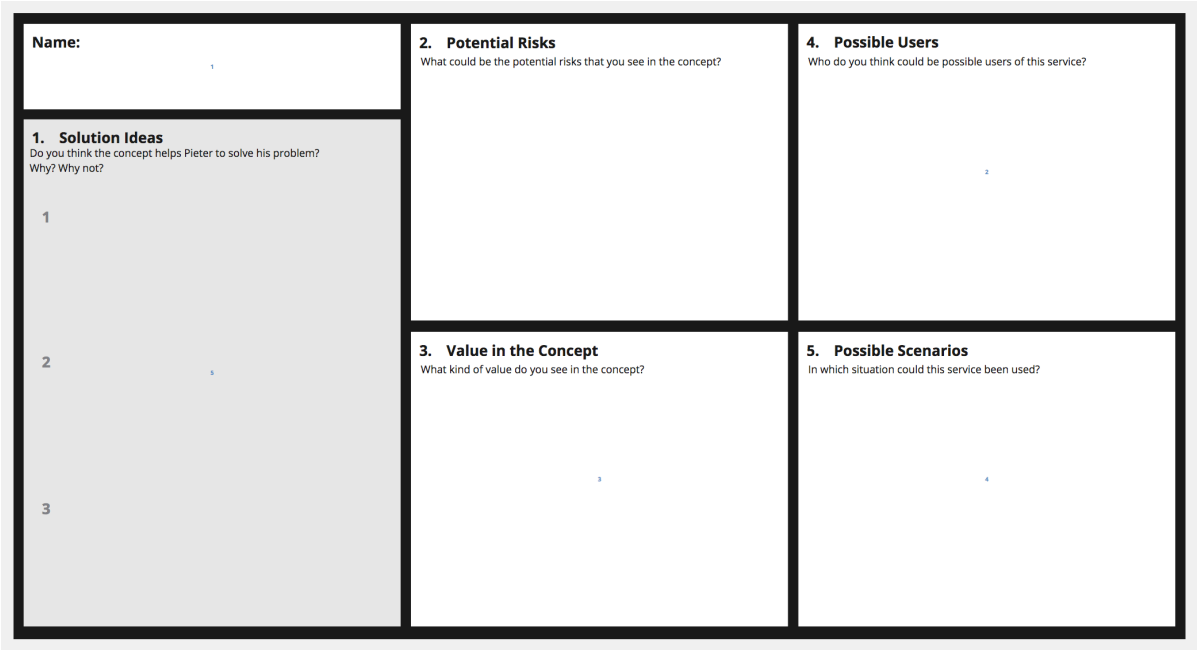
After you drive to IKEA and park the car in the parking lot. You meet Emir in time, pick up the sofa together from IKEA, and drive back home.

Appendix 5: Digital Prop For Paper Prototyping

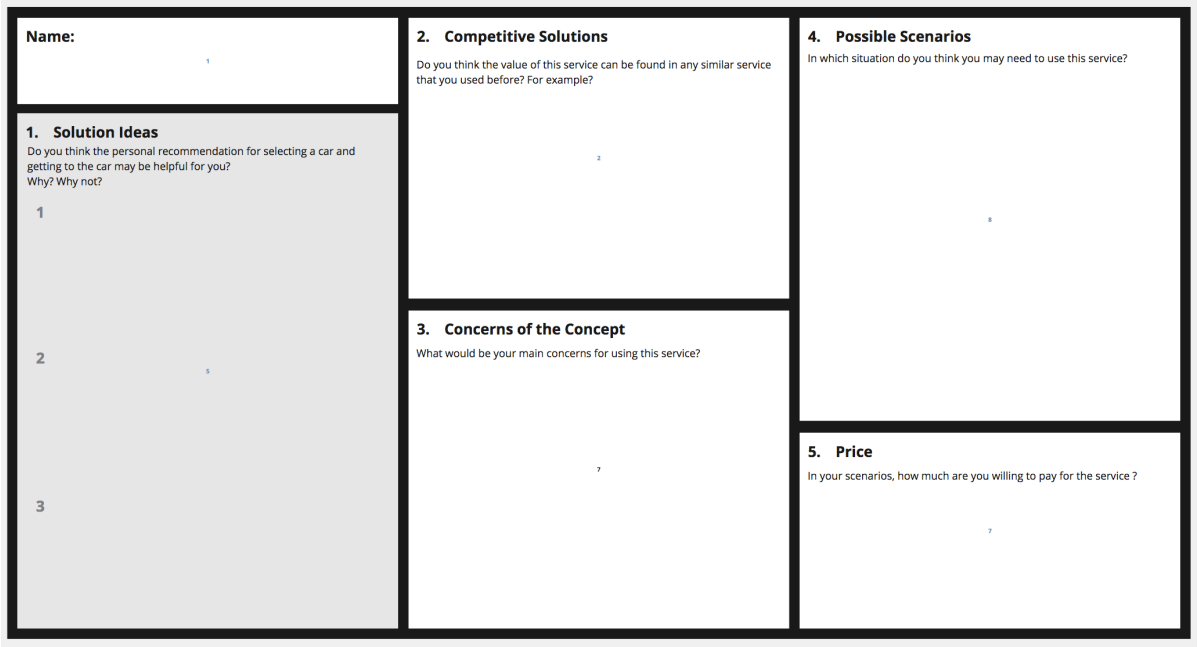


Appendix 6: Templates Used In The Workshop

Template 1 For Non Car-Sharing Users



Template 2 For Car-Sharing Users



Appendix 7: Participants' Workshop Answers

Positive Feedback About The Concept

- Integrate with other transportation
- Like the idea to combine different ways of transportation
- Umbrella for private services
- That the service integrates other means of transport that aren't integrated yet.

Value In The Concept

- Like the idea that you can personalize the trip both back and forth
- The App is easy to understand and guides you through the request
- It's user-friendly and good UX experience
- I like the concept because combining different services together adds value to me as a user, if I first have to walk 20 mins before I can access the car I either wouldn't use the service or would have to look up how to get to the car myself with public transport or other sharing services

Positive Feedback About The Prototype

- It's fun, simple and easy to understand

Negative Feedback/Suggestions To Improve The Concept

- Should specify types of luggage(the limitation of what I can have with me)
- What options are there if I want to use my own bike to get me there?
- I can't see the cost of the trip and how much taking the e-scooter would add
- If those services are working together the price could be lower for the individual services, there is an actual motivation to use it.
- Is it a defensible intellectual property? Can it be easily duplicated?
- Do not compare public transportation v.s. private transports
- What if the need is not addressable? "Too many luggage, cars too far..."
- Would competitors allow to use other App's than their own?
- How can you use existing services, or could it be relevant? Such as, Google Maps.

Negative Feedback/Suggestions About The Prototype

- How was the video connected to personalization of prototyping in SD?
- How different was this way of prototyping from standards(non-personalized service)?

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Appendix 7: Participants' Workshop Answers

Feedback From "Potential Users"

Solution Ideas

Participant A:
Yes, because when using DriveNow the car is often 15-20 min away which can be a reason for me to not use it

Participant B:
Yes, especially when there are not enough cars in my area

3. Competitive Solutions

Participant A:
I would look into how Google maps API could be useful
The combination of a car service app and rejseplanen could be used but then you have to use two apps
Participant C:
Deutsche Bahn, they are trying to connect different services
Participant B:
I am a bit worried that big players (Google) will be able to more easily implement integration with multiple mobility transportation providers/services

4. Concerns Of The Concept

Participant C:
Reputation of Volvo, they could be seen in connection with other providers. They don't have control about the quality of the other service, but users could think bad of Volvo in case the other service is not providing "good".
Participant B:
No defensive Intellectual property
Lack of clear competitive advantage

5. Possible Scenarios

Participant B:
When I need non-routine mobility services
Participant C:
When buying something bigger
Picking up a group of people
Going on a trip with several people
Participant A:
For free time activities or a situation where I can not carry something that need to go from A to B

6. Price

Participant B:

I am not willing to pay for the app or recommendation, only the normal price for the rental fee

Feedback From "Non-Users"

Solution Ideas

Participant D:
Yes, he saved time and got a car
Participant E:
Yes it's time-consuming and flexible, both ways he's driving
Participant F:
Yes hes was able to perform the activity he wanted to
Participant G:
It could work for specific scenarios, fewer passengers, light luggage

Potential Risks

Participant D:
Competitions
Technical
Participant E:
Private companies are not interesting in collaborating, they have their own app/online service
Participant F:
If equipment is defect (especially from the "other" service providers
Participant G:
Crowded markt, competitions with other service providers, do not integrate public transport which can be costly choice

Value In The Concept

Participant D:
Easy
Participant E:
More joint car-ownership and use of green transportation
Participant G:
It will combine few existing services in one platform

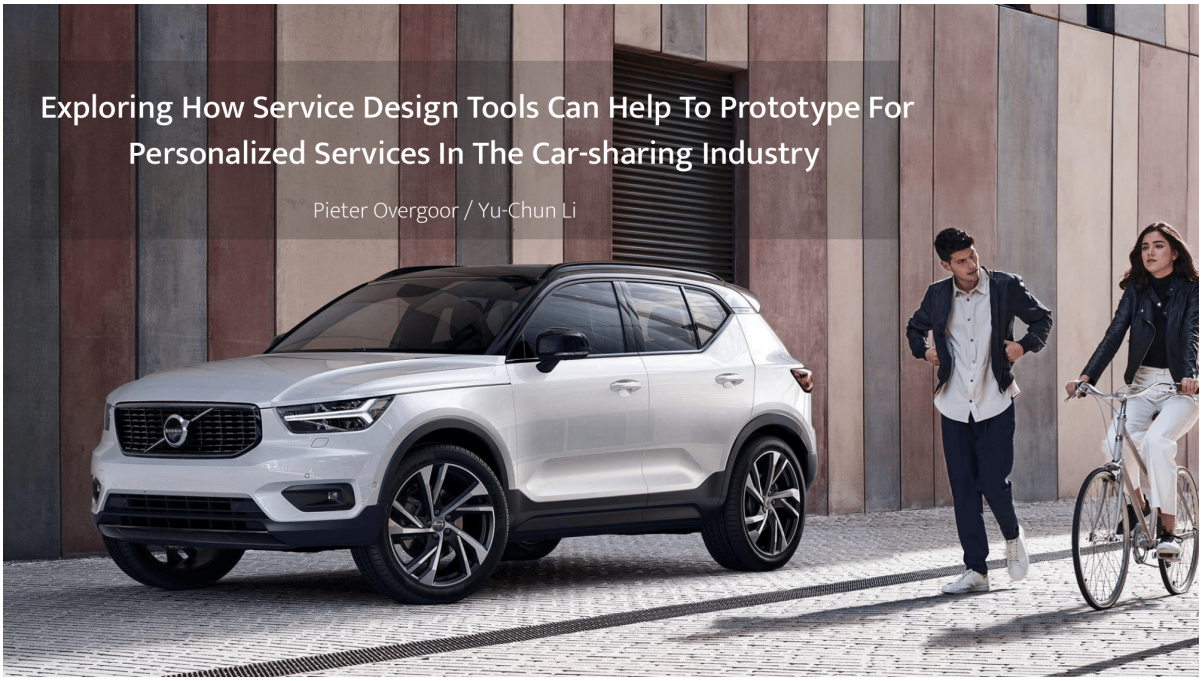
Possible Users

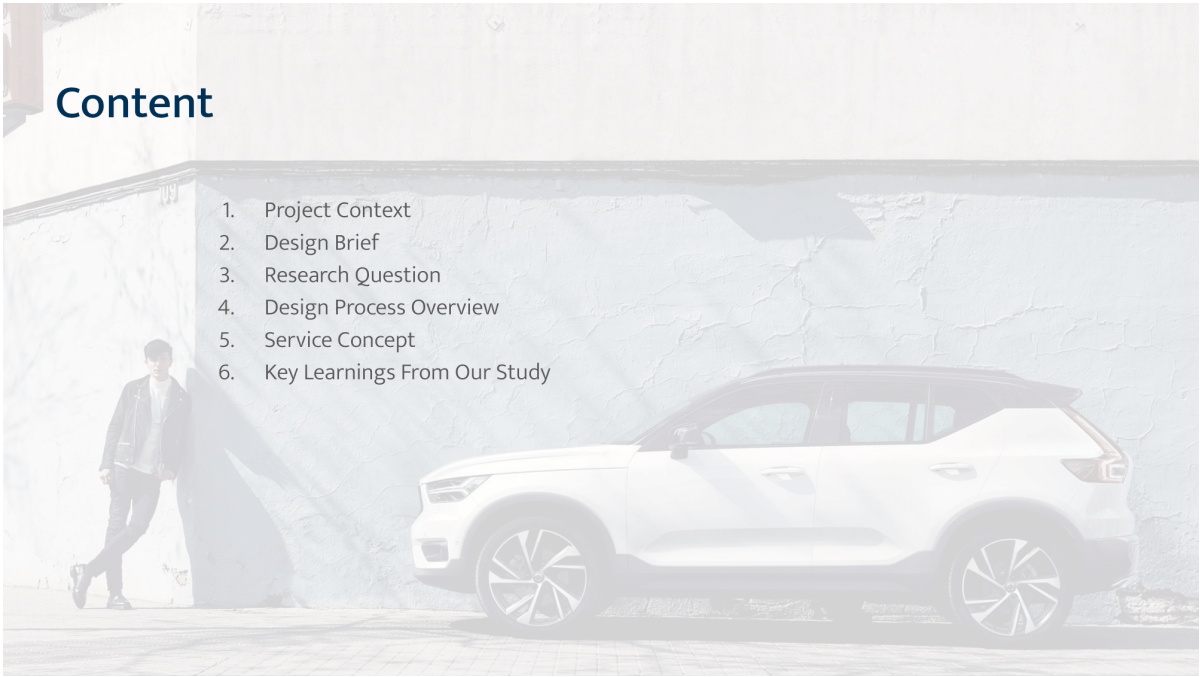
Participant D:
Family
Participant E:
Young people who cannot afford a car, scooter, bike etc. on their own
People with limited transportation opportunities
People who live far away from work, facilities etc.
Participant G:
Young users, tech driven, business people

Possible Scenarios

Participant E:
Sudden episodes occur (emergency?)
Participant G:
It could be used by big companies as offer to employees who travel around the city so they don't use their cars etc.

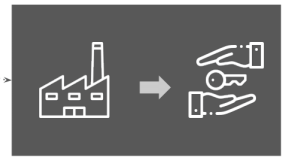
Appendix 8: Product Report





Project Context

Emergence of car-sharing services



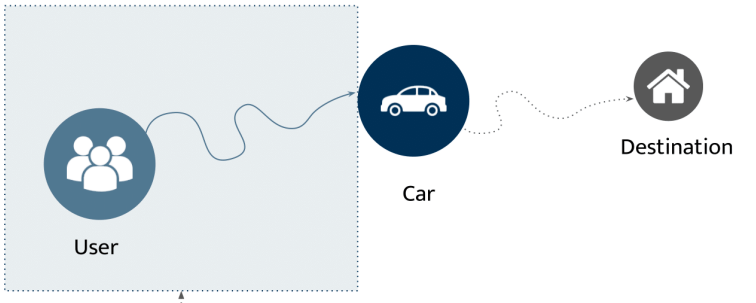
From car manufacturer to service provider

Challenges for car-sharing service providers

"The ability to proactively **tailor products and experiences** to tastes of individual consumers based upon their **personal and preference information**"
(Chellappa and Sin, 2005)

Personalization as a key to tackle challenges

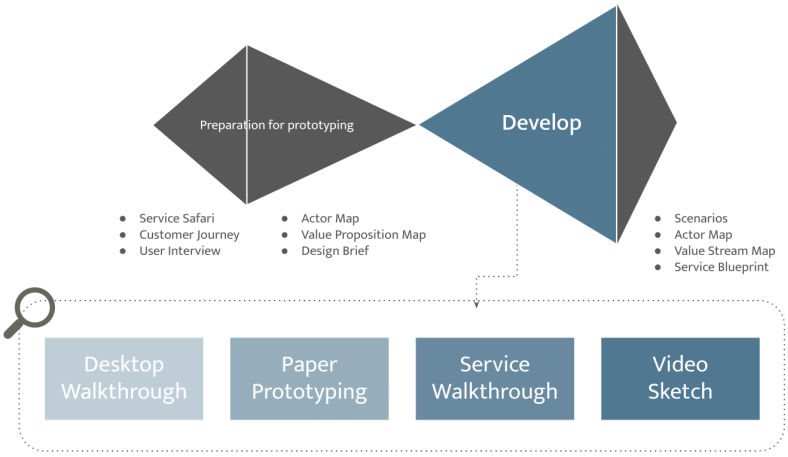
Design Brief for Volvo

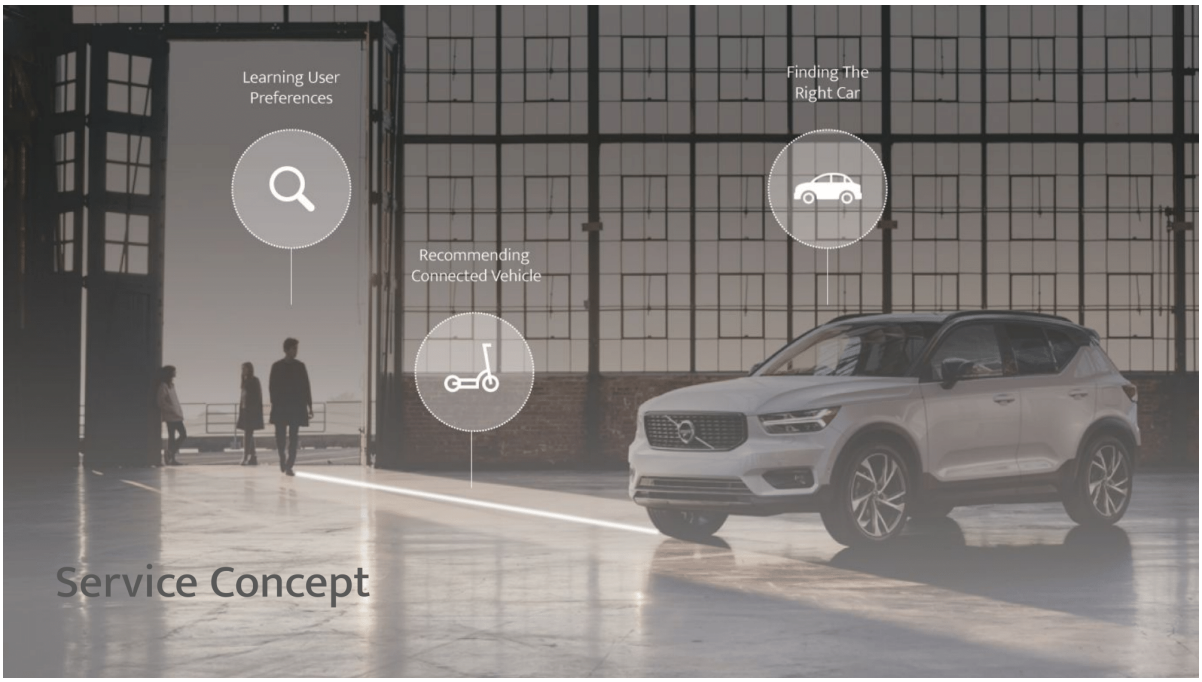


Personalize a car-sharing service to make it easier/quicker to get to a car-sharing vehicle

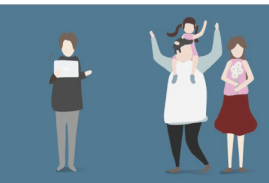
Design Process Overview

How can service design tools support the process for prototyping personalized shared services?





Target Group



Late Student
Recent Graduate

Young Working
Family

Demographics

- Between 25 - 35 years old
- Live in densely populated urban areas (Copenhagen)
- Higher educated

Characteristics

- Care about the environment
- Tech savvy
- Not owning a car

Use Behavior

Use Cases

- Transport large goods
- Transport to/from airport or train
- Pick up people
- Unplanned quick errand

Usage

- 1-5 times per month
- Short trips between 10-30 minutes

Motivation

Short Journey

- Shorten travel time
- Direct trip to destina -tion

Price

- Discount rewards
- Competitive price for premium experi -ence

Accessibility

- Quickly accesible
- Use the car without time limitation
- 24/7 accessible

Others

- private space
- Less pressure due to less damage control

Barriers

- Limited service area
- Hard to access the available car
- Far from parking to final destination
- Too expensive for constant use
- Feel confused about using the car
- Checking car condition is time-con- suming

Service Representation

Scenarios

A storyboard for communicating the new service from a user's perspective

Actors Map

A high-level network of actors and components in a system

Value Stream Map

More levels of detail about the relations of these actors and the value they exchange.

Service Blueprint

Most detailed level of interactions within a service, both visible front-stage and invisible back-stage interactions

This is Pieter. He needs to go to the aiport to pick up his family. He is a bit late, so he needs to hurry!

He opens the car-sharing app and answers a few questions about the intention of his trip, amount of people, luggage and destination.

The app calculates a personal recommendation for him, and suggests that he might need a bigger car because he will pick up 4 other people and some luggage.

The app knows he is in a hurry and suggests to take him an e-scooter that is standing nearby. The e-scooter will save him 16 min to get to the car

The app helps him to navigate to the e-scooter.

He opens the e-scooter with the app by sliding the unlock button.

He uses the e-scooter to get to the car.

After arriving, he parks the e-scooter next to the car.

He uses the app again to unlock the car.

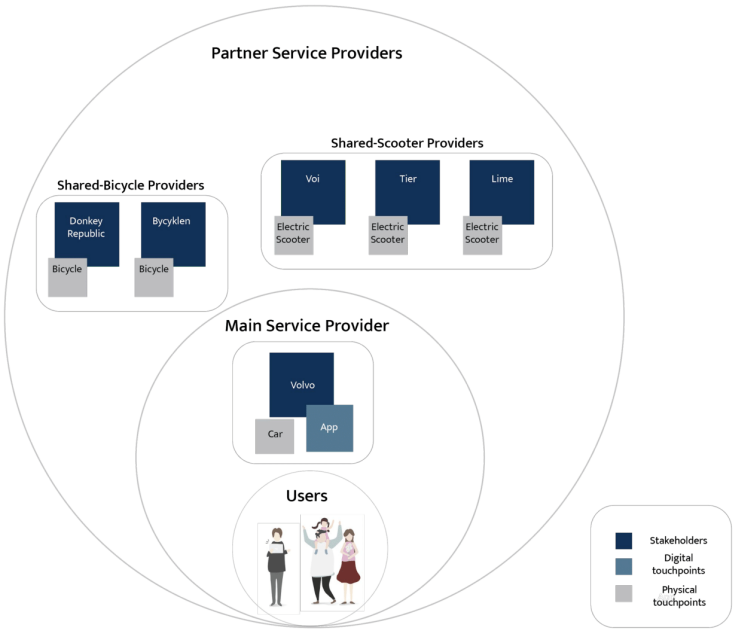
The car is opens and he is allowed to use it now.

He drives towards the airport and picks up his family right on time!

Scenario

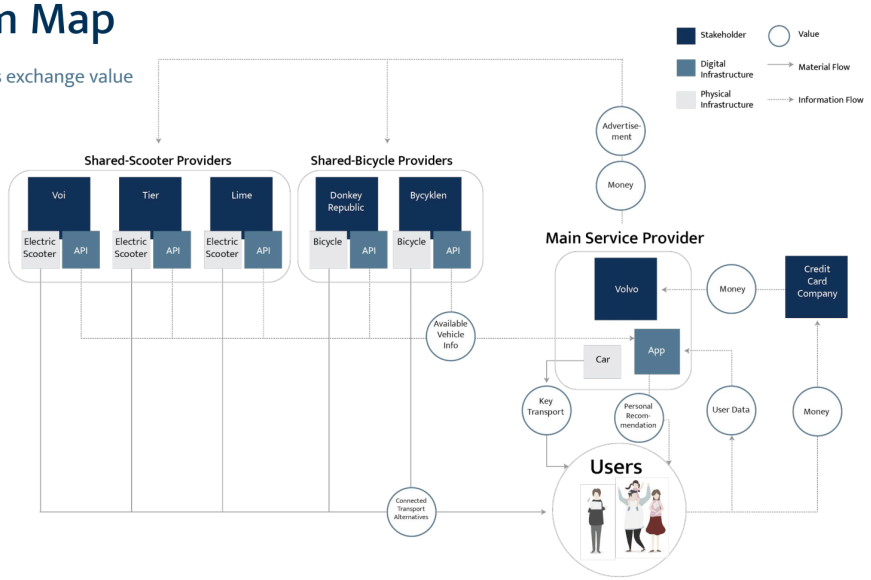
Actor Map

Represent various actors, and components in our service system. For example, Service providers, Users, and Touchpoints



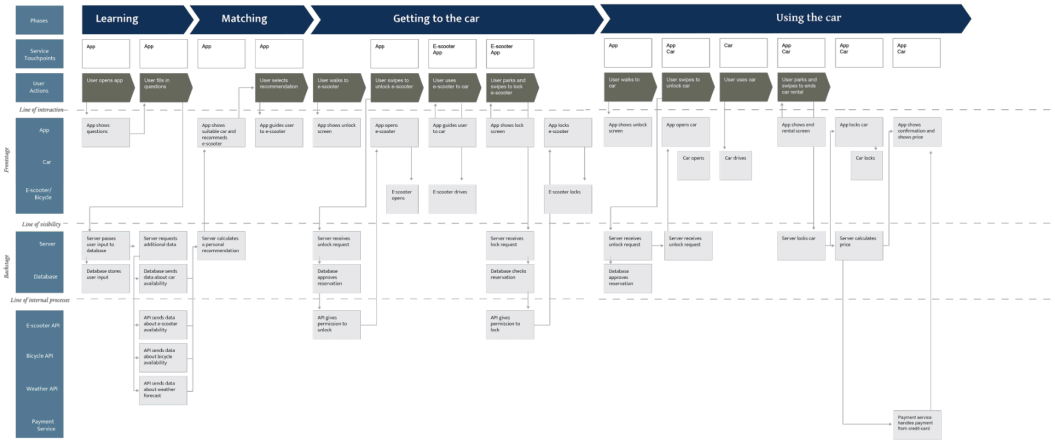
Value Stream Map

Represent how various actors exchange value in our service system.



Service Blueprint

Represent all Interactions in front-stage, back-stage and how information flows through the system.



Prototyping Approach

Four different prototyping methods are tested to explore the research question.

Key Learnings From Our Study

1. **Service Walkthrough** and **Paper Prototype** (direct prototypes) have the highest ability to test personalized services.
2. **Personalizing a prototype** can lead to the most detailed feedback and convincing results, but requires a significant investment of time and effort.
3. **High fidelity** prototypes require less involvement required from researchers
4. **Steering** helps to direct feedback but discourages open feedback
5. It is **important to prototype the whole journey** for testing out the personalized impact caused by a single touchpoint.

Prototyping Findings

	Building the prototype			Testing the prototype					Outcome	
Most	Ability to include personalization: 'learning'	Time needed to build	Skills required to build	Ability to test personalization: 'matching'	Amount of researcher involvement required	Amount of steering required	Ability to test the whole journey	Time needed to test	Detail of feedback	Amount of feedback
	Service Walkthrough	Video Sketch	Video Sketch	Service Walkthrough	Desktop Walkthrough	Desktop Walkthrough		Service Walkthrough	Service Walkthrough	Service Walkthrough
	Paper Prototype	Service Walkthrough	Service Walkthrough	Paper Prototype	Paper Prototype	Paper Prototype		Paper Prototype	Video Sketch	Video Sketch
	Desktop Walkthrough	Paper Prototype	Paper Prototype	Desktop Walkthrough	Service Walkthrough	Service Walkthrough		Desktop Walkthrough	Paper Prototype	
Least	Video Sketch	Desktop Walkthrough	Desktop Walkthrough	Video Sketch	Video Sketch	Video Sketch	Paper Prototype	Video Sketch	Desktop Walkthrough