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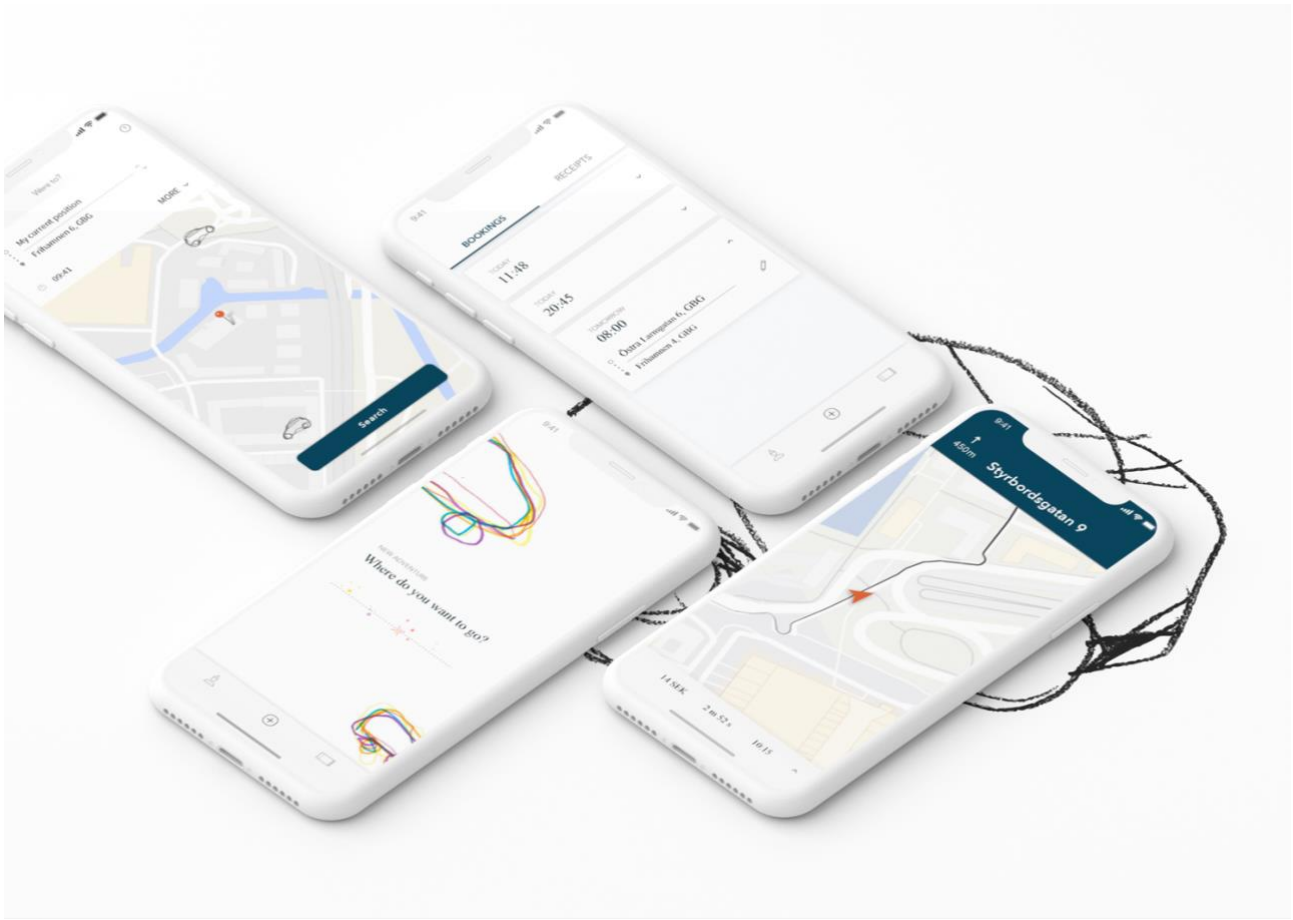

Flink - Shared Door to Door Mobility

with Autonomous, Light, Electric Vehicles

Master of Science Thesis, Industrial Design Engineering

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Gothenburg, Sweden 2018

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Preface

This report presents a master thesis covering 30 ECTS credits, conducted between January and June in 2018. The thesis was conducted by two students attending the master of Industrial Design Engineering at the division of Design and Human Factors at Chalmers University of Technology.

During this project, we have received a lot of help and support from various instances, companies and individual enthusiasts that shaped and made a positive impact on both our personal experience of the project and on the result.

Firstly, we would like to extend huge gratitude towards Publicis.Sapient in Gothenburg, for sharing your fine venues, extraordinary fikas and great competence with us throughout our project! Special thanks to Kalle Ulvstig who took us under his wing and to our supervisor Erik Arvedson for all the support and inspiration you've given us throughout this project. We would also like to thank Johan Baettig, for being a great source of ideas and suggestions, to Emma Ludvigsson Brinkhoff for professional guidance and to Elin Kristell for always being willing to give us honest feedback.

Thanks to all test participants and eager workshop members who gave us feedback along the way - your contribution was invaluable. Also, thanks to Elin Gebring och Fanny Wikman for being a great opponent group with whom we could bounce ideas with back and forth.

A great thanks to Sandeep Gajula, Johan Lindberg, Göran Folkesson, Cecilia Bergstad and HSB Living Labs for sharing your time and wisdom with us throughout our early phases of our project. Also, our deepest gratitude towards Björn Carlberg, who contributed with a boost in tricky moments.

We would like to extend our gratitude towards our supervisor Professor Ulrike Rahe for your strong opinions, clear guidance and visionary approach throughout this journey. Finally, we want to thank Otto Lundman, for giving us the opportunity to develop your idea. Your supervision was always insightful and challenging, coming from a start-up point of view, which we were not used to. Thanks to your help, and all the others mentioned above, we now hope to be ready to spread our wings and fly into the real world.

Gothenburg, July 9th, 2018,
Cecilia Henje and Magnus Pettersson

Abstract

Cities are currently densifying, which results in an increased strain on transportation systems. At the same time, cars are actively used for a very short part of their lifetime, with low utilization of available seats. The start-up company OLAB has a vision to disrupt this behaviour, by introducing an inexpensive autonomous sensor pack to light, electric vehicles (LEVs).

The aim of this project has been to produce a vision on how autonomous LEVs might bring best value to citizens in the near future. The project investigated *who* might initially use the vehicles, *why* and *when* they could benefit from using them, and *how* this interaction should be shaped to best suit their needs.

Throughout this project, an explorative approach has been used, mixing short research phases with short design phases to allow for several iterations within a short amount of time. Interviews with stakeholders in the transport service- and LEV manufacturing business in combination with literature studies and a market analysis concluded a basic idea of the current situation. Workshops with early adopters and regular citizens helped to explore the possibilities of what the technology could be used for to generate value. Prototype testing helped evaluate concept ideas and a landing page was used to evaluate the overall interest in the concept idea.

The result consists of a taxi service of autonomous LEVs, aimed to complement current public transport solutions within city centres. The thesis proposes a vision for how the service should evolve in congruence with legislation for autonomous driving.

The vision produced in this thesis is presented through a customer journey, a service blueprint, a branding concept, product specifications and a user interface of a mobile application, aimed at the customers using the service.

Table of Contents

1 Introduction

In the introduction, a background to the project is given. This is followed by the research questions and delimitations. In the end of the chapter, the project outline and the report outline is illustrated.

1.1 Background

Cities are currently growing denser, putting more strain on transport systems. A sector that is constantly debated is the transportation sector, not least because of the environmental threats it currently poses. Cars are used as a common means of transportation within the city. Passenger cars are only used actively in 5% of their lifetime (Barter, 2013) and, in Sweden, the average number of passengers per car is estimated to 1,2. To meet the upcoming challenges within the urban city environment, there is an urgent demand on innovation, especially within the transportation sector.

The increased competition of urban space is already very clear. Increased use of public transport also poses some challenges. Today, major connection points are spread out throughout the city because of the congestion. People hop of at these points and find alternative ways of getting into the city centre, as all busses and trams can't go through the central station because of congestion. Efforts being made to solve the problem are to introduce new means of transportation, like for instance Styr och Ställ and the free ferry trip from Lindholmen to Stenpiren in Gothenburg, Sweden. Therefore, an interesting opportunity is to introduce additional means of transportation that can complement the public transport system.

There are several models of so called light electric vehicles (LEVs) on the market and more are under development. LEVs are silent, nimble and designed for the urban environment. This group of vehicles could potentially reduce the noise levels in cities, clear up space and improve the local air quality. However, the acceptance level of such vehicles is currently low. OLAB is a start-up with the ambition of questioning our current means of transportation, by introducing hardware and software that makes LEVs autonomous. The development of the technology has come a long way but tests with LEVs are yet to be done. To move the development forward, OLAB also needs design concepts in order to verify that their product has potential and can bring new value to the urban city.

This thesis project will form a vision of which potential new values a transport service with autonomous LEVs could bring to people traveling in a city. This vision will resemble an important stepping stone for OLAB, as the start-up will be provided with material to attract investors, collaborators and employees.

What sets OLABs strategy apart from many other companies is that they aim to implement the transportation service in an early stage, allowing it to improve and grow organically. For this reason, it is important that the service is designed to function well for these different stages of use, related to user adoption, that will occur when the service is implemented in a city.

1.2 Research questions

This project aims to investigate how a transport service using autonomous, light, electric vehicles (LEV) could provide an enhanced travelling experience in the urban city environment. The following research questions are addressed in the thesis

- How should a transport service with LEVs work in order to facilitate peoples' journeys within cities?
- Which are the main user groups interested in a transport service with LEVs?
- What is a plausible strategy that the start-up could follow in order to successfully implement and grow a transport service with LEVs?

The thesis objective is to make the findings to the research questions tangible through a design concept. This objective is achieved by the following steps:

- Define potential user's needs, wishes and probable scenarios regarding a transport service with LEVs.
- Define a customer journey and highlight possible differences that arise in different stages of implementation.
- Develop a high-fidelity prototype of the transport service's user interface through several iterations of testing.
- Define and apply a brand identity for the transport service.

1.3 Delimitations

In order to narrow down the rather broad brief of the project, the following demarcations were set:

- The project did not include investigations on how the vehicle should behave and communicate with the user in special cases of autonomous transport situations, such as coping with crossings or around a construction site.
- The project did not include studies aiming to optimize the interaction with the interface when driving from a cognitive demand standpoint. Neither did it include investigations on the user experience of a transition between autonomous and manual driving mode. Instead, a brief look at the trends and what other companies are doing was performed and presented.
- The service was not designed with a particular vehicle company in mind, but instead aims to be implementable with any LEV.
- Explorative user research and testing was performed mainly with people from Gothenburg, with journeys within the municipality of Gothenburg in

focus, due to the limitations of the thesis project. However, the deliverables of course need to be applicable to users in other destinations as well.

- The project did not focus on researching and exploring possible future city infrastructure strategies. As the concept is expected to be implementable in a near future, the infrastructure of cities was assumed not to change to any significant extent in the next years to come.

1.4 Project outline

Figure 1.1 shows the project process. The blue-grey shows the progression of the concept development. Parallel to this, exploratory research was done to aid the ideation and refinement of the concept. And parallel to this, ideas and concepts were tested with users to get feedback on the design.

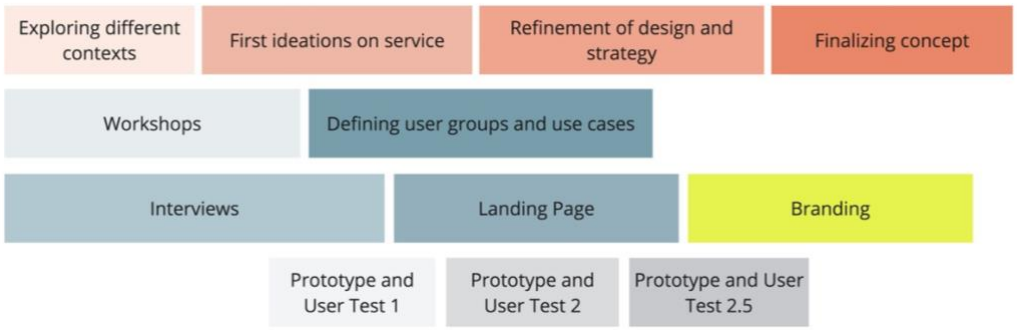


Figure 1.1: Project process

1.5 Report outline

Figure 1.2 shows the report structure. To get an overview of what this project is about, read the introduction and the conclusion. To get a bit more insight into how the project was done, read the intro and summary of each chapter. Finally, to get the full understanding, read the methods, procedures and results.

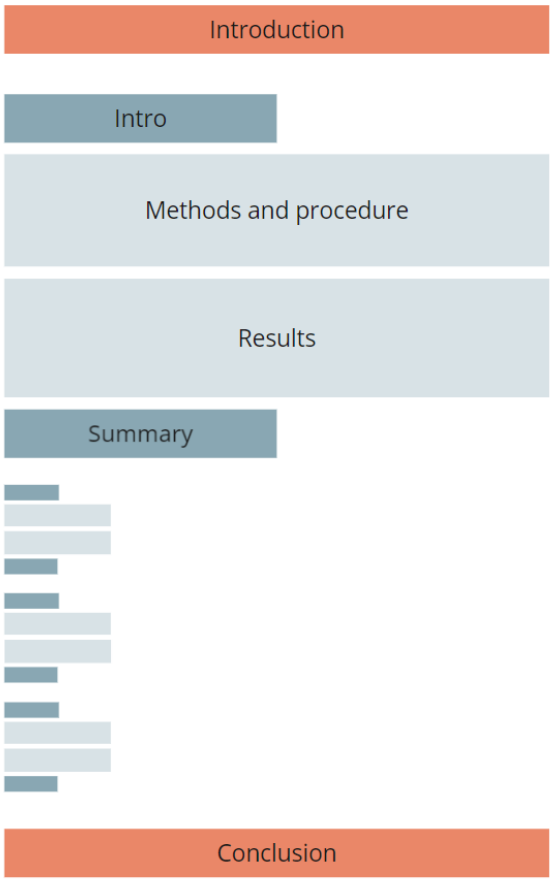
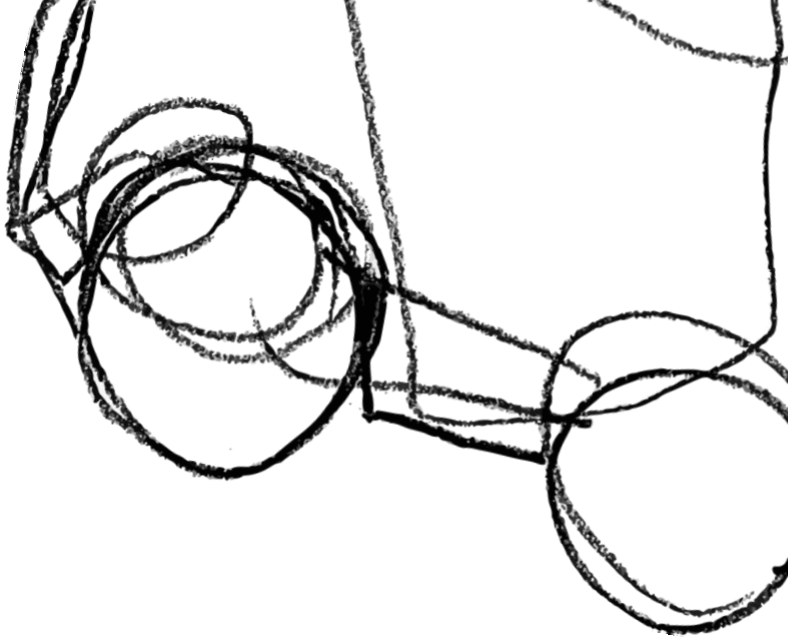


Figure 1.2: Report outline



2 Theory and Terminology

Here, terminology and theories used and considered during the project are presented.

2.1 Cognitive Ergonomics

How capable a person is of perceiving the difference of light and dark areas is described as *contrast sensitivity*. Increasing the contrast of elements, in for instance an interface, will make it easier for the user to distinguish lines, forms, type and colour. Several aspects can also reduce a person's contrast sensitivity. For instance, It is more difficult to perceive contrast from an object that is moving relatively to the observer. Contrast sensitivity is also diminished with age. Finally, reflection, typically present when looking at a screen in an outside environment, can also reduce the contrast sensitivity. (Osvalder, 2011)

When *searching,* for information, on for instance a mobile interface, the eye is moving in a more random pattern compared to when *scanning* for information. When scanning for information, the user knows what kind of information s/he is looking for. In the western world, people tend to search for information from the upper left to the bottom right corner of a page or screen. To increase the speed of searching there are a number of things that can be done. For instance, an eye-catching element is more easily and quickly perceived. Elements can be made eye catching by using colours, shapes and sizes that contrast relatively to others used in the interface. A user's expectations on where certain information ought to be found also affect the search for information. This means that by studying similar interfaces as the one being designed, as well as studying the user needs, the designer can place and display information in a way that is expected by the user. (Osvalder, 2011) Finally, the gestalt principles can be used to make information easier to search for and understand. For instance, by putting elements close to each other or giving them a similar appearance suggests that they belong together. Also, elements and graphics can be used to suggest where the user should look by placing the so that they create lines and curves for the eye to follow. (Interaction Design Foundation, 2018)

2.2 Usability

In this project, usability refers to the ISO standard definition of usability: *"The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use."* (ISO 9241-11)

Effectiveness describes to which extent a specified goal or task can be reached or completed respectively. *Efficiency* describes how much effort needs to be put in by the user to reach or complete these goals or tasks. Lastly, *satisfaction* refers to how satisfied the user feels when using the product or service. Satisfaction can also be seen as the absence of discomfort.

2.2.1 DESIGN PRINCIPLES BY PATRICK W. JORDAN

Patrick W. Jordan presents ten principles to consider when designing for high usability. The ones that are considered to be particularly relevant for this project are presented below.

- *Consistency.* For interface design, this means that problems of similar characteristics are solved in a similar way within the application, software, website or what have you. This makes it easier for the user to understand the interface because it allows him or her to make educated guesses on how to interact with the interface based on how s/he previously interacted with it. Consistency is not limited to how the user solves problems but can also include aspects that has to do with layout, colour and copywriting.
- *Compatibility.* A product that has good compatibility can be used with ease by a user because s/he can use previous experience from similar products as a starting point when interacting with it. Designing for compatibility is about understanding what expectations the user has on the product based on previous experience with similar products.
- *Feedback*. Feedback is about giving useful information to a user who just performed an action. When designing a new behaviour or experience, as in this project, useful feedback is crucial. The user does not know what to expect from certain actions as s/he has not performed them before and has no previous experience from performing similar actions on similar products.
- *Error prevention and recovery*. Design for minimizing the occurrence of use errors. It is also important to make sure that recovering from an error is fast and easy to do. In this project, where a shared mobility service is being developed, it is very important that error recovery is well designed as the wrong press of a button could potentially lead to issues like booking a vehicle for the wrong address or accidentally locking the vehicle with belongings still in it. Feedback can also be used to prevent a user from making an error or helping him or her to recover from an error by providing warnings, confirmations, corrective- and explanatory feedback.
- *Control.* Control naturally ties into error recovery and feedback. When designing, it is important to consider if the users feel in control over the product or not. If a high level of user control is undesirable, a low level of control should be communicated to the user. On the other hand, if the user in fact has a high level of control, this needs to be communicated in order to make the user feel in control and have a positive experience with the product.

Jordan also defined five components of usability that are related to how the user performance is influenced by experience and practice. Three of them are presented below.

- *Guessability* refers to how well the user can perform a task with a product the first time.
- *Learnability* refers to how well the user can perform a task with a product after having performed the same task a few times before.
- *Re-usability* refers to how well the user can perform a known task with a known product after not having performed that task for a longer period of time.

2.2.2 AFFORDANCE BY DONALD NORMAN

Affordances are described as clues given to the user about how to interact with a product. In interface design, there are a number of ways to create affordances. Interaction with a mouse or trackpad in an interface provides the advantage of communicating affordance regarding how to interact with the component. For instance, a common type of affordance is to change the cursor icon or use animations to emphasize how to interact with a component that the mouse hovers over. However, touch based interfaces cannot provide this type of affordance. Instead, the use of standards in typographical emphasis, coloured text, icons, line weight, whitespace and shadow effects are common tools to indicate if and how an area is interactive.

Constraints describe how interaction can be made simpler by limiting or removing options of interaction. A common practice in interface design is to reduce the contrast of an area to indicate that the area is inactive. Pop-ups with messages such as "*Are you sure you want to…"* can also be considered a constraint as they limit the interactions available with the purpose of reducing the risk of use errors.

2.3 UX and UI

The discipline of design within the digital world has been given many different names. A common understanding of the different terms used has not yet been reached in the academia or industry. In this section, the terms are explained and differentiated according to how they were interpreted and used throughout this project.

2.3.1 USER EXPERIENCE DESIGN (UX)

In this project, UX design describes the development of the interaction between the user and the product. The goal of UX design is to make it as easy and seamless as possible for the user to reach his or her goals, using the system. Hence, UX design mainly focuses on making sure that the interface has a flow and supporting elements that are easy to grasp and interact with. A good user

experience is developed through iterative testing with interactive prototypes on potential users.

2.3.2 USER INTERFACE DESIGN (UI)

In order to design a good user experience, UI design is an essential complement. User interface design determines how the interface will look. It comprises details such as colour schemes, hue, contrast, format on graphical elements, transitions, fonts, and text formatting. A consistent orchestration of the UI design elements can serve as an important conveyor of the products visual branding. It is also a fundamental part of the user experience.

2.4 Coopers Interaction Design Framework

Alan Cooper uses a number of terms to describe the early choices and basic structures that needs to be defined when creating a new interface (Cooper, 2014). These terms were discussed when the service was outlined, based on user needs and the environmental aspects of the journey.

2.4.1 INPUT METHOD

The input method describes how the user interacts with the product. The selection of input method is driven by the form factor and the posture of the product, as well as by users' attitudes and preferences. Examples of choices could be mouse, keyboard, thumb-board, voice, touchscreen, remote control etc.

2.4.2 PLATFORM

A product's platform can be described as the combination of software and hardware, that enables a product to function in terms of both the product's internal operations and user interactions.

2.4.3 POSTURE

The product's posture describes how it presents itself to the users. It is a way of describing how much attention the user will devote to interacting with the product, as well as the product's behaviour to the amount of attention it gets from the user. The selection of a posture for one's product is to be based on the likely usage contexts and environment of the interface.

Two classic examples are the *transient* and the *sovereign* postures. The sovereign posture requires full attention for a longer time, and often covers the entire screen. It displays a large number of features and functions, and the interaction with the interface is often deep and complex. An example of a sovereign postured interface is Microsoft Word, in figure 2.1 below.

The transient posture often presents a single function with a limited set of accompanied controls. Transient applications don't stay on the screen for extended periods of time, but is invoked when needed, performs it job and then quickly disappears. Due to the short usage time, a transient interface should be helpful and obvious, and present its controls clearly enough that it does not lead to confusion or mistakes, with big buttons and an easy-to-read typeface. An example of a transient posture is iOS's Calculator in figure 2.2.

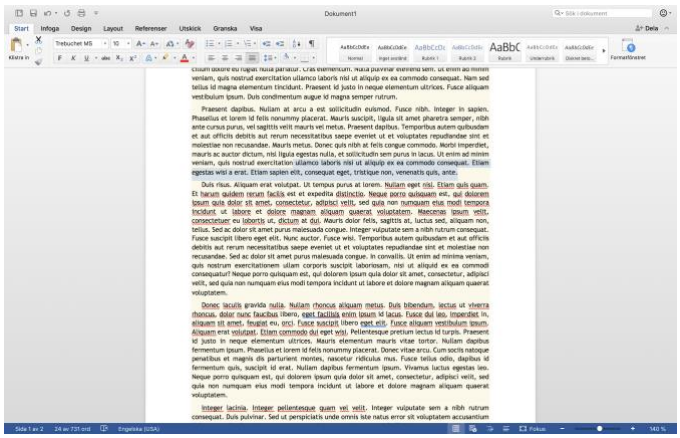


Figure 2.1: Microsoft Word, a sovereign postured interface. Figure 2.2: iOS Calculator, a transient postured interface.

2.5 Autonomous

Autonomous refers to a state in which a vehicle can drive by itself to different extents. SAE International has defined six levels of automation that describes what the vehicle can do, and what is expected from the driver, at the different levels. The technology that is used as a starting point for this project is currently at level 3. During ideal conditions, the vehicle will be able to get itself from A to B based on pre-recorded data. But tricky situations such as poorly designed intersections, bad weather, irrational pedestrian behaviour and construction work will stop the vehicle. How the technology is expected to be used in its current condition, and how the service will use a gradual implementation and improvement of autonomous drive to its advantage, is discussed in chapter 7.2.1 Horizons.

When the word autonomous is used in this report, it is referring to the fact that the vehicle is driving itself to some extent. If the level of autonomous drive is relevant at that particular instance, that will be made clear.

2.6 LEV - Light Electrical Vehicle

The Light Electric Vehicle Association defines light electric vehicles as follows. "*Light electric vehicles are defined as battery, fuel cell or hybrid-powered two- or three wheel vehicles generally weighing less than 200 pounds (100 kg)"* (Extraenergy, 2009).

However, this definition is of age and today, a broader definition would be useful to incorporate all the actors on the market that consider themselves to be part of the light electric vehicle movement. The service designed in this project is not only suited or meant for these small LEVs defined above. Bigger LEVs offer better weather protection and more space for cargo which makes them more attractive in certain use cases compared to the smaller bike-like LEVs. When LEV or light electric vehicle is mentioned in this report, the bigger kind is also included. Below, two different types of these bigger LEVs are presented.

2.6.1 ZBEE

The Zbee is a three wheeled vehicle developed and manufactured by Clean Motion (see Figure 2.3). It is powered by a lithium-ion battery and comes in two variants. One has a top speed of 45 km/h and the other 25 km/h. The Zbee has three seats, a luggage compartment and weighs in at 280kg.

Figure 2.3: A Zbee

2.6.2 RENAULT TWIZY

Renault Twizy has four wheels and comes in two variants (see one of the models in Figure 2.4). One is classed as a quad bike and has a top speed of 80 km/h. The other is classed as an electric moped and tops out at 45 km/h. Both models are powered by a lithium-ion battery. Renault Twizy has almost two seats, space for cargo and weighs between 446 and 474 kg depending on model.

Figure 2.4: A Twizy

2.7 Mixed Mobility

The term mixed mobility refers to a transportation system where many different means of transportation are being used for a single journey. An example of a person utilizing mixed mobility to get to work could look as follows. Taking the bike to the local train station. Taking a train to the city centre. Catching an *Uber* the last kilometre to work.

2.8 Shared Economy

Shared economy has a number of different meanings and contexts in which it can be used. When the term is mentioned in this report, it refers to being part of a service where a product is shared between other members of the service. A carpool for instance, is in that sense a shared economy system (Rudebeck, 2015).

2.9 About the Technology

The technology being used to enable autonomous drive by LEVs is very cheap in comparison with what is used to make regular cars autonomous. Cameras are mounted at the front of the vehicle. These cameras record everything that the front of the vehicle sees. When the vehicle drives along a route that it has already recorded, it recognises the route and can drive along it autonomously. In other words, in order to enable autonomous driving on a route through OLABs technology, the route first needs to be driven manually.

The technology is still in development. In order for the technology to make vehicles autonomous, legislation must catch up and allow autonomous vehicles on public city streets.

3 Phase A - Exploration

This chapter describes the methods, processes and results from the first, exploratory phase of the project. Interviews, a workshop and literature study was used to investigate potential opportunities for autonomous LEVs. In the end of Phase A, a context is chosen.

3.1 Methods and Process for Phase A

3.1.1 SEMI STRUCTURED INTERVIEWS

A number of semi structured interviews were held. When conducting a semi structured interview, the goal is to collect qualitative data from the interviewee. A number of topics or broad questions are prepared to keep the conversation within the relevant topic. However, the conversation is quite open and the interviewer uses a technique called probing to elicit thorough answers from the interviewee. When probing, the interviewer poses short follow up questions like "*What do you mean by…?"* or "*Why do you think that is the case?"*. (Bligård, 2015)

These people were interviewed in the project, as they had relevant perspectives related to the project:

Male, CEO, LEV manufacturing company

Being the CEO of a company that designs and manufactures a LEV, this interviewee has many insights regarding the obstacles and opportunities that is related to creating successful LEV mobility solutions. How are people in general reacting towards a LEV? What markets do you feel has potential? All questions can be found in Appendix 1: *Interview Questions.*

Male, Team Lead and Software Development Process Therapist, LEV taxi company

The aim of the interview was to find out what opportunities and threats the LEV taxi company has found when it comes to running and expanding a LEV mobility service. Which is their primary user group? Is the municipality showing interest in the mobility service? All questions can be found in Appendix 1: *Interview Questions*.

Male, Front Figure and Art Director at a LEV manufacturing and sales company

The interviewee has been involved in the journey the LEV company is making almost since the beginning. He has a lot of insight into the organization and the strategic decision that has been made along the way. What short term- and long-term problems are you trying to solve? Which business models have you considered? All questions can be found in Appendix 1: *Interview Questions*.

Male, Senior Digital Product Designer at a digital innovation company

This company works a lot with creating what they call demo experiences; developing, designing and presenting something that doesn't yet exist. The aim was to learn more about how such a project process might look and how to deal with the challenges it presents.

3.1.2 WORKSHOPS

In a workshop, a creative meeting with a group of people occurs, to explore an area of interest or to solve a task. (Wikberg, Nilsson, Ericson and Törlind, 2015) The participants may be users, experts, or people without any connection to the project. An aim is defined in advance to the workshop, so that a schedule can be created, which will facilitate to achieve the aim. Usually, the workshop starts with a short warm-up exercise, before exploring the area of interest with creative methods.

3.1.3 WORKSHOP 1: EXPLORING THE CONTEXT

Aim

The aim of the first workshop was to:

- Explore different contexts in which an autonomous LEV service could be used
- Map out common journeys the participants make on a regular basis.
- Investigate the participants' wishes regarding travelling in the city

Selection of participants

For this workshop, participants that were known to have the ability to think freely and be creative were chosen in order to be able to fulfil the first aim described above. Seven participants were recruited. All of them were students at Chalmers University of Technology. Figure A.1 enlists all participants with additional details.

	ID	Gender	Age	Car	Occupation
Workshop 1	W1P1	Woman	23	No	Student
	W1P2	Woman	24	No	Student
	W1P3	Man	25	No	Student
	W1P4	Woman	26	No	Student
	W1P5	Man	28	No	Student
	W1P6	Man	24	No	Student
	W1P7	Woman	25	No	Student

Figure A.1: Participants of Workshop 1

Procedure

First, the participants listed and discussed trips they make regularly and less regularly. Then, they ideated on the most desirable way to get from one destination to another and discussed their reasoning. The workshop ended with another ideation session in groups regarding in what contexts LEVs could bring value to people. The full procedure is described in Appendix 2: *Workshop 1 Procedure.*

3.1.4 THE KJ-METHOD

The KJ-method (The Kawakito Jiro Method) is a method of analysis with the purpose to compile and structure a united perspective on a large amount of data. All of the collected material is printed on paper, colour coded in relevant themes and then sorted into subject piles. Irrelevant data is eliminated by hand. As the piles grows larger they might be divided into new, smaller piles. This process is done with the entire project group, to give a deep and united perspective to all members. The process results in groups of data that are easy to review to identify user needs and pain points. (Scupin, 1997)

Qualitative data from workshop 1, the interviews introduced above and literature studies mentioned below, were gathered and structured using the KJ-method. The resulting clusters of information were reduced and used as inputs for the sight map and list of requirements. The full document can be found in Appendix 3: *Summary from the KJ-method.*

3.1.5 LITERATURE

Four reports with relevance to the thesis were read (Hansson and Härdfeldt, 2014; Hasselqvist, Hesselgren and Bogdan, 2016; Hasselqvist and Hesselgren, 2016; Pernestål Brenden, Kristoffersson and Mattsson, 2017). Interesting findings from the reports were noted and used as additional input when analysing information from the interviews and workshop 1.

3.1.6 EXPLORING OPPORTUNITIES

In order to get an overview of where LEVs could potentially bring value, a mind map of different contexts and usage situations was made. The mind map can be found in Appendix 4: *Map of Opportunities*. Ideas and inspiration was taken from Workshop 1 and from the different interviews held previously as well as from literature.

3.2 Results Phase A: Exploration

In this phase, it is explored where a shared transportation service using fully or partly autonomous LEVs can bring value. What are LEVs being used for today and which services already exists? What are the challenges and opportunities for LEV as a vehicle group and means of transportation?

3.2.1 SUMMARY OF INTERVIEWS

This chapter presents a summary of the interviews in bullet form. In Appendix 5: Interview notes, the content of each interview is presented more in detail in text along with a short description of the different companies interviewed.

LEV manufacturer and sales company

- The interviewee said that their LEV sells itself as soon as you start looking at the amount of money that the customer would save compared to a regular car.
- Because of a vast number of people still being unfamiliar to, and uninterested, in shared living, the LEV company will launch their product for independent ownership. Later on, a shared ownership offer will be introduced.
- The LEV company aim to please both early adopters and more conservative customer segments by launching the product with two different steering options.
- Focusing on the last mile journey, the LEV ships with a modular battery that the user can charge at the office. This is a solution that enables the LEV to bring value to urban cities even before charging stations are widely available.

LEV taxi service company

- The taxi service company wants to change the transportation behaviour of urban citizens and is therefore available at all times, even though it is not very profitable at some hours of the day.
- The taxi service company wants to complement, and not compete with, the public transport system.
- The average distance for a LEV taxi ride is two kilometres, meaning it is being used for last mile journeys in a mixed mobility behaviour.
- The interviewee finds interest in building a concept where the vehicles could be distributed autonomously. A business model where three parties work together is believed to be successful. One party provides the technology, one provides the vehicles and the last provides the service itself.

LEV manufacturer

- The interviewee believes that LEVs is the answer to many of the problems that is arising in urban cities related to transportation, but that there initially are several challenges in making it profitable.
- The interviewee believes that a LEV taxi service with chauffeur can initially bring value to the passengers and the service as a whole. The

reason is that it might be perceived as easier to try out a new service if the user does not need to learn how to drive a new type of vehicle.

3.2.2 WORKSHOP 1: USER HABITS

The workshop partly resulted in ideas on where a LEV service could be used and partly in findings regarding the participants travelling habits within the city of Gothenburg. The result is presented in greater detail in text in Appendix 6: *Workshop 1 Findings*.

- A LEV service could possibly be implemented in controlled areas like high school campuses, fair areas or in business parks. Another commonly mentioned context were cities, targeting everyday people, tourists or transportation of goods.
- Most participants had about five places to or from which they travel very frequently.
- One participant paid extra when travelling long distances by bus to be given privacy.
- One participant said she doesn't enjoy a certain bus because it takes a route that goes by places she would rather not see or visit.
- Many participants mentioned door to door transportation and privacy to be important when asked to describe the perfect means of transportation.

3.2.3 CHOSEN CONTEXT - SHORT DISTANCE TRIPS IN URBAN CITIES

Short distance trips in urban cities was chosen as the context to focus on for a number of reasons. Firstly, in order for LEVs to be adopted quickly, they need to be visible for, and easily accessible by, as many people as possible. In this regard, the urban context was believed to show great potential compared to other contexts brought up in workshop 1. The LEV service could potentially solve issues with congestion and global and local environmental issues by speeding up the diffusion of electric vehicles and autonomous drive. Secondly, a taxi like LEV service could potentially meet some of the key features of an attractive urban means of transportation that the participants in workshop 1 was asked to describe. Lastly, the few already available LEV transportation services seems to be doing well in the urban context. Examples include Bzzt in Stockholm, Sweden and Toyotas LEV sharing program Ha:Mo in Grenoble, France.

The value that a taxi like LEV service could bring is further increased when taking autonomous drive into account. Then, the vehicles could drive themselves to the customer's door, who could do other things while riding along to his or her destination. The technology that this project is sprung from is cheap and could

potentially be implemented in a LEV service today. The service could grow incrementally as user adoption increases and laws and regulations catch up. The amount of autonomy introduced in the service could increase in tandem. By incrementally introducing autonomy in the city, perhaps citizens and government will look at autonomy in another way. It might not be as daunting to start implementing it, if it is present in our lives and developing in front of our eyes. This hypothesis, that an incrementally implemented autonomous LEV service could bring value to people in its initial phases as well as later phases, was decided to move forward with and is laid out more in detail in chapter 7.2.1 Horizons.

3.2.4 SUMMARY OF PHASE A

The LEV movement is facing a number of challenges. Examples include:

- Making the business profitable in early phases.
- Implementing a shared economy business model in a society where private ownership is dominating
- Getting people to choose a new type of vehicle and introducing LEVs in an infrastructure built for big vehicles

On the other hand, LEVs show great potential for the urban city. Examples include:

- Increasing the utilization rate of vehicles through shared ownership
- Decreasing congestion thanks to the small vehicle size
- Improving the local environment thanks to the electric engine and low noise from the vehicle in general
- Creating a safer city environment thanks to the low weight and speed of the vehicles
- Providing an attractive last mile journey alternative to walking or taking a taxi

In conclusion, it is plausible that an incrementally implemented autonomous LEV service, focusing on short distance trips within the urban city could bring value to many.

4 Phase B: Service Outlines

This chapter describes methods, processes and results from exploring questions such as: What type of users would find most value in an autonomous LEV transport initially, in an urban environment? When would they need this type of service? How should the service best serve the users to best suit their needs?

4.1 Methods and Process for Phase B

4.1.1 EMPATHIC MODELLING

Empathic modelling is the name of a method that is typically used when designing something for users with impairments of some kind. The designer then puts him or herself in the user's situation. For instance, if a new building layout is being designed, the designer could move around in a similar building using a wheelchair in order to get a better understanding of how that context performs for users in need of wheelchairs.

In this project, the method was used when ideating in the initial phase on what the user journey could look like. The project members took to the streets with a mobile phone in their hand, as if they were using the service that is to be designed. It gave the project members a sense of what functionality might need to be included in the application by breaking down a journey step by step. After these quite structured sessions, it was easier to keep the real context in mind throughout the design phase.

4.1.2 CUSTOMER JOURNEY WITH EMOTIONAL DIAGRAM

A customer journey is a visual representation of what a customer goes through when for instance purchasing a product or using a service. A customer journey focusing on a service typically goes through the stages of how the customer becomes aware of, joins, uses and leaves the service.
In this way, the customer journey identifies the key interactions that the customer has with the company providing the service. Having these clearly defined, and knowing how the customer interacts with them, makes it easier to design a positive experience for the customer. In order to more clearly focus on the experience and emotions elicited throughout the journey, one can choose to include looking at what the user thinks, feels and experiences. This can be noted down in words or displayed in an emotional diagram, which is a graph representing the customers positive and negative feelings elicited throughout the journey. Finally, one can highlight opportunities for redesigning the service based on the emotional graph (Risdon, 2013).

4.1.3 WORKSHOP 2: USERS HABITS

Aim

The aim of the workshop was to:

- Map out participants' common journeys

- Get insight into what preferences and wishes the participants would have before, during and after their journeys.
- Discover eventual pain points and subjects of joy occuring before, during and after journeys.
- Investigate where participants imagine that autonomous LEVs might bring value to their current and future travelling habits.
- Investigate the participants' attitudes towards adopting this vehicle service in an early stage.
- Shallow investigation on participants opinions regarding sharing of data when using the transport service.

Selection of participants

For this workshop, plausible early adopters of a transport service for the urban environment were sought after. The participants selected were tenants at HSB Living Lab in Gothenburg. HSB Living Lab is an accommodation where tenants participate actively and passively in collecting data for research on sustainable living. The full procedure is described in Appendix 7: *Workshop 2 Procedure,* and all participants are enlisted in Figure B.1 bellow.

	ID	Gender	Age	Car	Occupation
Workshop 2	W2P1	Man	23	No	Student
	W2P2	Man	22	No	Student
	W2P3	Man	22	No	Student
	W2P4	Man	43	No	Researcher
	W2P5	Woman	24	No	Student
	W2P6	Man	23	No	Student
	W2P7	Man	24	No	Student

Figure B.1. Participants of Workshop 2

Procedure

First, the participants wrote down their most common destinations. In a card game like exercise, they discussed how their choice of transportation to these destinations would change given certain conditions such as rain or having to bring a one year old child. Lastly, the participants got to imagine how they would like to use a LEV service by creating a customer-journey-like mind map.

4.1.4 FLOWCHARTS, DATA ELEMENTS & FUNCTIONAL ELEMENTS

A flowchart is a type of diagram that displays a customer journey, a workflow or a process. It shows the contents of the process in boxes of various kinds, and displays order by connecting the boxes with arrows.

In a detailed flowchart, the box contents can be divided into data elements and functional elements. Data elements are typically the fundamental subjects of interactive products. These objects are for example e-mail messages, photos and customer records; basically, the units referred to, responded to and acted upon by the user. Functional elements are the operations that can be done to the data elements and their representations in the products interface. They include tools and ways to structurally and visually manage data elements. (Cooper, 2014).

4.1.5 OUTLINING SERVICE

In this phase, the idea of where the LEVs could be used, and how they could be used to bring the most value, were ideated on. Given the findings on user groups, use scenarios and knowledge on how the technology works, a basic core idea could be defined. This basic idea was then iterated throughout the rest of the project.

4.2 Results from Phase B

4.2.1 WORKSHOP 2: USER HABITS

Results regarding the participants' travelling habits are discussed in chapter 3.2.2, Workshop 1: User Habits, as the first part of the workshop was the same. The full results from workshop 2 is presented in Appendix 8: *Workshop 2 Findings*. Below, a condensed version of the findings is presented.

Participant motivation for using a LEV service

- Being able to achieve door to door transportation
- Using a, in many aspects, sustainable transportation option

Things that would make the service less enjoyable

- Having to look for parking
- If the LEVs drive slowly
- Bad weather, as some LEVs are open on the sides

Things that would make the service more enjoyable

- Being able to do other things when driving autonomously
- If the waiting time for a vehicle is low

Quotes from the workshop

"If I had this as an option, I would leave my carpool right now"

"If this was an option I would seriously consider it today, as Västtrafik is lacking on the connections I need"

"The flexibility in where I can start and end up is a big plus!"

"I don't feel safe in those. There are a lot of bigger vehicles going fast within the city"

"I walk or take the tram. A service like this wouldn't be necessary for me."

"The vehicle size affects my stress level when I navigate in a city centre."

Attitudes towards sharing data

None of the test participants were negative towards that their routes would be recorded and the data shared. However, the participants all had an interest in technology and some of them considered themselves to be early adopters. Perhaps not all users are as open towards sharing data and if so, the way that the user receives information about how the system works and stores data must be more carefully designed. This hypothesis, that users may feel differently towards sharing data is brought up in a report of Ericsson's 10 Hot Consumer Trends of 2017. It to paints a picture of a landscape where some consumers are open towards sharing data while others prefer using encrypted services (Ericsson ConsumerLab, 2017).

4.2.2 IDENTIFIED USER GROUPS

A large number of different potential user groups were considered. However, the result from the workshops and the exploration done in Phase A, narrowed the focus down to two different user types: the 'I don't care, get me there'-users and The Recorders.

I don't care, get me there (IDC)

An IDC user typically belongs in the early or late majority. S/he uses the service because of the flexibility of door to door transportation. S/he wants to get from A to B as quickly as possible and thus prefers driving the vehicle manually. An IDC user has a quite well-paid job and works and/or lives in the city centre. S/he also has a few other points of interest in the city that s/he regularly visits such as the gym. Typically, s/he will not use the service systematically to, for instance, go to work, but rather when having other errands to run, when needing to carry additional luggage or when being in a hurry.
To use the service, s/he is prepared to pay a higher price than public transport but less than a regular taxi.

The Recorder

A *recorder* is typically an early adopter or in the early majority. Being an early adopter fits the user's self-concept. *The recorder* is fascinated by the transportation service and the technology it utilizes. S/he sees the potential the service has and uses it partly for its utility and partly because of the benefits it can bring him- or herself and society in the long term. The recorder finds autonomous drive intriguing and wants to be a part of the community that assists in developing and improving the service. S/he has a general interest in technology and is up to date on autonomy, shared living and other related buzzwords.

Comments on categorization and where to focus

The categorization of user types was helpful when discussing and designing the service concept. The IDC category helped the project group make sure not to forget about the importance not making the design overly complicated, as the IDC group simply wants to go from A to B.

Most people fall under the user type *IDC*, though in reality, users are often a mix of the two user types. A single user can also fall under one user type definition one day and under the other the next day. However, it is crucial that the main value of the service, which is to provide an attractive door to door transportation service, is verified first. This rational need is present in both user types. Satisfying *recorders* special needs is also important, as it opens up opportunities to involve users in the development of the service. But the main value could be tested without investing time and money into satisfying the recorders. For this reason, the part of the service that involves getting a customer from A to B will be focused on initially.

4.2.3 USE SCENARIOS

Below, three scenarios are described. Each scenario represents a type of trip that is commonly being made within the city. These trips are based on the findings from the two workshops.

More planned trip

In this scenario, the user is heading for an important meeting or event. This could be rare events such as a job interview or a dinner in the city centre. But also, more common events such as catching a train at the central station or going home from the grocery store after shopping. The journey could provide time to relax and turn inward before an important meeting. If the vehicle can host several passengers the journey can be used to get in the mood with friends or dinner guests.

It is important for the user that the vehicle arrives on time. S/he is willing to prepare this trip in advance and get familiar with the system beforehand in order to assure that the journey will be smooth. S/he wants to experience a door to door transportation. The user prefers whichever route is the most reliable and prefers to go autonomous. S/he is prepared to pay a moderate amount of money for the trip. Figure B.2 summarizes this scenario.

Figure B.2: Simple user journey for a more planned trip. Heading to an important meeting.

Less planned trip

In this scenario, the user is turning to the service more or less on the spot. Perhaps s/he just missed the bus or had planned to walk but the weather quickly took a turn for the worse. These trips could also occur when in a hurry and no other affordable alternative will get him or her there on time. The user wants quick and effortless access to vehicles. S/he wants to get going as soon as possible and is willing to walk to a pick-up point if that results in quicker access. During the journey s/he prefers the quickest route available. The user is willing to pay slightly more than public transport. Figure B.3 summarizes this scenario.

Figure B.3: Simple user journey for a less planned trip. Going home in the rain.

Regular trip

These are trips that are expected and occur frequently. Trips include travelling to work in the morning, attending the weekly book club meeting or picking up a child at preschool. These trips might be multi modal, using the service to get to a certain bus stop. The user wants the service to integrate smoothly into the daily

routine and a vehicle to arrive, for instance, every day at 15:30. The user needs to be able to adjust the pickup time slightly to compensate for irregular behaviour such as oversleeping. S/he would rather go autonomously and do other things while travelling but is willing to go manually in order to optimize the route in the start. S/he wants to know the periodic, say monthly, cost of the service and pay in advance. Figure B.4 summarizes this scenario.

*Figure B.4: Simple user journey for a regular trip. Heading to work in the morning. *Setting up is only necessary the first time!*

4.2.4 LEV TRANSPORT SERVICE FOR URBAN CITIES USING OLABS TECHNOLOGY.

Below, it is described how a LEV transportation service, using OLABs autonomous technology, is believed to work. The service could be launched today but would have to develop over time in order to reach the vision of an autonomous door to door transportation service.

A LEV Transportation Service

The type of transportation service that was decided to be designed in the project is a taxi service where the user is his or her own chauffeur (see Figure B.5). The idea is that a user can order a vehicle that arrives at their doorstep, enter it, drive it wherever the they desire and leave it there without having to look for parking. In other words, a door to door transportation service using LEVs. By using OLABs technology, autonomous drive could be introduced to the service. This would result in the vehicles being able to drive themselves to, and between, customers. It would also allow the users to do other things while riding along. Potentially, other user groups might also find value in the service when it is autonomous. What makes this idea interesting is that OLABs technology could be installed in the vehicles today and prepare the service to be the first autonomous door to door transportation service once autonomous drive is legalised sometime in the future. How the service is expected to move through these horizons is explained in chapter 7.2.1 Horizons.

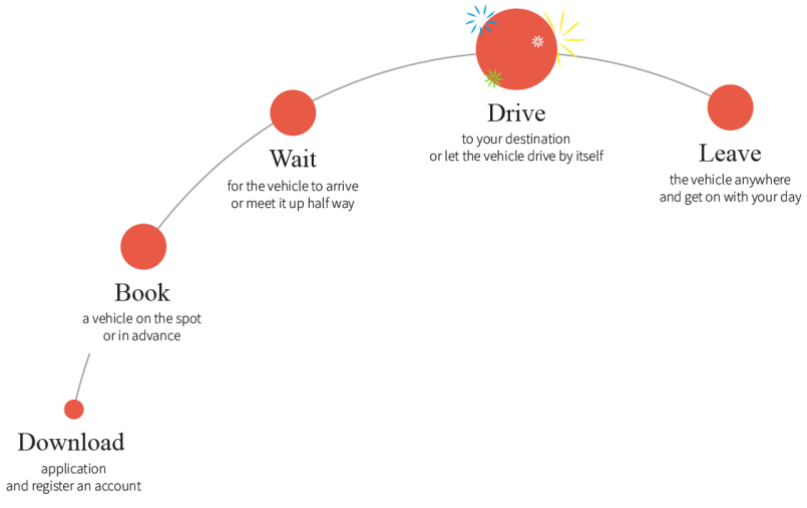


Figure B.5: A simplified version of the customer journey, only showing actions taken by the customer. This version also omits many of the actions. A complete version of the customer journey can be found in Appendix 25: User Journey.

Central network of routes

In order for the service to become autonomous using OLABs technology there needs to be a connected network of recorded routes in the city centre. Without it, the vehicles can no longer distribute themselves between customers. For this reason, it is important to define a central network that should always be up to date and that can guarantee that the LEVs can drive autonomously on them. Up to date means that it is re-recorded often enough to encompass changes in the traffic environment such as construction work.

When deciding which roads, bike lanes and paths to include in this central network, a few things are important to consider.

- How dense should the central network of routes be? The denser the network is laid out, meaning the more streets that are included within a certain area, the higher is the probability that a certain customer achieves door to door transportation. If only a few streets are included, almost all customers would need to walk a few hundred metres in order to get to the vehicle. On the other hand, a very dense network could potentially be very expensive to keep up to date. These two parameters need to be analysed in order to come up with a good decision.
- If the service is to complement what the public transport system offers, the central network of routes can preferably be laid out where public transport is not available. Figure B.6 shows all the streets, marked with a black line, on which buses and trams drive in Gothenburg. All bus- and tram stops are marked with a black square. An example of where the central network of routes can be laid out is shown in Figure B.7 in orange. As shown, the LEVs can trafficate along streets that offer something else

that just a way to get from one point to another. For instance, they could move along the canal in Gothenburg; a quiet route with nice views that gives the customer added value. The transportation habits of people can also be considered. What are important points of interest that people regularly visit in town, to or from which a LEV could be an attractive means of transportation? Such findings are presented Appendix 8: *Workshop.*

Figure B.6: The black squares and black lines show public transport stops and routes.

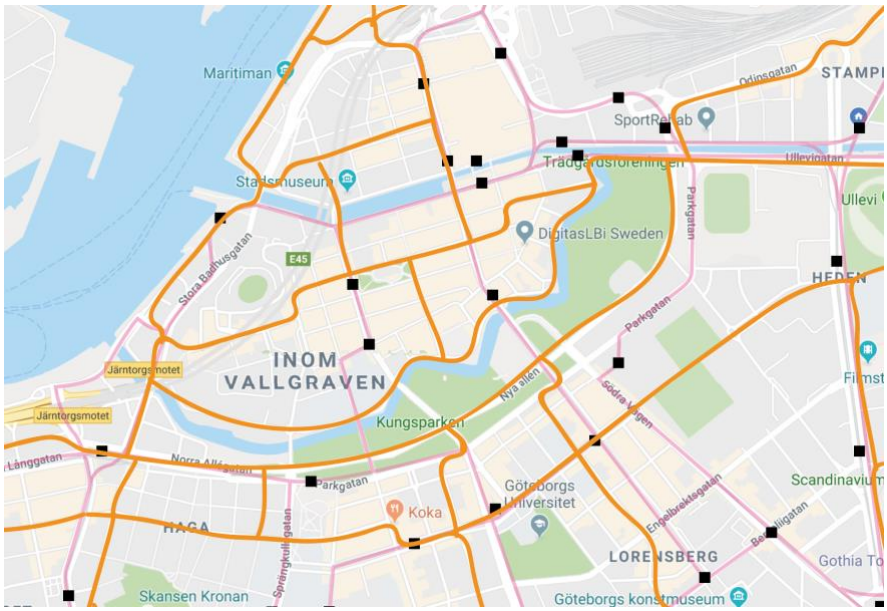


Figure B.7. The orange lines show where a LEV service could provide value.

Who should record the central network of routes?

It does not necessarily need to be done by the start-up owning the service. Other parties, such as restaurants and nightclubs could be interested in recording a route that goes by their location. It would give the restaurant publicity and customers would have the option to try the LEV service when visiting their restaurant. Organisations such as football teams could be interested in recording routes in exchange for money. Perhaps they are willing to accept a lower payment than what it would cost the start-up to use their own employees to do so. Finally, a way to expand the service that shows great potential is through user involvement. By using gamification and other means to create motivation, early adopters might find value in investing their time in growing the community and service.

Expanding the service

In order for the service to expand, more routes need to be recorded. The goal is to have every street in the city recorded, allowing the vehicles to drive autonomously to every address in the city. During the initial interviews and tests, it was found that some people find it plausible that they would record their own routes if given the possibility. This would mean that they can achieve a door to door transportation to certain destinations by investing some of their time in recording the route. Since the vehicles are recording all the time, the user would have to drive from the closest recorded route, to their final destination and back again. Depending on how the technology deals with newly recorded footage, the user might have to wait a certain time until the newly recorded route can actually be used.

Figure B.8 - 10 below show how an expansion of the network could look given that it is expanded by the users themselves. First, only the central network of routes is in place. Then, a few users who regularly use the service record the routes to their destinations. These users can now get a vehicle to drive all the way to their front door to pick them up. They can also leave the vehicle at their front door as it can drive autonomously away from there via the recorded route. When the number of users increase and more people start recording their own routes, many separate routes will eventually be connected, forming a denser network. It is also important to note that most of the city will probably be recorded when users are driving towards their final destination. Only streets that are very rarely used, or the final 20 meters to someone’s door, might be in need of being recorded separately.

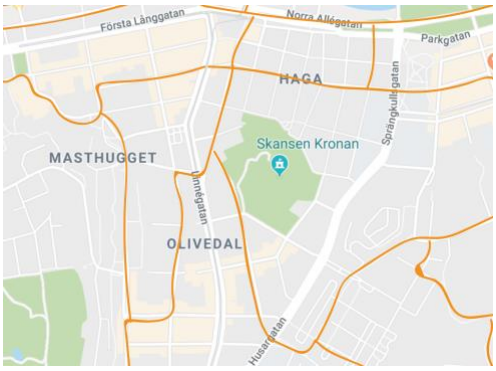


Figure B.8. The central network of routes.

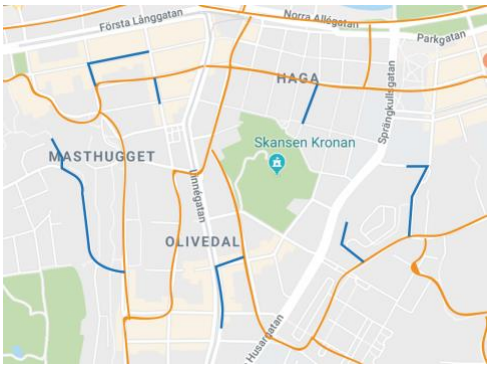


Figure B.9. The central network of routes slightly extended by users.

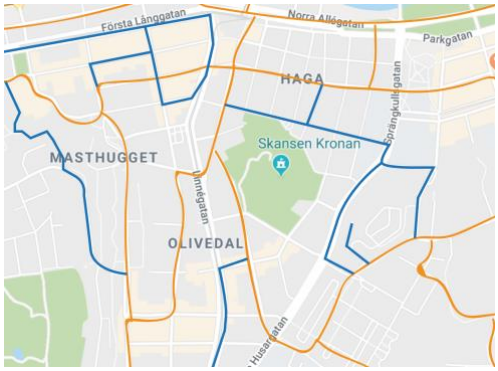


Figure B.10. A denser network forming because of many new routes being connected.

4.2.5 DESIGNING THE APPLICATION: FORM FACTOR, INPUT METHODS AND POSTURE

The form factor mobile application was chosen because the interface needs to be accessed by the user from anywhere as well as when driving the LEV. Allowing the users to use their own mobile phone when driving might also increase the

feeling of a personal vehicle even though the service is shared. It is also believed that the perceived control and flexibility is increased when all interaction with the service in done via a single device. In order to ensure that the service could be implemented as soon as possible by the start-up, and hence easily adapted by the target group, the interface prototypes were made based on mobile technology common in the spring of 2018.

The primary input method will be the user's fingers, interacting with the mobile's touch screen. A complimentary input method will be the GPS position of the user, required by the GPS mode.

The applications posture differs throughout the user journey, as the users focus and need for feedback and information varies a lot. Before and after the ride the app acts as a handheld, standalone posture. (Cooper, 2014). This means that it shares attributes with both transient and sovereign postures (see chapter 2.4 Coopers Interaction Design Framework). Like a sovereign application, it requires full screen access, functions accessible via toolbars, and sometimes includes dialog screens or pop-ups. However, it will also make use of comparatively large controls and text, due to limitations with finger based input. Also, the required interactions need to be short and easily understood by a user whose attention is mainly focused on for instance finishing up an activity prior to the ride itself, or driving the LEV. This requires transient posture characteristics.

Finally, the interface might need to provide the option of audio instructions during GPS mode, as the choice of form factor results in a very limited screen size, and the placement of the phone might be relatively far from the user.

4.3 Summary Phase B

Two user types were defined based on the findings from the two workshops; I Don't Care (IDC-users) and Recorders. The trips they are most likely to make were defined as less planned trips, more planned trips and regular trips.

It is believed that the solution could complement current transport solutions, as an autonomous taxi service that arrives on demand. Basic components of the mobile application such as interface form factor and posture were defined based on user goals.

The idea of a gradually growing autonomous network, expanded by user collaboration, originated. It is believed that implementing and developing the autonomous technology and service together with the users, creating a community feel, can help overcome challenges such as initial profitability and acceptance towards sharing vehicles.

5 Phase C:

Main Structure of interface

This chapter describes methods, processes and results for answering the following questions: 'What information is needed during a journey?', 'Should the users be allowed to book a vehicle many days in advance?' and 'How much should the user interact with the autonomous technology?'. Also, process and results from investigating people's general interest in an autonomous pod-taxi service through a landing page is described.

5.1 Methods and Process for Phase C

5.1.1 PROTOTYPE 1 AND USER TEST 1

Throughout this project, the experience of the interface and the service has been iterated in X rounds of prototypes and tests. The purpose of building and testing a prototype is either to identify major problems in an early concept idea, or evaluate the usability of a more refined concept. Depending on the purpose, the prototype varies in detail and the test varies in how structured it is. A drawback of prototype testing is that it mainly evaluates the guessability of the interface, since all test participants are first-time users.

Aim

The aims of prototype round 1 was to:

- Investigate different interface flows for booking and getting a spontaneous ride respectively.
- Investigate how well the fact that the users have to walk a certain distance to get to the vehicle is communicated in the interface.
- Investigate user attitudes towards not being able to get door to door transportation in autonomous mode.

This test was also used as an opportunity to get an idea of how user friendly the different prototypes were.

Prototyping

Three different prototypes were created. The prototypes were first created in rough paper sketches, then created in the software Figma. Figma is a collaborative online tool for creating responsive interface prototypes. The wireframes were kept simple in their appearance in order to bring the focus to the content and functionality.

Selection of participants

People recruited for this test fell within the IDC group, because they are most likely to be the primary early majority of users. All participants are listed in Figure C.1.

	ID	Gender	Age	Car	Occupation
Test 1	T1P1	Woman	33	No	UX
	T1P2	Man	37	Yes	Art Director
	T1P3	Man	41	No	Art Director
	T1P4	Man	35	No	Art Director
	T1P4	Woman	29	No	Student

Figure C.1: Test participants of User Test 1

Procedure

The participants completed tasks related to initiating a trip on three different prototypes.
After the tasks had been completed, a discussion about the test participant's transportation habits and preferences were held (see Figure C.2). A detailed explanation is given in Appendix 9: *Test 1 Procedure*.

Figure C.2: Image from a discussion during the first user test. Paper prints were used to facilitate the discussion.

5.1.2 LANDING PAGE

A landing page is a stand-alone web page that often has the purpose of receiving potential customers contact information or raising interest for the main website by presenting it in a easily digestible way on the landing page. (The Landing Page Course, 2018)

Purpose

In this project, the purpose of the landing page was to get to know, and get in contact with, the user base. It provided possibility to extract insights from real potential users.

Designing the landing page

In order to design an attractive landing page, tips on how to write create effective copywriting and the basics of landing page design was read up on using the online resources *The Landing Page Course* and *The Copy Blogger*. In order to improve the design and copywriting of the landing page before launch, it was shown to a design strategist and a copywriter (see Figure C.3). First, a so called *five second test* was made (The Landing Page Course, 2018). After that, the participants were given more time to give feedback on the design and copywriting.

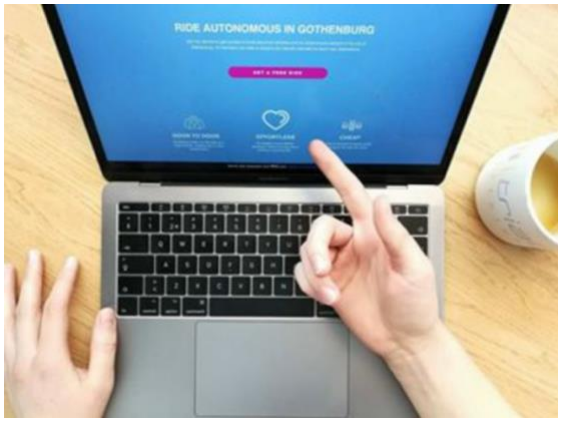


Figure C.3: Process picture from designing the landing page.

Launching the landing page

The landing page was distributed through the following channels

- On internet based forums and groups focusing on the urban environment in Gothenburg.
- On internet based forums and groups focusing on alternative electric transportation such as electric bikes and LEVs.
- On internet based forums spreading news about, and discussing, technology in general.
- Via a design agency newsletter sent out to all Nordic offices.

Gathering data from sign ups

Google Analytics was connected to the website to gather quantitative data about the visitors. An email was sent to the people who signed up on the landing page. The email contained more information about the project and in which phase the project is currently in. A questionnaire, that had been set up online via the website *Typeform*, was sent out in the same email. The aim of the questionnaire was to get to know more about the people who signed up, their transportation habits and why they were interested in the shared LEV service presented on the landing page. The full questionnaire can be found in Appendix 10: *Landing Page Questionnaire*. Later in the process, another email was sent. This email

contained an invite to the second prototype test described in detail in chapter 6.1.1 Prototype 2 and User Test 2.

5.2 Results from Phase C

5.2.1 PROTOTYPE 1 AND USER TEST 1

Three prototypes with different interaction flows regarding initiation and managing of journeys were designed. The prototypes were also given other minor differences in order to spark discussions.

Prototype 1a - *Booking in advance*

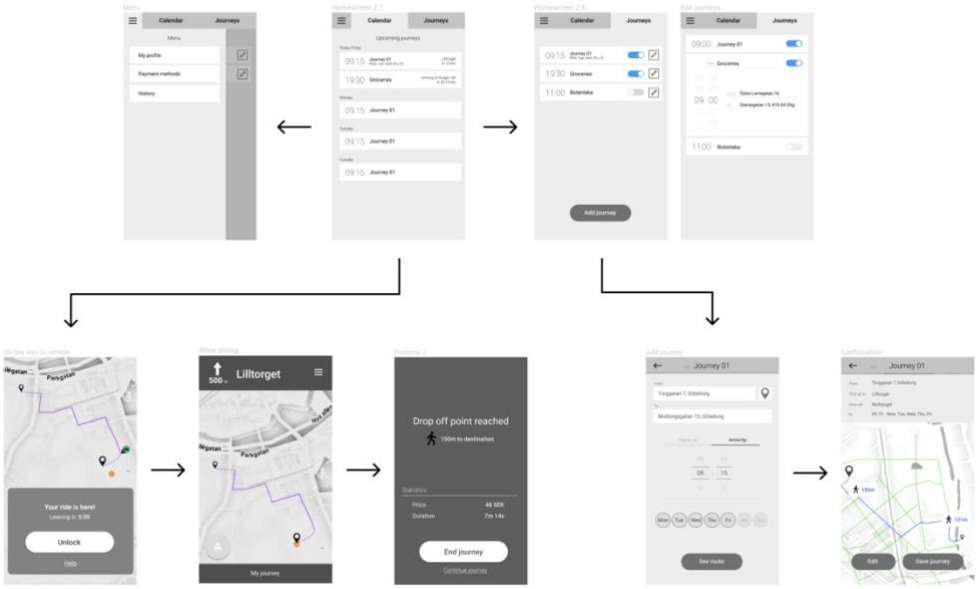


Figure C.4: Frames from prototype 1a.

This concept is based on booking trips in advance. For instance, if the user wants to go from home to work every day at 7AM, a booking can be made so that a vehicle shows up every day at this time. The home screen features two tabs (see Figure C.4). In the *Journeys* tab, an overview of the created bookings is presented. Here, bookings can be activated, deactivated, edited and added. Much like how an alarm works on mobile devices, if a booking is active, a vehicle will show up at the set pick up point at the set time on the days chosen. In the *calendar* tab, the upcoming journeys are listed. If the user wants to make a single trip that will not recur, a booking still needs to be made but set to not repeat.

Prototype 1b - *Booking on the spot*

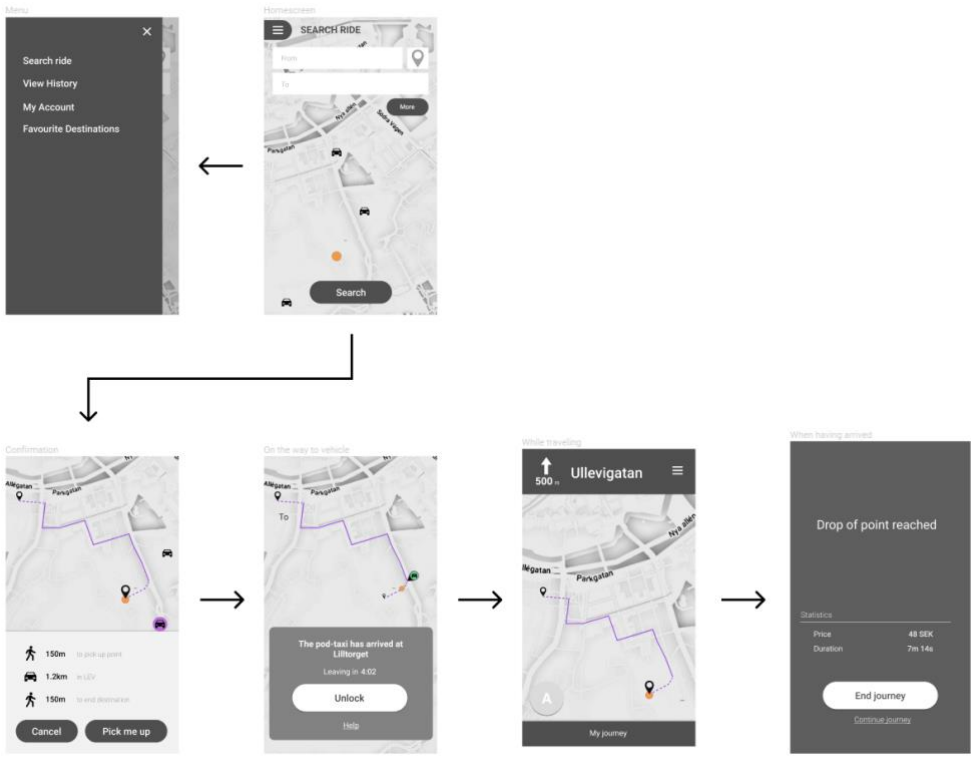


Figure C.5: Frames from prototype 1b.

This prototype is the opposite of prototype 1a. The home screen features a map view where the user can overview nearby vehicles and order a single trip (see Figure C.5). Once the details have been filled in, the vehicle starts moving towards the pick-up point. If the user wants to make a certain trip every day, that trip needs to be ordered manually each time.

Prototype 1c - *The golden middle ground*

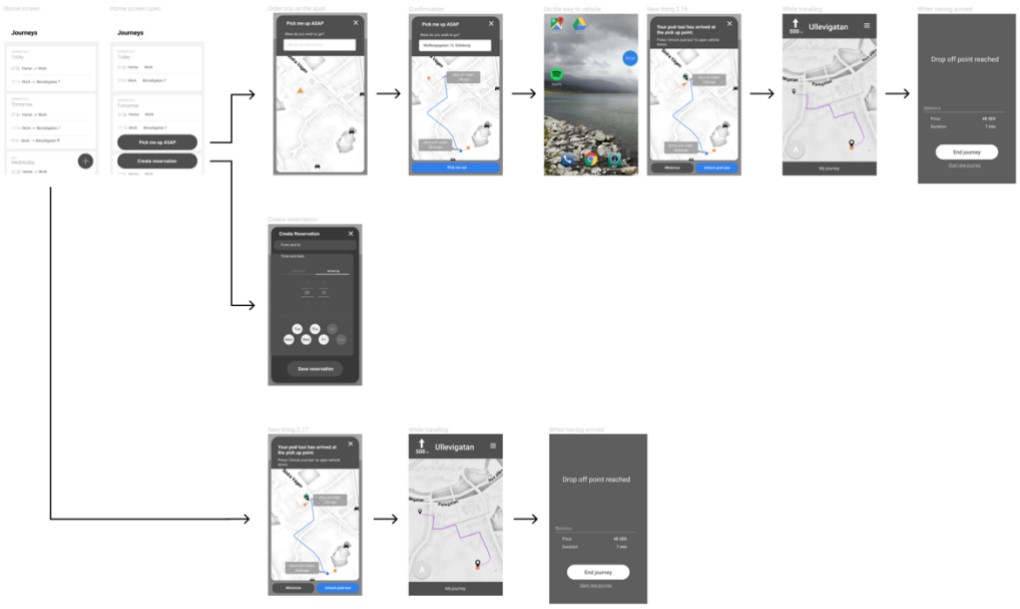


Figure C.6: Frames from prototype 1c.

As the name suggests, this prototype is a mix of the two. It features easy access to both ordering a vehicle on the spot and booking one in advance. The home screen provides an overview of the upcoming trips (see Figure C.6).

Spontaneous vs planned trips

The findings are presented in Appendix 11: *Test 1 Findings*. Below, selected findings are presented.

Below, a few reasons to why booking trips spontaneously was preferred, over having a recurring schedule-like booking system, are listed.

- Activities that occur frequently does not necessarily occur at the same time every time
- Many participants had flexible work hours and went to and from work at slightly different times every day
- It was perceived as easier to book a new trip spontaneously than having the adjust a previously set recurring booking
- Participants were already familiar with the app flow of booking a spontaneous trip from other apps like *Uber*, *Reseplaneraren* and *Google Maps*

However, booking trips in advance was perceived as powerful when needing to book a return trip from an errand such as grocery shopping or exercising.

Decision: Prioritize impulsive trips

To make the implementation of the service easier, the possibility of booking a trip spontaneously should be the highest prioritisation in an MVP-product when launching the service. However, allowing the users to book in advance can, in some cases, increase the value provided by the service and should be implemented in later horizons. In an early horizon, it is also important that the service is readily available for everyone to try. Allowing users to schedule recurring bookings could result in few vehicles being available for new customers.

5.2.2 LANDING PAGE

The landing page is available at: *https://autonomtaxigbg.wixsite.com/joindemo*
The landing page contains a headline, three selling points, how to use the service in a three-step guide, a short description of the start-up story and a sign-up page (see screenshots in Figure C.7 – 8). The page was also designed with references to Gothenburg, in order for it to feel familiar enough for potential local test participants to click the call to action-button.

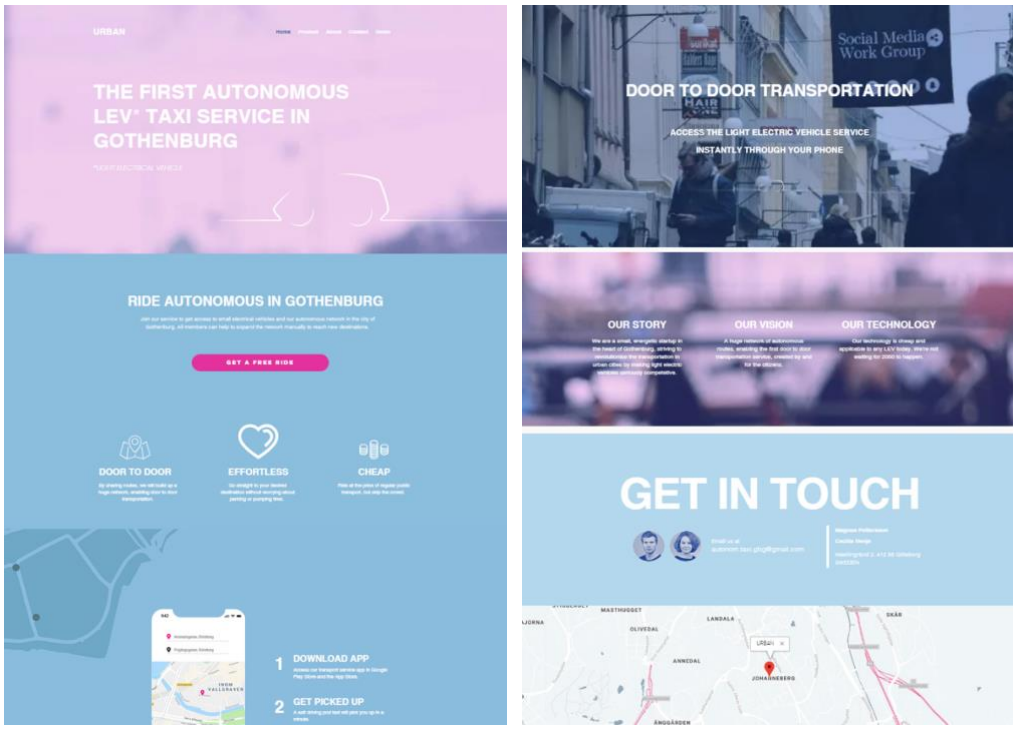


Figure C.7. & C.8: The web based version of the landing page.

Quantitative Results

Through Google analytics, and by sending an online survey to people who reported an interest through the page, lots of quantitative data was collected.

Below follows a summary of this data. All quantitative data collected from the survey is available to view in Appendix 12: *Landing Page Quantitative Results*.

Figure C.9 displays data regarding all visitors from between launching day in February 27th until April 17th, 2018. Ca 81% of all mobile visitors at the site during this period were android users, and the average length of a session was 53 seconds. 45% of the visits came from Gothenburg and 23% from Stockholm. Most other visitors were from around Sweden. Also, a few unexpected visitors were found, from Orlando, Bristol, Tbilisi, Salt Lake City and East Lansing.

Figure C.9: Unique visitors and number of session in total and per OS.

	Android	Windows	Mackintosh	iOS	Other
Unique Visitors	62	25	15	4	2
Sessions	82	29	44	4	3

22 (20%) of all the visitors at the landing page signed up to try the service or reported their interest (expressed in figure C.10). A bit more than half of all that signed up responded on the survey. Half of all of the people that responded to the survey were people between the ages 31-50 years old. 67% of the respondents were male. 50% of all that responded had an occupation in the engineering field.

N.o. sign-ups	22 (20% out of all visitors)
N.o. responses on survey	12

Figure C.10: Number of sign-ups in landing page and responses on survey.

Qualitative Results

Twelve persons responded to the survey sent out via the landing page. The answer to why they were interested in the service, can be summarized as follows:

- Finds interest in the autonomous technology
- Urban transportation is my field of profession
- Finds appeal in the sustainability aspect of the service
- Finds appeal in the utility of the service, perceived as flexible and practical

The possibility of doing other activities such as working or calling during the ride is not mentioned. The service is compared to walking, going by bus or by car and related to the activities that are possible to do when using these modes of transportation.

When asked what they would use the service for, answers commonly fell within these categories:

- When needing to carry goods
- When public transport is lacking, e.g. during nights, weekends and to unconnected locations or to locations where several line changes are required

The findings from the landing page confirms what was found in earlier investigations, regarding what kind of trips people see themselves using this service for. This does not limit the potential of this service to only such trips, but it might indicate when and why people are willing to change their transportation habits initially.

"I have watched the development of autonomous vehicles for about ten years now. I must say that the development has gone incredibly fast in the latest years, and now I want to take part when science fiction is transferred into reality." - LP3

"I think it's the most sustainable and smart way for urban transportations as a compliment to human powered transportation." - LP9

All qualitative results can be found in Appendix 13: *Landing Page Qualitative Results.*

5.3 Summary of Phase C

The public interest and willingness of contributing with opinions for when developing an autonomous taxi service in Gothenburg was confirmed through a landing page. It was decided that in an MVP-product, impulsive booking should be prioritized. Also, the user flow of initiating a journey through an app was prototyped and tested.

6 Phase D:

Testing the Experience

In this phase, the service was tested twice in context with a real LEV. The purpose of the two tests was to investigate if the assumptions and findings regarding the interface design and user needs from previous testing holds true in a more real context.

6.1 Methods and Process for Phase D

6.1.1 PROTOTYPE 2 AND USER TEST 2

Based on the findings from Test 1 a new prototype was generated. This prototype and test aimed at testing the experience of the service with a higher level of realism. The test users were asked to interact with the app, whilst riding in a real LEV, as a mediating object. This test was inspired by Eric Ries's theory regarding producing a minimum viable product (Ries, 2011) as the project members to some extent acted as the service itself. By preforming tasks in a real LEV with a fictional autonomous functionality, the test persons required less introduction to understand the context of the app and could hence preform the tasks with a higher level of realism.

Aim

The aim of testing Prototype 2 was to investigate:

- What information is needed for the user to find their booked vehicle, and how should this information be presented?
- What information is needed when the user shifts between manual and autonomous driving? How should this information be presented?
- How does the user perceive autonomous versus manual driving in a LEV? Is any of the modes preferred and why?
- What information is needed for the users to realize the limits of the autonomous routes? How and when should it be presented?
- How should the interface nudge users into expanding the autonomous network?

Some limitations were set to ensure that the building and testing of prototype 2 did not exceed a reasonable timespan. For example, the prototype did not show the real GPS coordinates of the test participant in GPS-mode.

Prototype 2

Prototype 2 was first outlined in a flowchart with data elements and functional elements, see Figure D.1 below. After that, the prototype was elaborated in a paper prototype (Figure D.2 and D.3) and then developed into an interactive prototype in Figma.

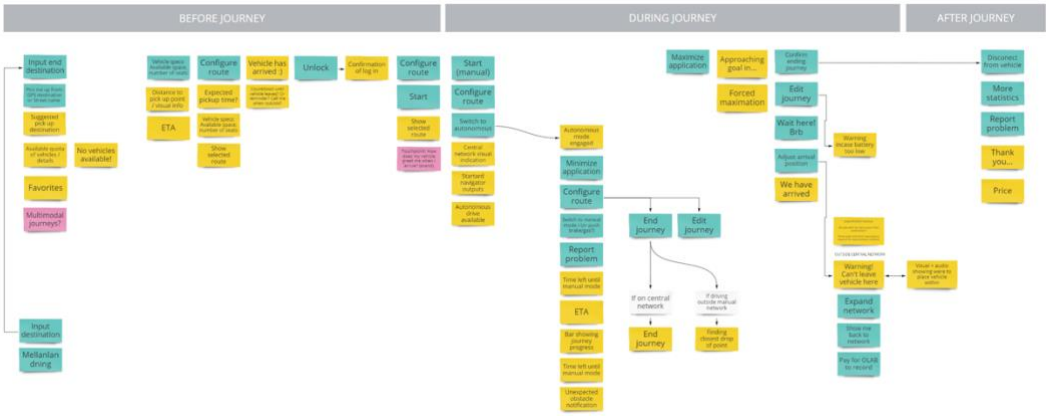


Figure D.1: A flowchart of prototype 2. Blue squares contain data elements and blue the functional elements.

Figure D.2 and D.3. The prototype elaborated on paper wireframes.

Selection of Participants

The test participants (TP) consisted of 3 IDC-users and 2 Recorders. The majority of the participants were recruited through the Landing Page (see chapter 5.2.2 Landing Page). People who had reported an interest in using the service though the website were asked to fill in a form. This form aimed to investigate whether they seemed to fit within the constraints of the two user groups. If so, they were invited to the test. Figure D.4 lists the test participants.

	ID	Gender	Age	Car	Occupation
Test 2	T2P1	Woman	21 - 30	No	Student
	T2P2	Man	31 - 50	Yes	System Developer
	T2P3	Man	21 - 30	No	Student
	T2P4	Man	31 - 50	No	Automatio Engineer
	T2P4	Woman	31 - 50	Yes	Manager

Figure D.4: Participants in User Test 2.

Procedure

The second user test followed a rather structured process, and took place in medium to lightly trafficked routes, on the outskirts of Chalmers campus Johanneberg. The participant was informed enough to classify as a first-time user of the service and then got to perform two different tasks by using the application and riding the LEV in Figure D.5. A more detailed description of the procedure can be found in Appendix 14: *Test 2 Procedure*.

Figure D.5: The LEV used during User Test 2 and 2.5.

Figure D.6: Photo from inside the LEV during test 2.

6.1.2 PROTOTYPE 2.5 AND USER TEST 2.5

During the testing of prototype 2, several insights were gathered (Chapter 6.2.1). These insights led to a new perspective on what might bring the most value to the users and lead to a quick iteration called Prototype 2.5. The prototype and an altered test manuscript was developed in under 3 hours of work.

Aim

The aims of prototype round 2.5 was to:

- Discuss how the test participant experience the manual door-to-door service, in comparison to her current travelling solutions?
- Discuss what information is necessary before, during and after the journey?
- Discuss what options and functions are necessary before, during and after the journey to provide an optimal experience from the service?

Prototyping

Prototype 2.5 was quickly elaborated in a flowchart (see figure D.7), using *Realtimeboard*, and then created in the prototyping software *Sketch*.

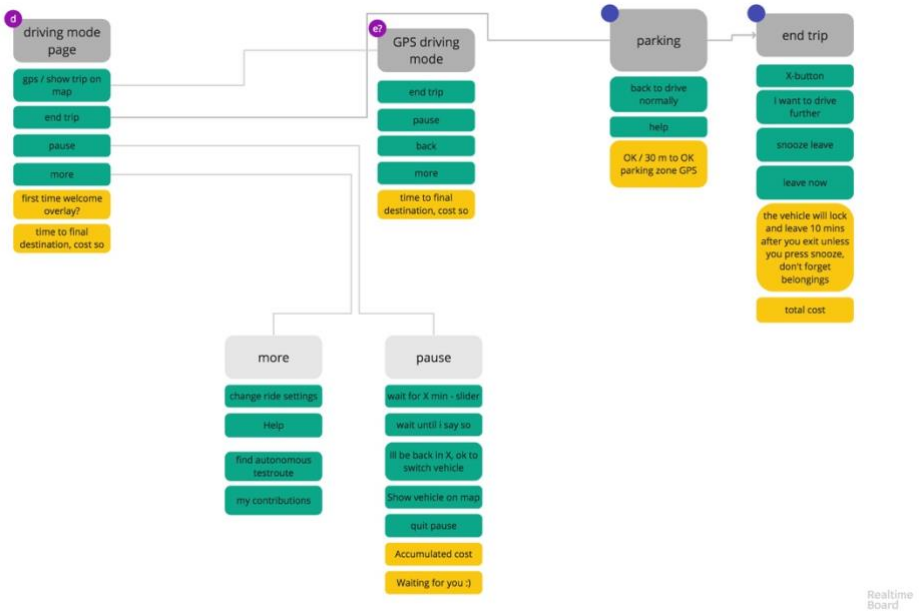


Figure D.7. Flowchart

Selection of participants

To do test 2.5 was a spontaneous decision, resulting in with very little time for planning. Therefore, the test was only carried out on a single test participant; an IDC-user originally booked to participate in Test 2 (details in figure D.8.). The project members felt that after five runs with Test 2, the number of new findings per test had begun to decrease, in accordance to Jakob Nielsen's findings on test participants and identified problems through user testing (Nielsen, 2000). Also, the insights from test 2 suggested that to make some changes to the service was necessary, and they decided to take the opportunity to test these changes whilst a LEV vehicle was available.

	ID	Gender	Age	Car	Occupation
Test 2.5	T25P1	Woman	33	No	UX

Figure D.8: Participant in User Test 2.5.

Procedure

The test procedure in test 2.5 was similar to the one in test 2, but instead the TP drove the vehicle herself and the procedure was less controlled by the test leaders. The test participant was given the prototype and the task of travelling to a certain destination. Then, it was very much up to the test participant to make her way there using the prototype and the LEV. A full description can be read in Appendix 15: *Test 2.5 Procedure*.

6.2 Results from Phase D

6.2.1 PROTOTYPE 2 AND USER TEST 2

Prototype 2

Prototype 2 (see Figure D.9) works similarly as prototype 1b, were the user searches for a journey, is provided with an option and then books it. The user uses a GPS-interface to locate the Pick-up Point, located where the vehicle is waiting for the user. In Driving mode, another GPS-interface displays street name, arrival time and the ability to shift between manual and autonomous mode. When the drop of point is reached, and is located at a longer distance than 50 meters from the users originally requested destination, the user is given with the option to expand the autonomous network to include their final stop. If the user agrees, s/he will be asked to drive on the new route three times to record and test it. As a token of appreciation, s/he will get a reduced price on the entire trip.

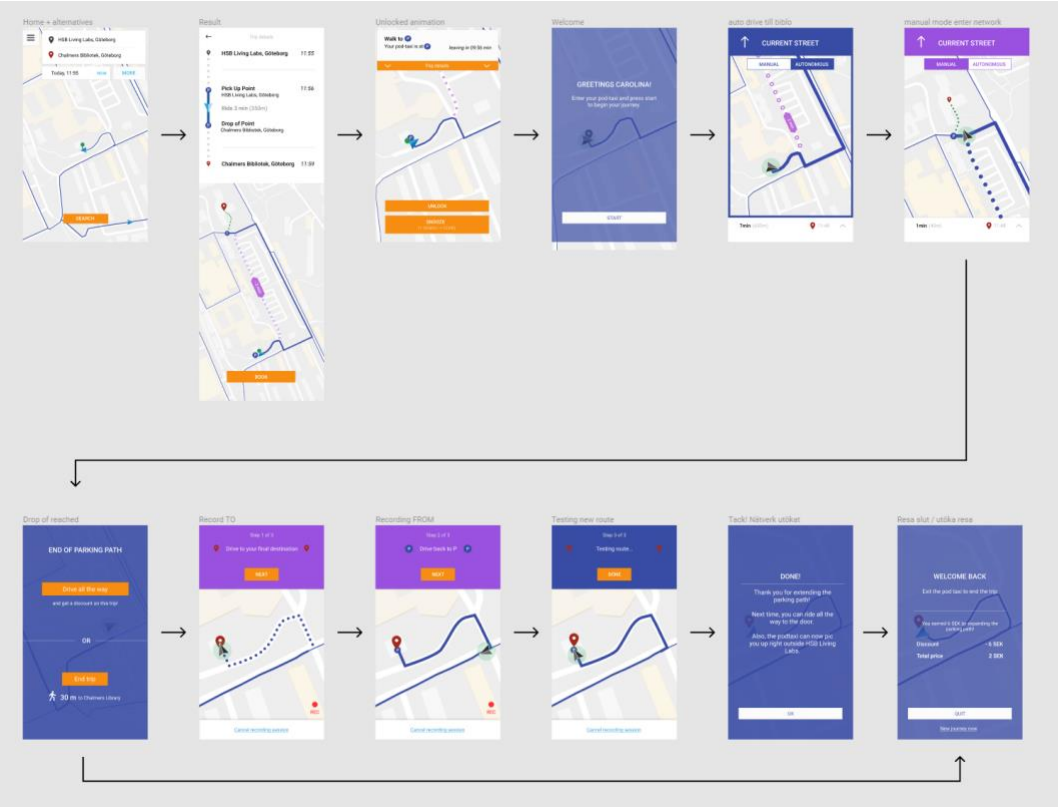


Figure D.9: Frames from Prototype 2.

All findings from test 2 can be read in Appendix 16: *Test 2 Findings*. Highlights from this are listed below.

Acquiring a Vehicle

- Because of a route suggestion being displayed when searching for a trip, the service was not perceived as flexible
- The app flow of how to order and find the vehicle felt familiar and rather easy for the participants to go through
- The participants did not mind walking a short distance to their vehicle.

Autonomous vs. Manual

Below are findings regarding switching between the two driving modes

- Participants were uncertain of what would happen when they press the autonomous button
- Many participants wanted more information on what to expect when switching driving mode
- Some participants wanted to stop the vehicle before switching driving mode

To improve the situation, a visual or auditory stimuli from the vehicle itself would be clarifying when switching driving mode. The interface could also more clearly separate the two driving modes using colour.

Below are findings regarding driving autonomously

- All participants understood that only some routes can be driven on autonomously, based on the blue lines in the interface and the on-boarding information before the test. However, it was not obvious to the users that they could deviate from the proposed route through manual driving.
- Many participants felt that the autonomous driving mode was too slow
- All participants said they would prefer to drive manually but some said they might try the autonomous driving mode for fun
- Many participants felt that they were in the way of cars while riding autonomously on semi busy roads
- A few participants also expressed uncertainty when approaching roadwork, a road crossing or an occupied pedestrian crossing in autonomous mode. *“I feel slightly unsafe in autonomous mode because I fear I might lose attention”.*

For the autonomous mode to generate a positive experience, the mobile interface or the LEV itself needs to clearly communicate what situations it can handle by itself and when it might need help from the driver. The autonomous mode also needs to be notably faster than regular walking speed.

Recording New Routes

All test participants expressed confusion or irritation over the interface in Figure D.10. They did not feel like they would have the time nor the incentive to read and understand the technological aspects of driving back and forth three times. Most participants said that they would just skip expanding the network and walk the last bit. The information displayed was tested and iterated in 4 different formats, but no version generated positive responses. Because of this and T2P5's comment:*"It would be perfect if I just could order it, and it came to me. Then I drive around by myself, and I jump off whenever I feel like it."* the matter was discussed. Either, the benefit the user receives by expanding the network must be clearly communicated. Or, the service could allow the user to just drop the vehicle outside the autonomous network for a small fee.

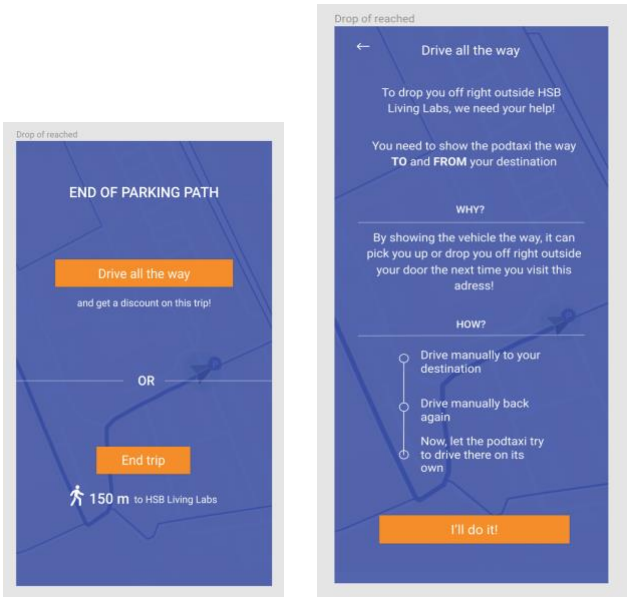


Figure D.10: Two examples of information shown to test participants, asking to help to expand the network.

6.2.2 PROTOTYPE 2.5 & USER TEST 2.5

User Test 2.5 was a quick iteration of User Test 2. The fact that the prototype (see Figure D.11) could only be tested on a single participant greatly affects the reliability of the findings. Therefore, further verification of the service idea is needed.

Prototype 2.5

Prototype 2.5 differs from prototype 2 in several aspects. When searching for a ride, no route is displayed in the results, to strengthen the experience of that you're renting a vehicle and not paying for going a specific route.

The GPS is no longer a major part of the driving interface. It is instead available as a screen option to avoid nudging the user to just drive on the route suggested by the GPS.

The option of driving autonomously is slightly hidden in a side menu with the title ‘Our little secret’ and only available at special test routes. This was done to make the service feel like it is about to start using new exciting technology soon. But the service is fully functional and easy to use without it.

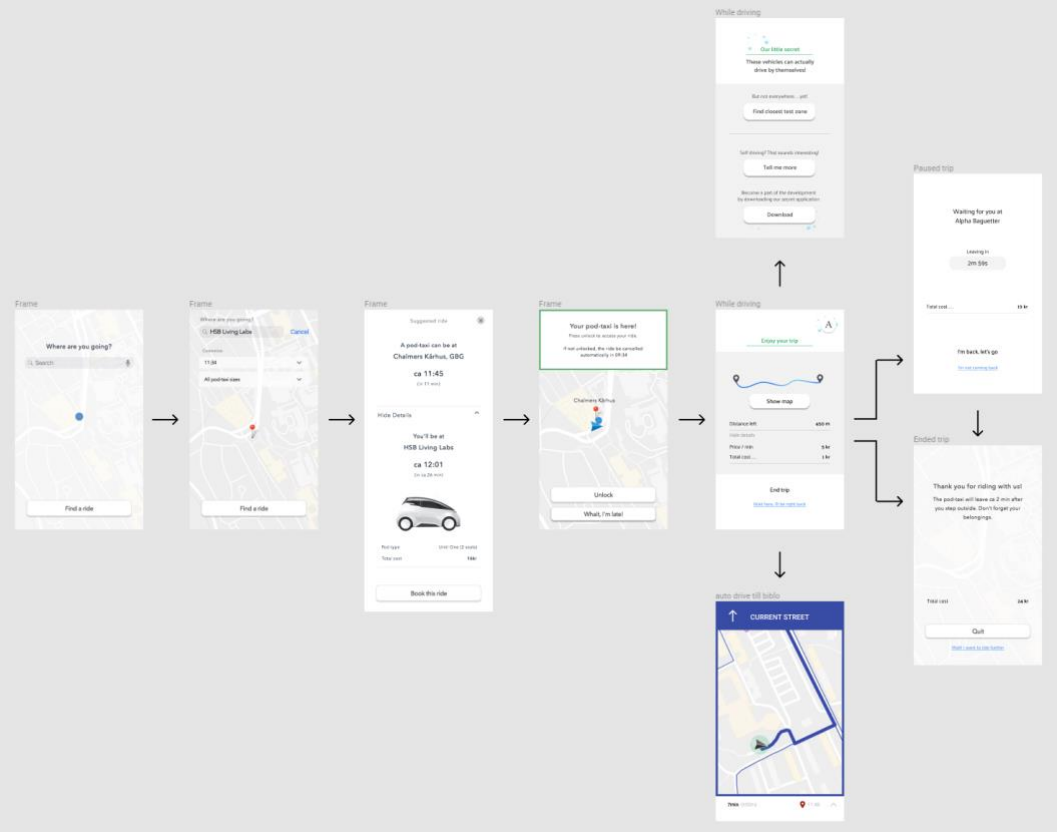


Figure D.11: Frames from Prototype 2.5.

Information in the Interface

All findings from test 2.5 can be read in Appendix 17: *Test 2.5 Findings*. Over all, the information provided in the interface was sufficient for the test participant to perform a journey. However, some problems were identified.

- Issues with internal consistency
- The participant wanted the possibility to access information on how to drive the LEV, a vehicle s/he had never driven before. This information could be available when waiting for the vehicle to arrive and when entering the vehicle. However, on-boarding is most likely not necessary for a more experience user.

- The interface was not clear on where the test participant could leave the vehicle. S/he talked about how great the idea of dropping the vehicle of anywhere is, but still chose to make a perfect parking in a parking spot at the end of the test. If the service can allow people to jump off anywhere it will have to signal this more clearly, to change the users' old mental model of how vehicles should be vacated. But if the vehicle has to be parked, the interface should clearly show the user where s/he can park it.

Additional Functionality

- When stopping at Alpha and telling the vehicle to wait, the test participant experienced stress when releasing the vehicle would leave if s/he could not make it back it time. Instead, s/he wanted to be able to pause the vehicle for as long as s/he would like. In that case, notifications can regularly be sent to remind the user of prolonging the pause or cancel the rental.
- When parking the vehicle, the test participant expected there to be parking sensors. It is important to keep in mind that some people take it for granted and thus might experience the service as low budget if there are no parking sensors on the vehicles.

"My problem with Drive Now is the parking-bit. As long as the vehicle itself knows where I can park it doesn't matter." -T25P1.

6.2.3 DECISIONS MOVING FORWARD

After User Test 2 and 2.5, it was decided to communicate the service as one where an electric vehicle can be ordered to your location and then driven manually to your destination where it can be dropped off; a door to door transportation service. This decision is discussed below.

The majority of people interested in the service find appeal in the effective, on-demand transportation made possible by the autonomous feature, and not the feature per say. Therefore, a good starting point for the service would be to focus on manual drive and use the autonomous feature to enable door to door transportation. In other words, the autonomous feature will make the LEVs drive to customers and allow customers to drop the vehicle off at any autonomous route. This is a benefit that is easy to communicate and appealing to most people.

The possibility of driving autonomously should not be removed, but in early phases be restrained to a few, secure destinations. This service has great potential in introducing autonomous drive in society. The fact that the vehicles arrive without a driver where the customer wants it to, might convince people that the autonomous feature is actually working well, making them willing to try it.

A few people, the early adopters, who are interested in, or curious about, autonomous drive and technology will try it for fun. Some will also use it so that they can work or do other things while the vehicle is driving itself at a slow speed. These people will most likely get to know about the service and its autonomous feature and potential regardless of how the service is branded and communicated. However, it could be disadvantageous to focus the service around the autonomy as it might disappoint or confuse the bigger mass of potential customers in early stages.

In conclusion, based on test findings and the reasoning above, it is believed that the service has a bigger chance of succeeding if it is mainly communicated as a simple transport service, but still being transparent and inclusive about its autonomous vision. An IDC-user will enjoy the utility, namely the door to door mobility that the service provides. A recorder will enjoy the same utility but also the excitement about being able to take part in the evolvement of the service by testing autonomous drive as it is being developed.

To read more about how this idea will be implemented over time, see Chapter 7.2.1: *Horizons*.

6.2.4 SUMMARY OF PHASE D

The prototype used in User Test 2 had several issues. The biggest problem was that the application was in fact targeting recorders. Few found interest in driving autonomously on regular basis and it proved difficult to communicate the concept of recording new routes. In other words, the application focused too much on the underlying technology and secondary functionality. Instead, it should focus on communicating the core value of the service, which is to be a door to door transportation service. Test 2.5 investigated the alternative of allowing only manual driving in a door to door service, based on findings in phase D. This could allow for the service to launch even before autonomous drive is legalized.

7 Phase E:
Building the Final Concept

In phase E, a Service Design Blueprint was created to list how the service should evolve over time, in relation to autonomous legislation.

7.1 Methods and Processes for Phase E

7.1.1 SERVICE DESIGN BLUEPRINT

Service blueprint can be thought of as a more in-depth version of a customer journey map. Aside from including the customer actions and touchpoints, the blueprint also includes activities being undertaken that is not visible for the customer. The service blueprint is presented in five rows and as many columns as needed, based on the number of customer actions. The five rows are labelled as follows:

- *Physical evidence.* Here, anything that the customer can see, feel, smell and hear related to his or her actions is listed.
- *Customer actions*. These are the actions that the customer needs to do at the different touchpoint in order to use the service.
- *Front office*. These are activities that the start-up does that the user can observe after having made an action.
- *Back office*. These are activities that the start-up does that the customer can't observe, that happens in order to make a customer action possible or after a customer has made an action.
- *Supporting actions*. Systems, assets and actions needed to support the activities listed above.

A service blueprint was made for the iteration of the service that represents the vision, called horizon three. A second blueprint was made for the state that the service is plausible to be launched in, called horizon one. The two blueprints were compared to highlight what differences can be expected in the early and late phase of the service's lifetime. Also, a list of plausible objectives that needs to be completed to move from horizon one to horizon three was created.

7.2 Results from Phase E

7.2.1 HORIZONS

An overview of the horizons is presented in Figure E.1 below. A more detailed description is given in text in the following chapters.

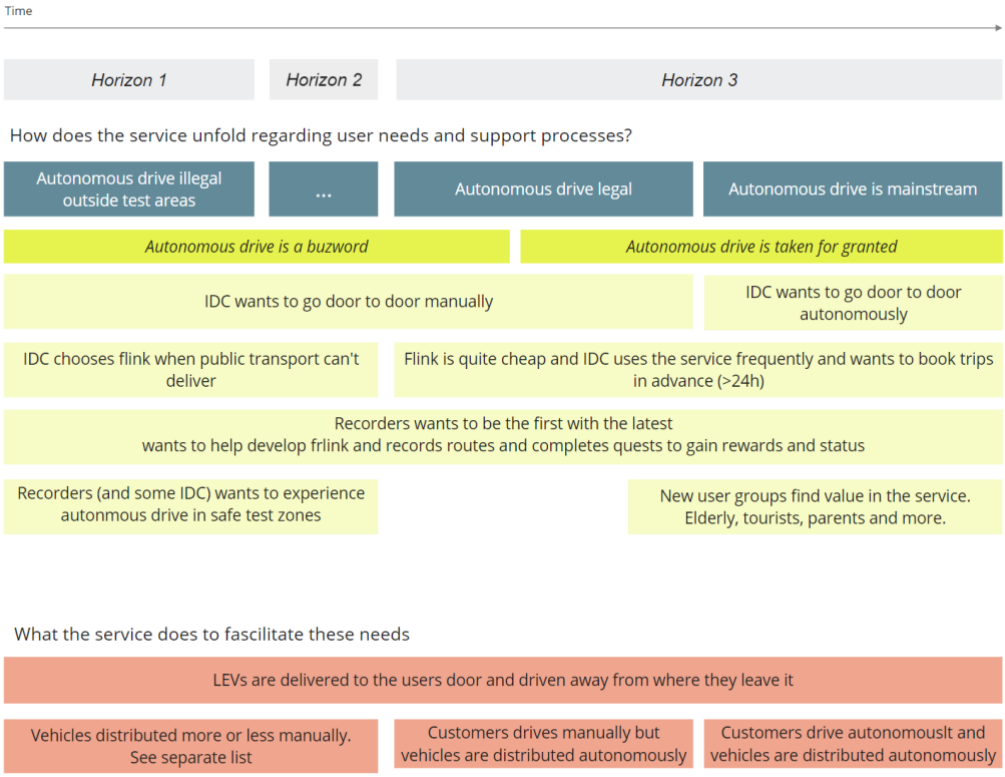


Figure E.1: Horizon overview.

Horizon 1 - *Minimum Viable Product*

In this horizon, autonomous drive is not allowed on public streets. The technology that is to be used to make the LEVs autonomous is still in development. Relatively few people within the city know about the service. The people who use the service are mostly early adopters, called *recorders*.

Scenario - A typical journey for an IDC user

This user has never used the service before and orders a LEV to pick her up 15 minutes from now. At the time, it is not possible to pre-order vehicles more than 24 hours in advance. The LEV is driven to the her by an employee who leaves the sight upon arrival. The user unlocks the vehicle and goes inside where s/he goes through the on-boarding process of learning the vehicle controls. S/he then drives the LEV manually to her destination where s/he leaves it at the side of the road just outside the door of her destination. The vehicle sits there for a minute before an employee comes and drives it to the next customer.

Scenario - A typical journey for a recorder

This user has used the service a few times before and is active within the community that provides feedback to the start-up. S/he uses a special version of the application, described in chapter 7.2.3 Two Apps. Today, s/he is taking a walk to the city centre and opens the app to see if there are any available nearby

quests to complete that will give her progress towards her next discount. There is an autonomous test zone nearby in the direction s/he was headed anyway. S/he goes to the test zone, gets to try out the latest version of the autonomous drive mode interface and technology and leaves some feedback. As a token of appreciation, s/he receives a discount voucher for her next trip.

A big challenge in this horizon is how to give the customers a door to door mobility service when autonomous drive is not allowed. Providing door to door mobility is believed to be a key differentiating factor that will attract customers to the LEV service. Because of this, it is important to try to find ways of making this reality even in horizon 1. A number of ideas on how to provide door to door mobility without autonomous distribution of vehicles has been generated. Some of these ideas can be implemented in horizon one and some only in later horizons. See possible solution ideas mapped according to ease of implementation in Figure E.2.

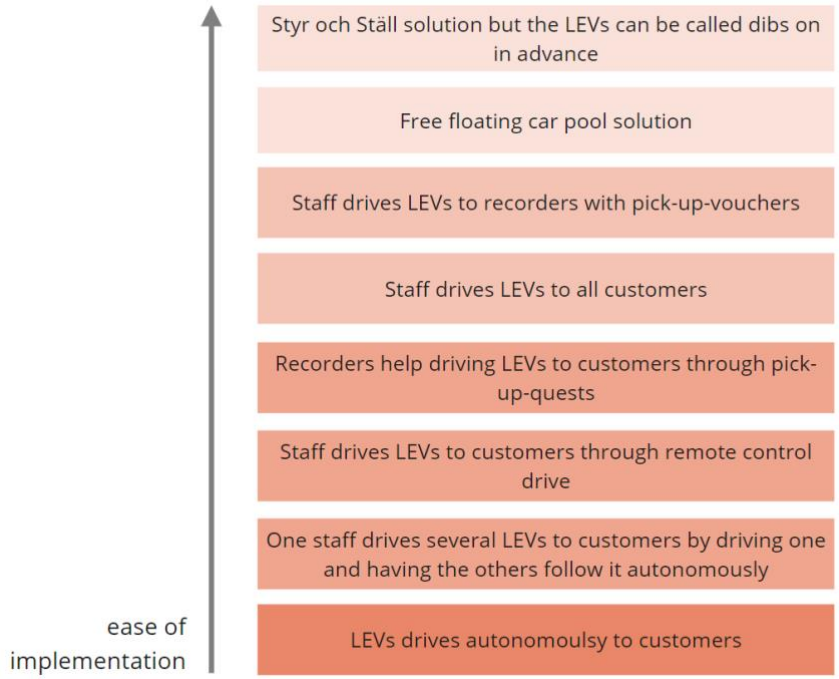


Figure E.2. Solutions for moving LEVs between customers before autonomous drive is legal.

Goals

The following bullet points are believed to indicate that the service is moving into the next horizon

- There is an awareness of the LEV service amongst people living in the city. In this sense, the service has become a part of Gothenburg's mobility solutions.

- A strong community has formed around the service and the relationship that the start-up has with its early adopters is healthy and providing.
- The community is active, uses the various tools available to help the service grow and provides feedback to the start-up.
- The start-up has formed a good understanding of what demands the customers have when using the service. These demands can regard anything from vehicle sizes and comfort to ease of understanding the on-boarding and information on insurance policies.
- The start-up, or city, has started investing in charging stations so that the utilization rate of the vehicles can increase, making the service more profitable
- The start-up has established one, or a few, test parks where autonomous drive can be experienced by the customers.

Horizon 2 - *Halfway There*

In this horizon, legislation is beginning to catch up and the technology that is to be used to make the LEVs autonomous is almost finished. Because of this, it is easier for the start-up to get permission for doing tests of the autonomous feature on larger scale and on public streets. The service is well known within the city. User adoption has increased but the main user groups are still *IDC users* and *recorders* and the trips are still more or less limited to the trips defined in chapter 4.2.3 Use Scenarios.

Goals

The following bullet points are believed to indicate that the service is moving into the next horizon

- Various companies have made big investments in the service, as the full potential of it is now starting to be understood by the public.
- Early adopter feedback is still invaluable, but the start-up has formed a thorough understanding of what the service needs to be, in order to be attractive for the customers.
- Every street, bicycle lane and path in the central city has been recorded.
- The start-up has a good understanding of where customers tend to travel. Thanks to this data, the start-up can predict where and when the LEVs are needed the most. Based on this information, charging infrastructure can be built where it is most efficient.
- Multimodal journeys are starting to become more common. In this way, the LEV service is naturally being suggested to people as a way to travel within the city.

Horizon 3 - *The Company Vision*

In this horizon, autonomous drive is allowed, the technology used has been perfected and the user adoption is high. The LEVs drive autonomously to customers, who can choose to simply sit back and enjoy an autonomous ride towards their destination or drive the vehicle there manually if they so prefer. Once at the destination, the customer gets out of the vehicle and carries on with his or her business as the vehicle drives away by itself. Based on data from previous trips and user behavioural patterns, the LEVs can distribute autonomously throughout the city and position themselves where they anticipate being needed.

Because of autonomous drive most probably being more mainstream and accepted at this point, it is believed that users will find value in driving autonomously to a greater extent compared with today. The possibility of doing other things while riding in a LEV might open up opportunities for the LEV service to be used as a commuting option. At this stage, it is plausible that other services and mobility solutions appear on the market. But because this LEV service has been around for a couple of years already, it is believed that it will have an advantage over the competitors as the awareness and trust in the brand is hopefully high.

In this horizon, the LEV service can bring benefits in other ways that just as a way to get from A to B. For example, tourists could use the LEV service for sightseeing. The LEV could drive autonomously along a predetermined path, going past popular sights. Also, the service could be used to pick up children from kindergarten or to drive patients to hospitals. The possibilities are almost endless. More examples of what the service could be used for has been ideated on and are presented in Appendix 4 Map of Opportunities.

7.2.2 SERVICE BLUEPRINTS

Two service blueprints were made. One for horizon 1 and one for horizon 3. The blueprints can be found in Appendix 19: Service Blueprints. Below, some interesting findings from the blueprints are mentioned in bullet form. The full text version can be found in Appendix 20: Service Blueprints Findings.

- The blueprints make it visually clear that it requires considerably less work to implement the service in horizon one compared to horizon three. This is because less support processes are expected to be needed in horizon one.
- There is an opportunity to involve the users in many areas of the service in horizon one. This include driving vehicles to customers, recoding new routes or giving new customers a memorable experience through personal on-boarding.

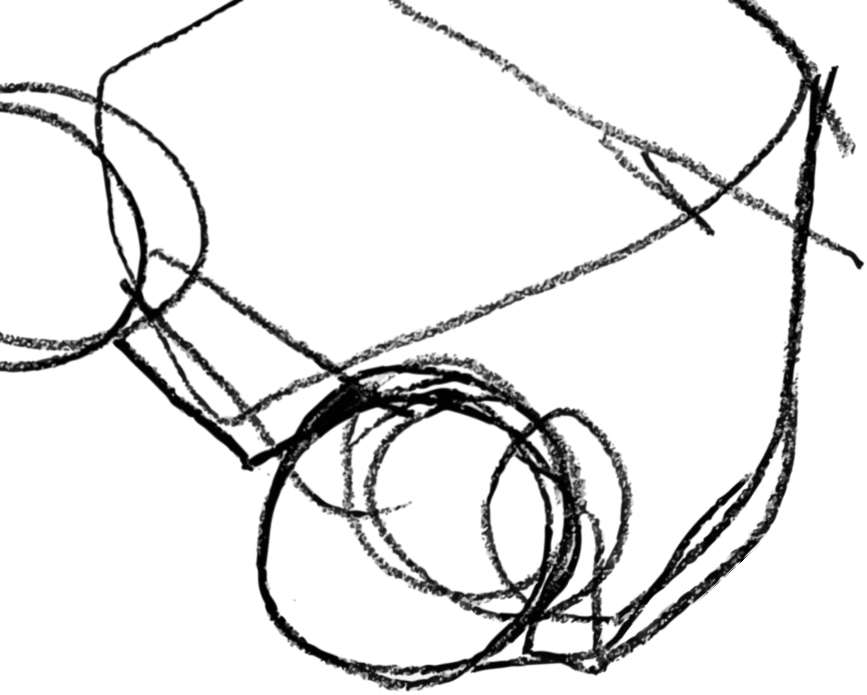
7.2.3 TWO APPS

Since the two different user types has different reasons for, and goals with, using the transportation service, it was decided to launch two separate applications. One application is targeting the bigger mass, the *IDC* users. This is the standard version of the app and focuses on allowing users to quickly access the door to door transportation service and get from A to B. The second application targets *the recorders.* These are users with an interest in the service that extends beyond getting from A to B. The recorders also find interests in trying and commenting on the technology behind the autonomous feature. This app should allow Recorders to contribute with complimentary network recordings and general feedback around the service. It should to some extent make use of gamification elements, to motivate the users to contribute. It is believed that the community feeling will be emphasized by the action of downloading a second application. The secondary app will have a slightly different visual brand identity, to cater to these interests.

Users familiar with the IDC-application should be nudged into visiting and trying an autonomous test route by their app. If they afterwards are interested in learning more or collaborate, they should be presented with the option of using the Recorder-application.

7.2.4 SUMMARY OF PHASE E

The development of the service stretches over three horizons. In the first horizon, the LEVs are driven manually, but there are test routes located around town to promote users' normalization of the technology. In the third horizon, all vehicles are driven autonomously. It was also decided to create two applications; a primary app for IDC-users and a secondary app for testing beta-technology, more directed towards the recorders.



8 Phase F: Branding & Packaging Concept

This phase describes the final result of the project, including branding, naming of the start-up, and the flowchart and UI of the final prototype.

8.1 Methods and Processes from Phase F

8.1.1 PUGH MATRIX

A PUGH matrix is a method used to facilitate decision making when needing to choose between, for instance, multiple concepts of a product design. The method can help the designer to make a decision without being influenced by personal preference or other non-measurable biases. The rows in the matrix are made up of criteria and demands that the product should satisfy. The columns are made up of the different concepts that are going to be evaluated. One of the concepts are set as the reference, giving it a score of 0 on all the rows. If a concept satisfies criteria better, similar or worse than the reference concept, it is given a score of +, 0 or - respectively. The scores are summarized giving a suggestion on which concept to move forward with (Virginia Tech, 2010).

In this project, the PUGH matrix was used to evaluate which visual concept best suited the brand identity. The criteria were derived from what the brand identity needs to communicate in order to stay true to the service delivered as well as a few other criteria such as standing out from the competition and taking graphical design trends into account.

8.1.2 BRANDING

Process

To build a strong branding identity, an analysis of similar services' brands was conducted, followed by the creation of a brand platform for the service. This was followed by three quick iterations of visual branding concepts. In the iterations, music, mood boards, GIFs and text was used generate various expressions. The last iteration experimented with a balance between expressing professionalism and playfulness, generating five different concepts. These concepts were shown to five persons, out of which two had many years of experience working with brand identity and entrepreneurship. The five concepts were discussed by enlisting strong and weak points for each. To assist in deciding which concept to move forward with, a PUGH matrix was used. The PUGH matrix can be found in appendix 23.

Brand Platform

As high-quality products and services are expected from the customers of today, companies and organisations needs to separate themselves from the competition by not only focusing on functionality and rational values. In order for a brand strategy to be perceived as intended by the customers, it must permeate through the entire organizations, including the top levels, so that the experience of the brand is coherent and present in all touchpoints.

Insights from previous phases of the project were used as a basis when defining the different steps in the brand platform, a tool developed by Tony Leidenkrantz (Leidenkrantz, 2017). The first steps include defining the brands vision, purpose, relationship and role. The brand was then positioned in the brand map (Leidenkrantz, 2017), striving to find an archetype that best describes the brand sought to be created. Possible competitors to the service being designed were also analysed and placed on the brand map in order to create awareness of which archetypes are already being used within the area. Then, the last steps of the platform were defined. These include differentiating personality, differentiating competence, differentiating emotional added values, differentiating rational added values and the brand promise.

The brand platform was defined to guide the ideation process of coming up with visual concepts of the interface and other digital touchpoints.

8.1.3 NAMING THE START-UP

When naming the fictional company that would launch the transportation service being designed in this project, the following list of different common brand names were studied.

- Visual names that helps form an image of the brand characteristics
- Descriptive names that explicitly describes what makes the start-up unique
- Directive names that urges the customer to do something
- Expressive names that makes the customer feel a certain feeling
- Promissory names that communicates what the brand promises to the customer
- Nonsensical names are made up words that sound good or are easy to remember

A Brainwriting session was held, where the different categories were used to structure the process. The names that were considered the best were then discussed together with two experienced entrepreneurs, who gave input regarding which names they thought fit the start-up the best. After a quick market analyse on the top five name suggestions, along with a discussion with two other UX-designers, a name of the start-up was selected.

8.1.4 PROTOTYPE 3: THE FINAL CONCEPT

Prototyping

A flowchart was created to enlist what information the interface needs to exchange with the user. The elements in the flowchart were all based on needs identified in earlier steps of the process. The flowchart was later used as a skeleton for the interface's structure, and enlisted functional and data elements. See Figure F.1 below or Appendix 21: *Final Flowchart* for a higher resolution.

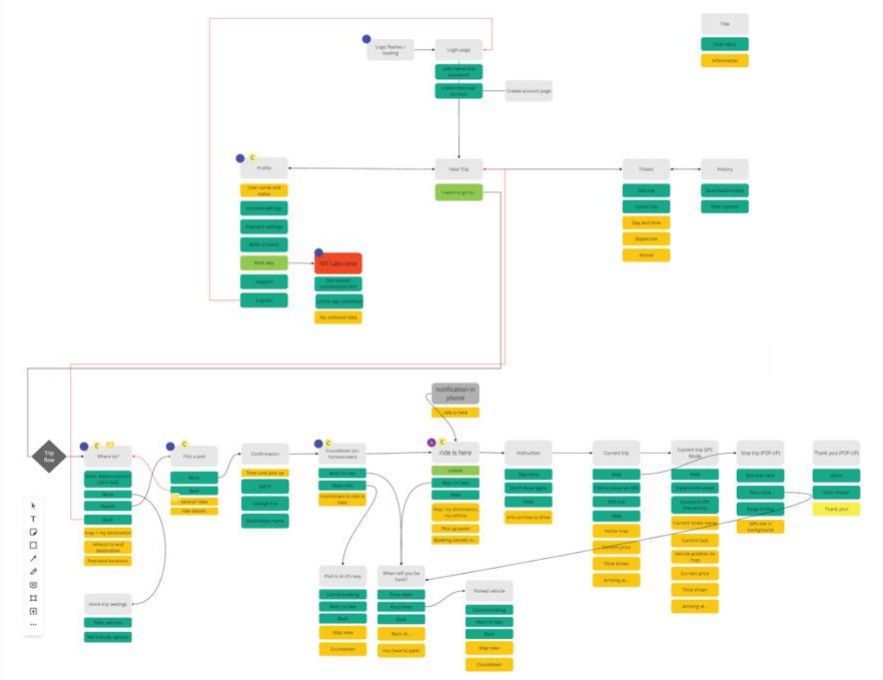


Figure F.1: Flowchart of the final prototype with data elements (green) and functional elements (yellow).

A paper prototype was made in order to quickly get a feel for what the interaction would feel like (see figure F.2). Elements of the interface was drawn on printed outlines of mobile phones. These sketches were then cut out and put together in the sequence in which the interaction would take place. Using post-it notes and markers, the prototype could easily be reviewed and updated as the process progressed.

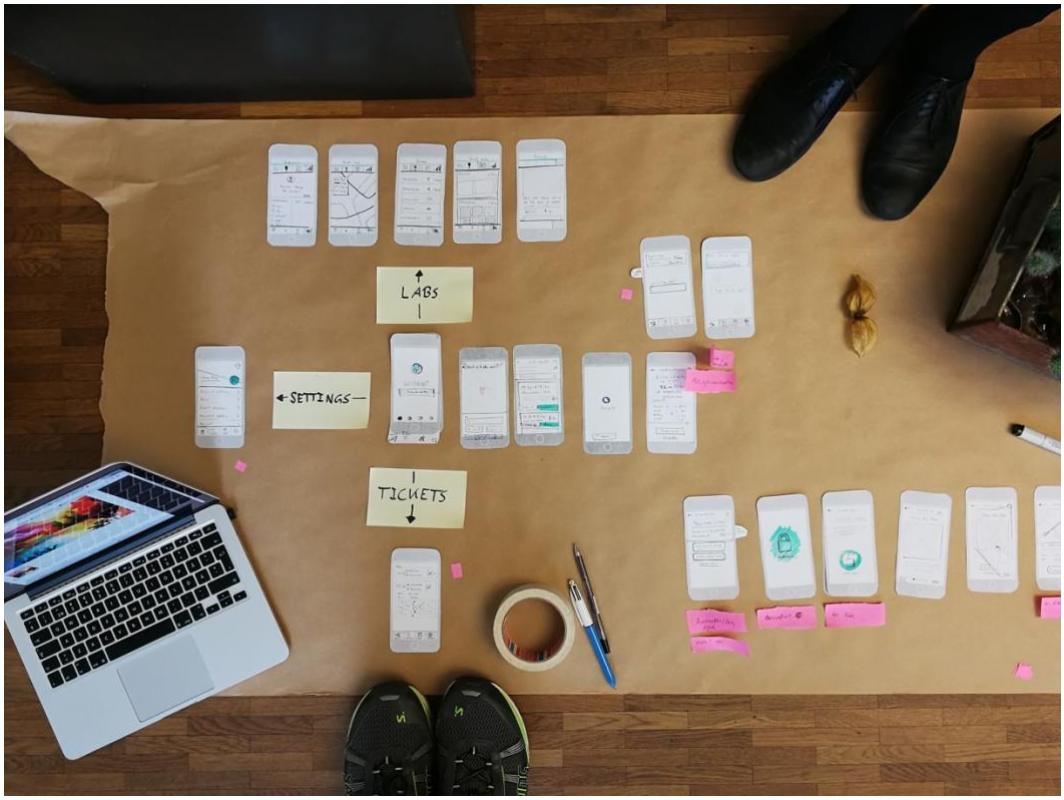


Figure F.2: Paper prototype of the final concept.

Usability Test

A short usability test was performed on the prototype with the aim to detect uncertainties in the interaction flow and the UI. The users were both UX-designers and potential IDC-users. They were given the task of performing a trip, and a rolling chair was used as a quick replica of a LEV. Weaknesses found in the tests were fixed immediately, and does not exist in the final prototype presented in Chapter 8.2.3: Final Prototype.

8.2 Results from Phase F

8.2.1 BRANDING

Competitor Brand Maps

In order to get an overview of how competitors and similar services brand their companies, the visual brand identity of three other brands were analysed. Below in Figure F.3, image boards representing three different mobility service solutions, available on the Swedish market, are shown.

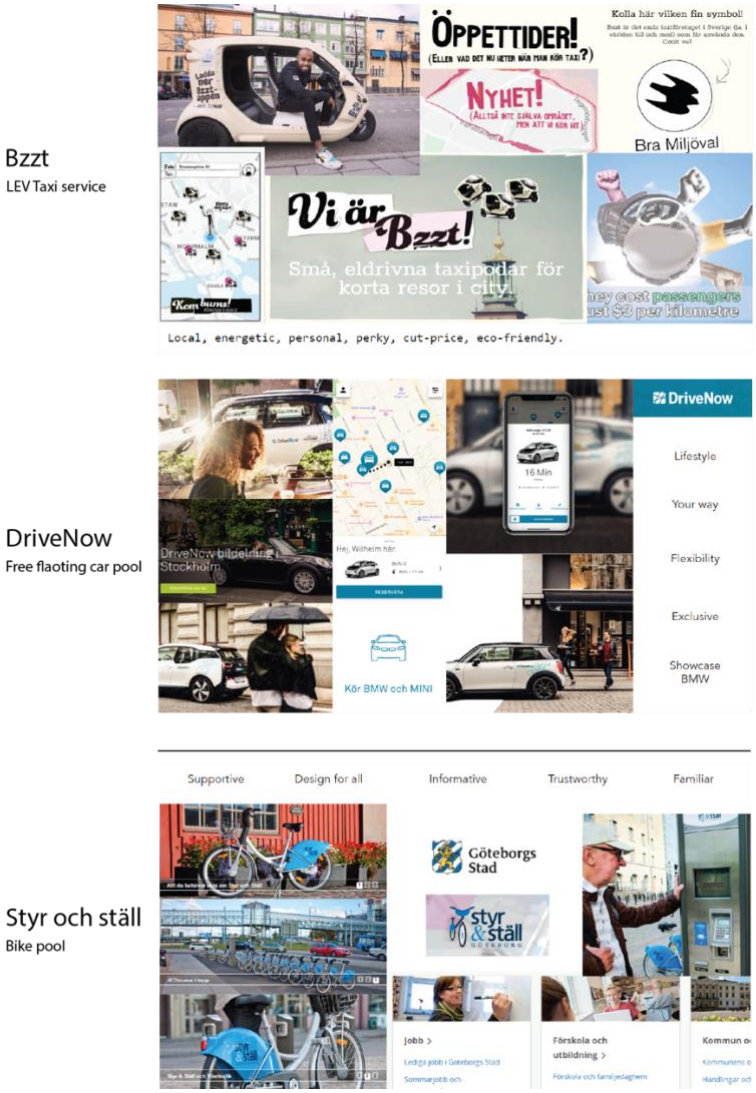


Figure F.3: Image boards representing the visual brand identity of three different existing mobility solutions.

Based on these image boards and the general impression that was received from the service through their website, applications and other touchpoints, the different services were positioned on the brand map. The result is shown below in Figure F.4.

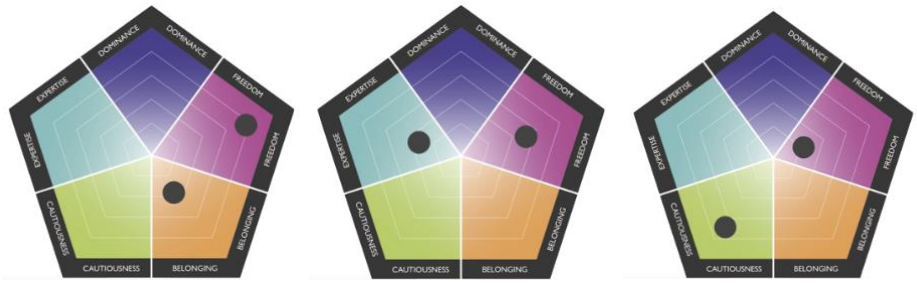


Figure F.4: Brand maps of Bsst, DriveNow and Styr&Ställ.

Bzzt has gone for a collage type of visual identity, with handwritten fonts and playful language. They are making a statement and want to stand out from the crowd. *BMW* is highlighting the freedom the service brings you while making sure to show off their vehicles in the best light possible. The imagery used is generic but easy to understand and appreciate. *Styr och Ställ* takes a very cautious approach and uses recognisable, non-touched up imagery and clear, honest language.

All brands emphasize the freedom their transportation service brings. There is an opportunity to create a brand that focuses on being the expert, showcasing technology and knowledge. Also, none of the above brands are strong in dominance. When positioning the concept designed in this project, these competitors and opportunities were kept in mind.

Branding Platform

In the branding platform (Leidenkrantz, 2017), the following areas were accentuated:

- *Company purpose:* To speed up the adoption of autonomous driving in city centres, and offer an attractive shared mobility alternative in situations where public transport is lacking.
- *Company vision:* To provide a flexible transportation service, that optimizes vehicles active time and passenger capacity. This can, in the long run, promote silent and space-efficient urban environments.
- *Differentiating rational added values:* The delight of having access to a personal bubble on your way somewhere, but without the fuss of having to catch the last bus, repair a broken tire or carry heavy bags through a Nordic autumn drizzle.
- *Differentiating emotional added values:* Proper, inviting and accommodating at first, but something new, techy, quirky and innovative seems to be bubbling underneath the surface.

Branding Iterations

In the first iteration, branding concepts were generated based on 5 different songs. ‘KAWAII’ and ‘HÅKAN’ were selected as they seemed to best fit the branding platform (see Figure F.5 below). These were explored deeper in the next iteration.

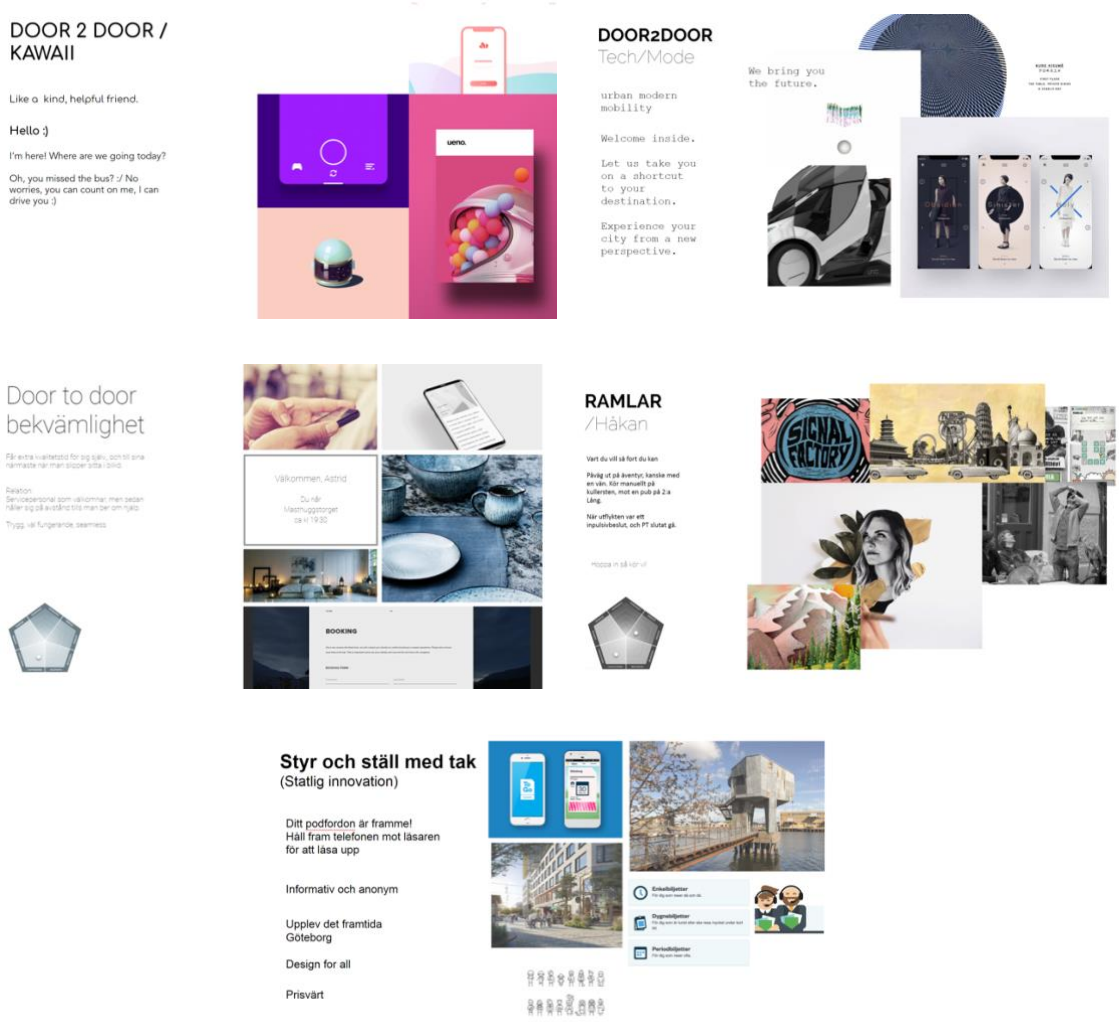


Figure F.5. Image boards from the first iteration of producing a visual brand identity. The top left and middle right concept were taken to the next iteration.

The second iteration had a slightly stronger focus on UI and colour schemes. Here, number 4 and number 5 in figure F.6 was selected for further exploration.

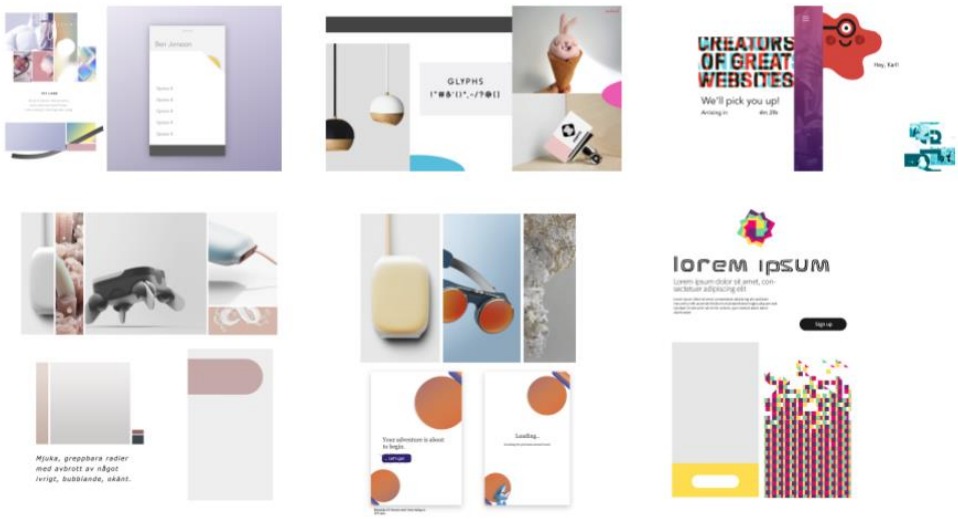


Figure F.6. Five concepts from the second iteration. The right and middle option in the bottom row was explored further, and a new, more professional direction was explored in the last iteration.

A mixture off professionalism and playfulness was elaborated in iteration 3, generating four concepts (see Figure F.7 - F.10 below). The winner came to be the concept ‘Veckans Gubbe’ (‘The Weekly Doodle’), presented in Figure F.8. This branding concept is described in the next chapter.

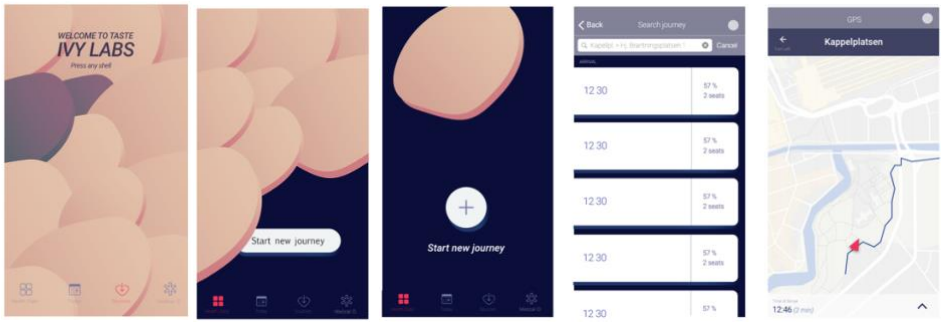


Figure F.7: The ‘Playful Potato’ concept.

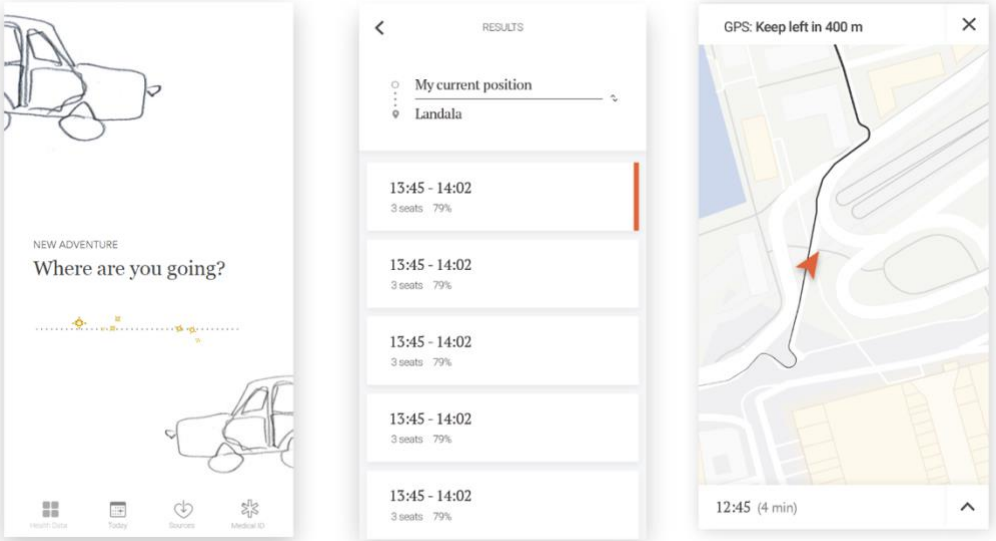


Figure F.8: The ‘Veckans Gubbe’ concept.

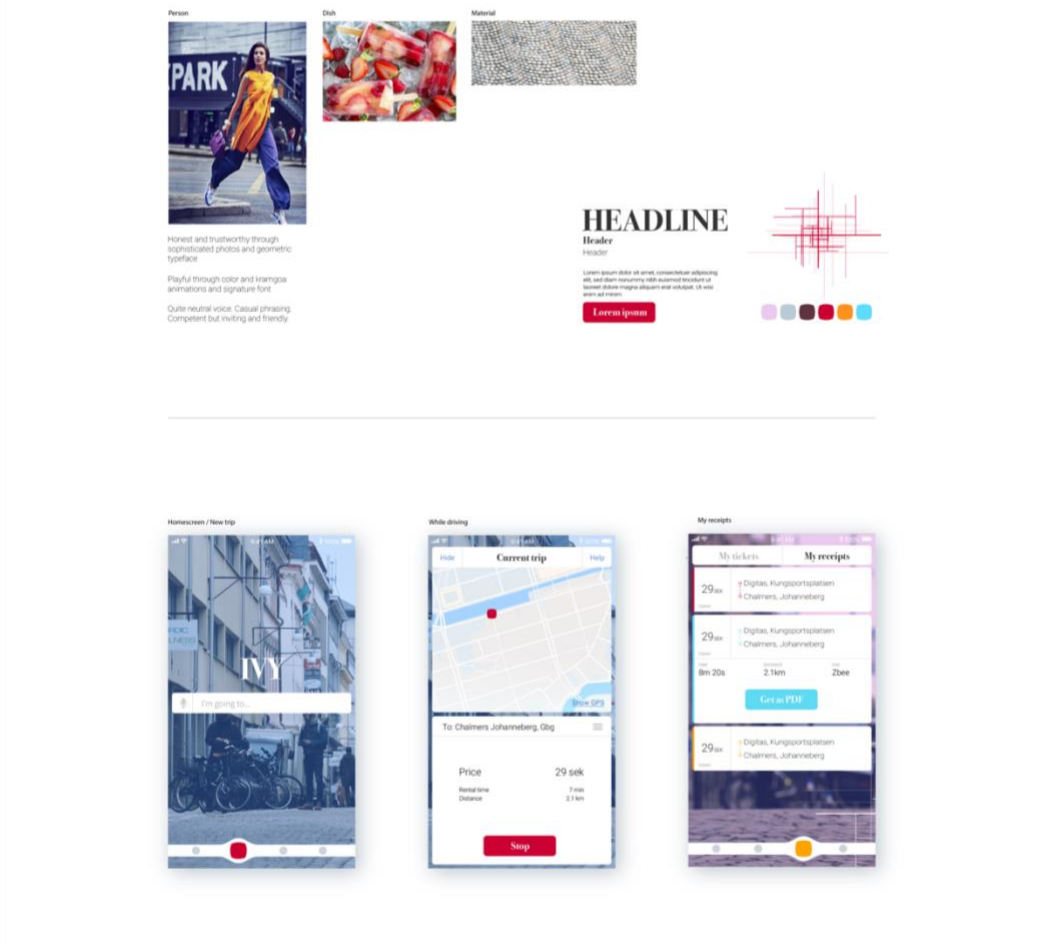


Figure F.9: The ‘French Fashion’ concept.

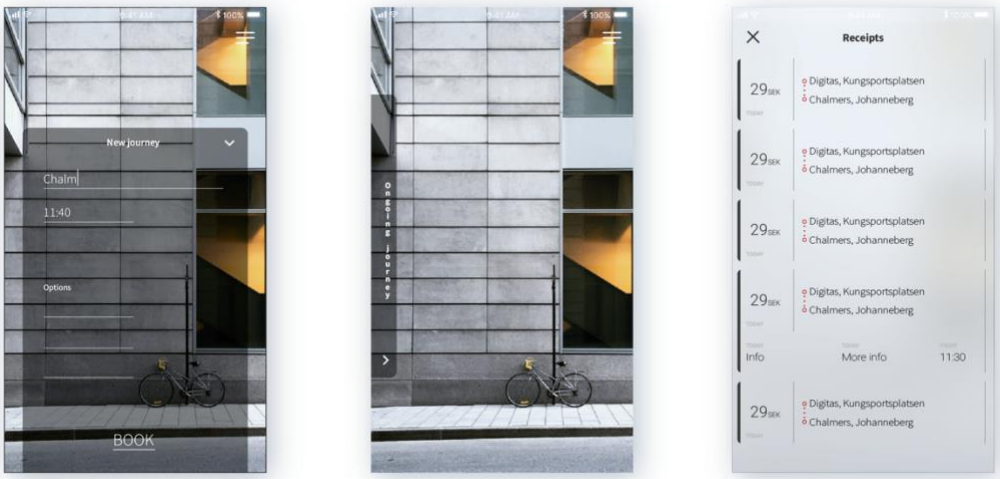


Figure F.10: The ‘Behance++’ concept.

Final Branding Concept

The branding concept ‘Veckans Gubbe’, translated to ‘The weekly doodle’ was chosen as it was considered to contain the right mixture of serious business, humble details and beta-technology-vibes to fit what the service offered (see Figure F.11)

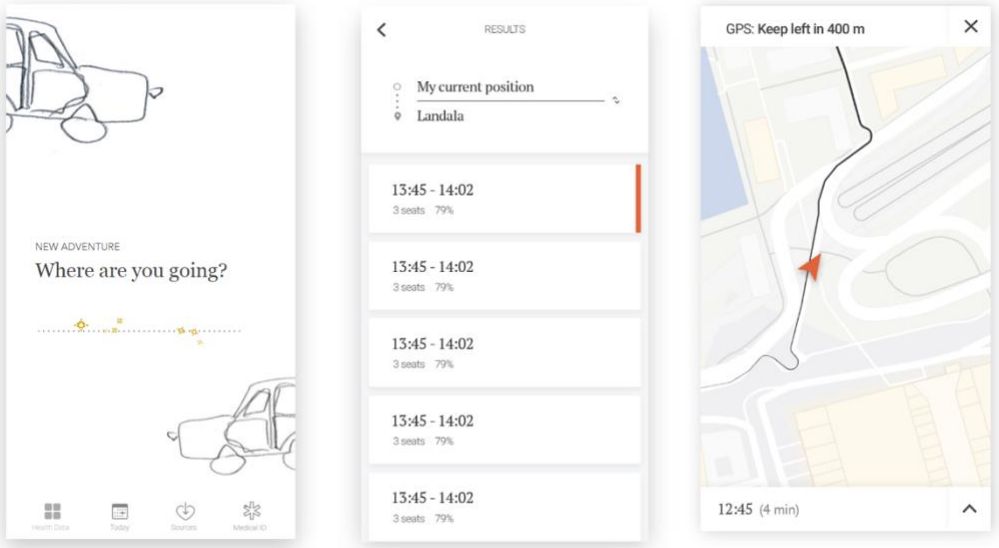


Figure F.11: Early conceptual UI-designs for the chosen brand identity. In a digital format, the stars on the dotted line in the left frame are GIFs, sparkling repeatedly.

The serif font and the white space provides trustworthiness, and the serif-free compliment ensures readability on the digital screen (see style elaboration in Figure F.12). This combination is uncommon in modern UI-interfaces, and has the potential of being remembered and generate traction. With the help from layers and soft shadows, hierarchy is established, which also facilitates readability. However, the whitespace must be precise and calculated, in order to avoid the association to a website that failed to load.

Rough vehicle sketches add a humble and playful detail, but should only sparsely appear in dialogue pages, website home pages and in loading screens. The sketches can also be altered to bring LEVs of various models to mind, without requiring expensive renderings.

The sparkling GIFs generates excitement in the otherwise rather calm elements. GIFs should be applied in the beginning and end of a journey and bring attention to autonomous test routes.

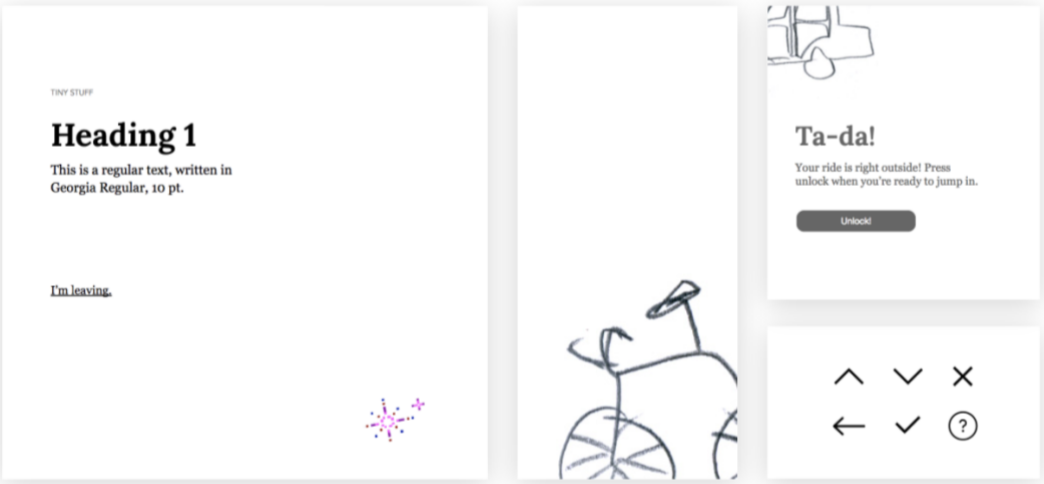


Figure F.12. Font combinations, icon-design and sketches for the concept.

The tonality in all messages should be short, semi-excited and in casual formulations. It should never be childish or snobby, but eager to serve the customer.

The mood board in figure F.13 further describes the brand personality. The personality of the brand is represented by the emotion in the picture of the baby in the suit; strict, neutral colours and something slightly off, that disrupts the entire impression. If the brand was a dish it would be two slightly odd flavours of ice cream, served in a proper and minimalistic way. If it was an animal, it would be a penguin that always wears a clean-cut suit, but often is seen walking in an odd fashion or tummy-sliding on ice. If the brand was a room, it would consist of a minimalistic Scandinavian interior, but the calmness would be disrupted by something in the corner of your eye.

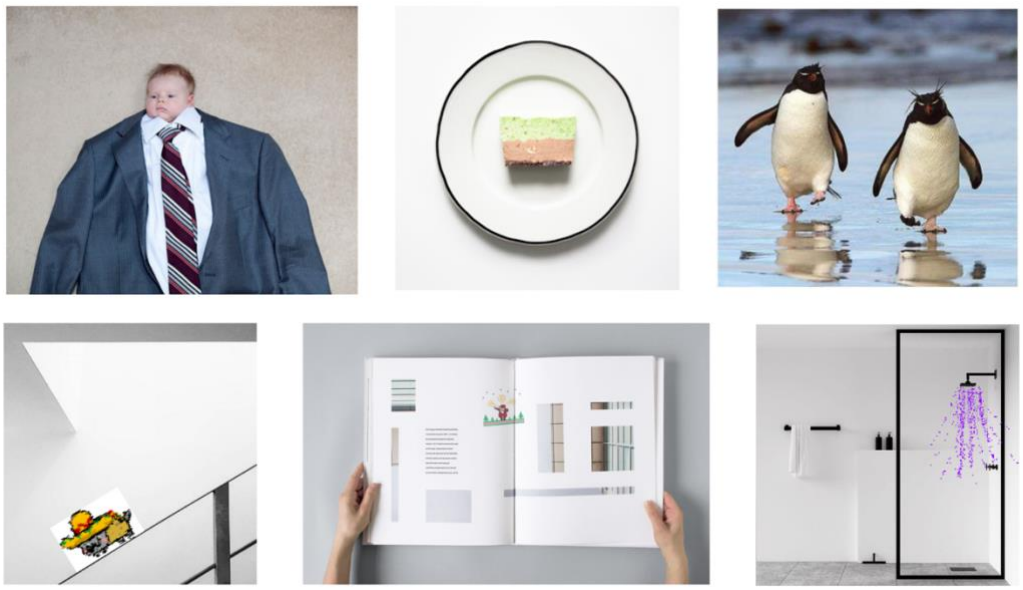
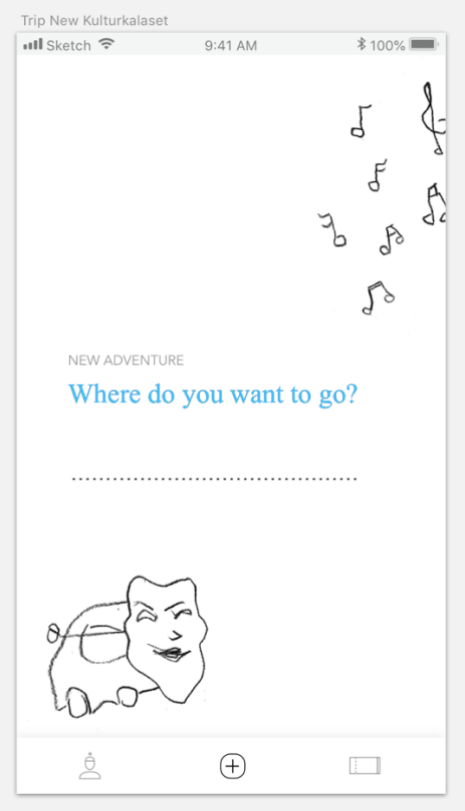


Figure F.13: Mood board for Veckans Gubbe.

A Living Application

In order to make the application and the start-up feel alive and constantly evolving, the sketches that can be found throughout the interface regularly change. The sketches will change to reflect what it is happening in the city. For instance, during *Kulturkalaset*, an event that transforms the city of Gothenburg into place filled with culture in form of music, theatre, food and dance, the sketches can pick up details that represents this event. Also, during events such as *EuroPride*, colour can be introduced to support the event. To create a feeling of a living application is important as *flink* needs to evolve in order to bring its full potential to the city. It is also believed that users will be more prone to embrace the co-creating aspects of *flink Labs* if the application is perceived as alive (see examples in Figure.14 – 15).



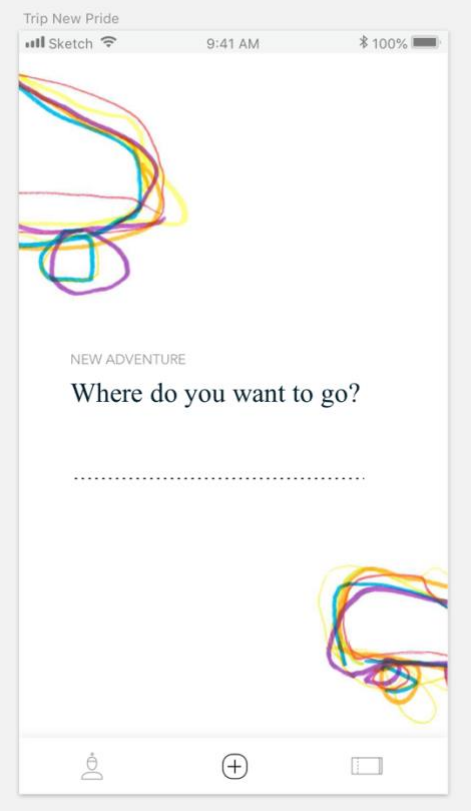


Figure F.14: Example of how the start screen could look during Kulturkalaset in Gothenburg.

Figure F.15: Example of how the start screen could look during Pride Week.

Holistic Brand Identity

To promote the personality of the brand, several UI-details has been hidden in the interface. For example, the icons in the tab bar will tweak if clicked (see Figure F.16). Loading screens varies with different sketches spinning above an explanatory text (see Figure F.17). Whilst driving, free meter-bonuses can appear on the map which the user receives by driving through them (see example in Figure F.18) This can be used by the start-up to have users drive on an unrecorded path. In a similar manner, the map can indicate if the user is driving closely to an autonomous test route. To promote an experience of a united pod-taxi community, two pod-taxis could be able to salute each other when driving close enough to each other, either auditory or through the app (example in Figure F.19). This should however not compromise with a safe driving experience.

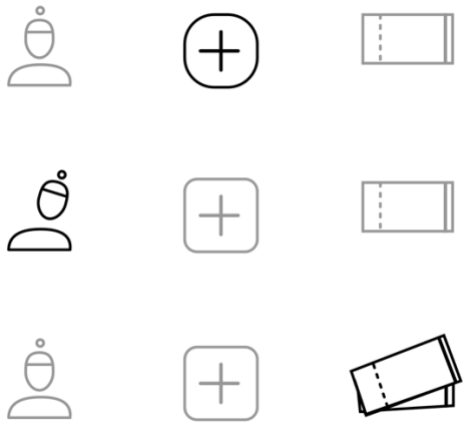


Figure F.16: Icons shifting shape when clicked, in the tab bar.

Figure F.17: Loading screen examples.

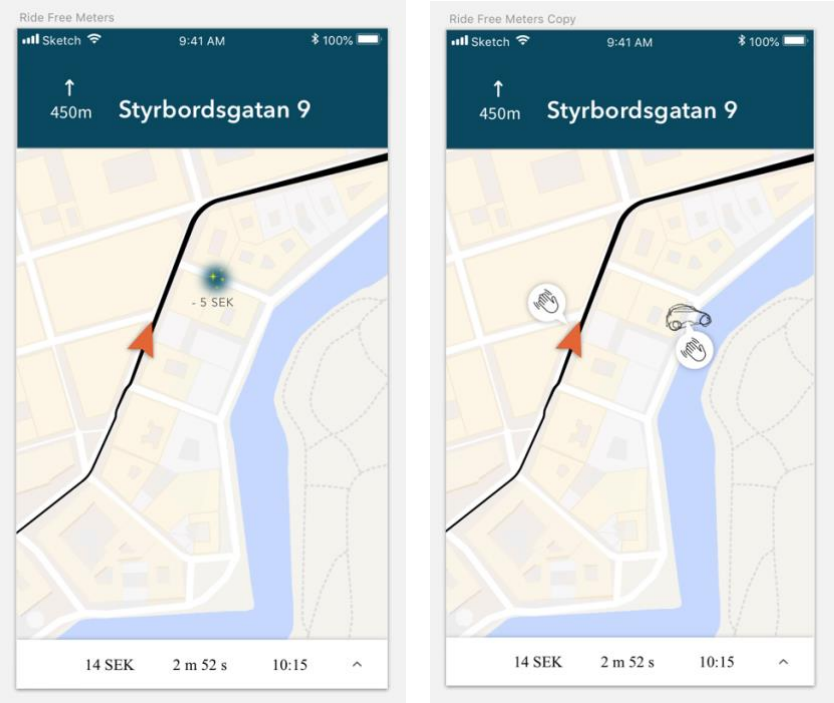


Figure F.18: A chance of earning free meters by taking a short detour is presented for the driver through the map. Figure F.19: Vehicles saluting each-others.

The extraordinary, odd brand identity should cover all touchpoints which the customer experiences. It should if possible be reflected in the interior and exterior of the pod-taxis, in social media, on *flink'*s future website and in the personality of the public figures for the start-up.

Naming the start-up

The winning name for the service was 'flink*'*, as it represents an alternative and smarter mean of transportation. The name can be associated with a 'link', as in a quick way of accessing a webpage compared to typing the domain name by hand, or the link that the service provides between two destinations, or the growing network of autonomous routes that the service is building. Another association is a blink, as in in the blink of an eye, referencing a quick trip. *flink* translates to smart in Norwegian, resonating well with the underlying technology of the service. The word has a humble yet energetic touch to it that suits well with the visual branding material as well as how LEVs look in general.

Below, a few different examples of how this name could be used in conversation is given. The name can be used as the name for the vehicles, as the name of the service or as a verb. The examples are given in English and Swedish.

Oj kolla, där är en sån där flink!

Hey look, a flink! We should try those later today when we're going to Jesper.

Alright, I will be there in 5 minutes. I'll grab a flink.

Det ligger rätt så långt bort, ska vi flinka dit?

Should we walk or catch a bus? Nah, let's flink there!

Tog du bussen imorse eller? Nej, jag åkte med flink.

It was decided to spell *flink* with a minuscule 'f', since this gave a slightly friendlier feel to the logotype. A proposition on the logotype on an app icon is displayed in Figure F.20 below.

Figure F.20. A proposal of flink's logotype on an app icon.

flink Labs Branding

The recorders application, complimentary to *flink*, will be called *'flink Labs'*. This is mainly inspired by the Swedish train operator *SJs* app 'SJ LABS'. *SJ LABS* lets travellers try out, and give feedback on, beta versions of *SJs* solutions. *flink Labs* will do the same, however also include elements of gamification to motivate users into validating and contribute to the service development. The word 'lab' indicates that something is under development, which is believed to make users forgiving towards imperfect functionalities.

flink Labs' tonality should be similar to *flink's*, however in a slightly more familiar and community-oriented manner, to welcome the user into the community.

flink Labs' UI is much like *flink's* visual identity, but complimented with a few green-yellow nuances. This gives the second application a more alert and gamified impression. It also creates a clear distinction between the two apps.

8.2.2 FINAL CONCEPT FLOWCHART

The picture below visualises the flow of the application. A detailed version of the flowchart can be found in appendix F.21.

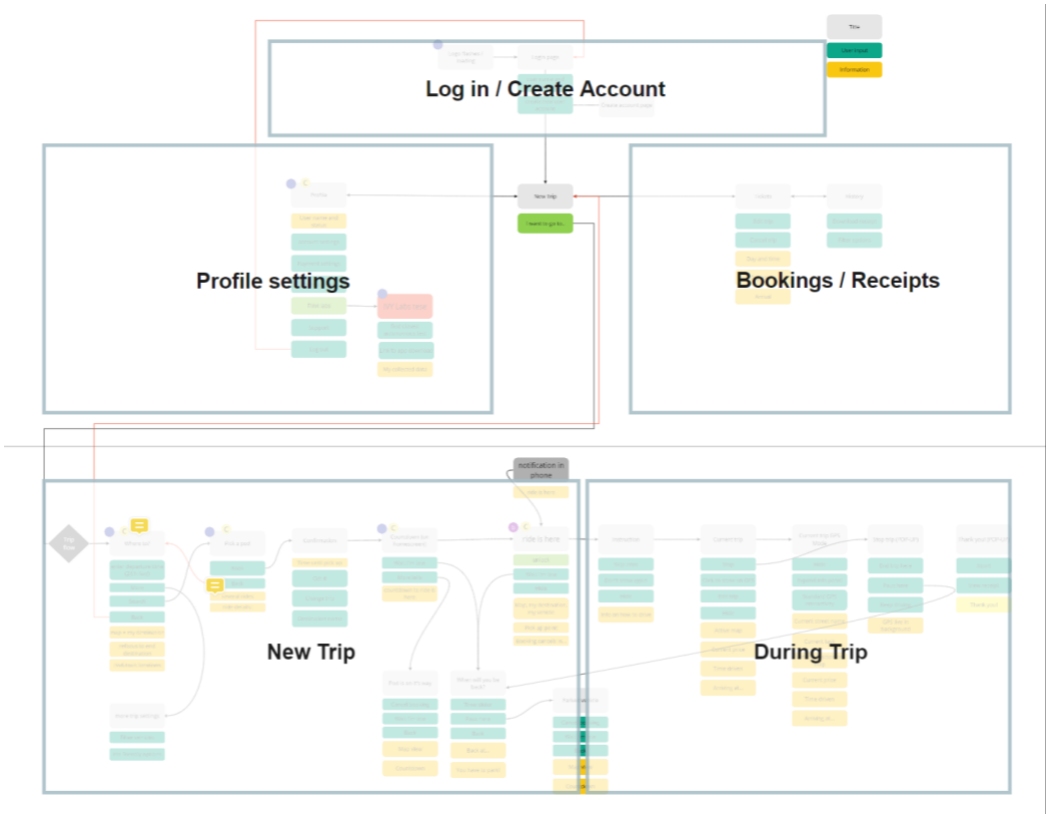


Figure F.21. Flowchart of final prototype.

The application is made up of three different tabs that contain profile settings, booking a new trip and viewing bookings and receipts. In profile settings, functionality that is not part of the main user flow can be found. These are functions that are important but that does not need to be accessed quickly at any given point. Examples include payment settings, refer a friend and accessing on-boarding tutorials. Under the tab bookings, the upcoming bookings are displayed. The user can book trips up to 24 hours in advance. The receipts from previous trips are also found in this tab. Under the main tab, the plus sign, the user makes a new booking and gets information on how long time it is left until the next upcoming trip. This tab will be active when the application opens up and functions as the home screen of the application as this is where the most important functionality is accessed. The user can jump freely between the tabs unless the user is in the flow of a trip. To enter the trip flow, the user presses unlock when standing outside a booked vehicle. The user is then inside the trip flow and will not get out of it until the trip is over or paused. This decision was made based on the fact that the service is targeted towards short distance trips. It is unlikely that the user needs to access other functionality than what is available within the application while driving the vehicle to the destination.

When deciding on the final flow, the goal of creating a simple application was always kept in mind. Functionality that is not necessary for the users to reach their goal with the interaction was removed or designed in a way so that it does

not complicate the interaction. For instance, the possibility to minimize the active trip to access other functionality such as profile settings while driving was removed. Keeping the app simple and small also makes it cheaper and easier to implement. Once the service has been up and running for some time, gathered insights should guide the decisions being taken on what additional functionality should be added or removed.

8.2.3 FINAL PROTOTYPE

The final prototype of *flink* mainly contains of the user flow for booking and driving a pod-taxi. It also allows the user to change pre-booked rides, see recipes and configure profile settings. *flink* also contains a teaser for *flink Labs*.

Start screen and main flow

The start screen of *flink* is shown in Figure F.22. To nudge users to start a new journey, users are asked *'Where do you want to go?'*, followed by a dotted line for them to fill in. The text and the line makes use of outer consistency, referencing an analogue paper form. The dotted line is highlighted with sparkling GIFs, to show affordance on that it's intractable and to generate excitement.

When the user clicks on the line, s/he enters the main flow of the app. This is signalled by how the frame in Figure F.23 slides up and covers the screen. Here, the user can select the start and end destination of the trip, set preferred arrival or departure time and specify vehicle size by clicking 'MORE'. When the user clicks on, and starts writing start and end destination, the app should suggest the most common journeys.

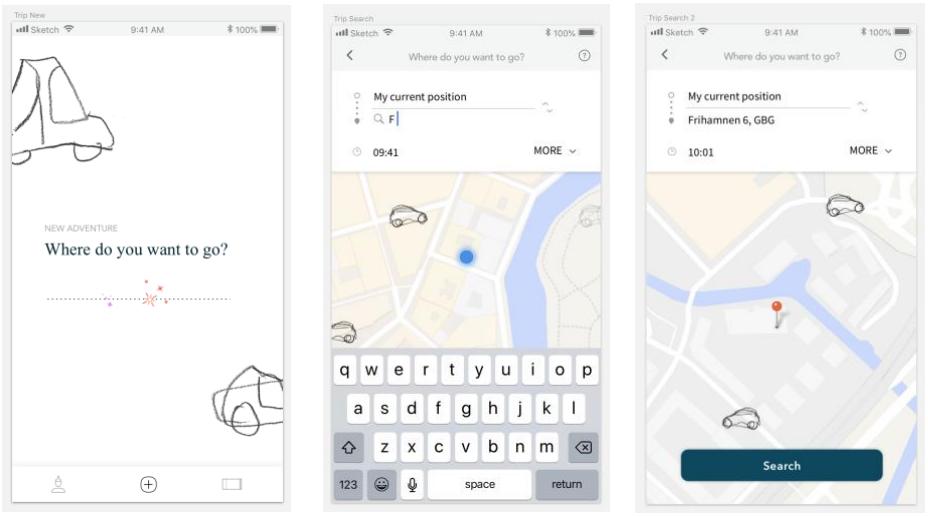


Figure F.22: Start screen. Figure F.23: a Entering end destination. Figure F.23: b The user has entered where s/he wants to go.

The interface uses standard components from Apple's IOS Design Kit, and a standard map design from Google Maps. This is to promote an as cheap solution as possible for the start-up, and to promote compatibility in the navigation within

the app. Also, the user's GPS-position and *flink* vehicles around town are displayed with live update on the map. This is to create a feeling of an active and alive service for the user.

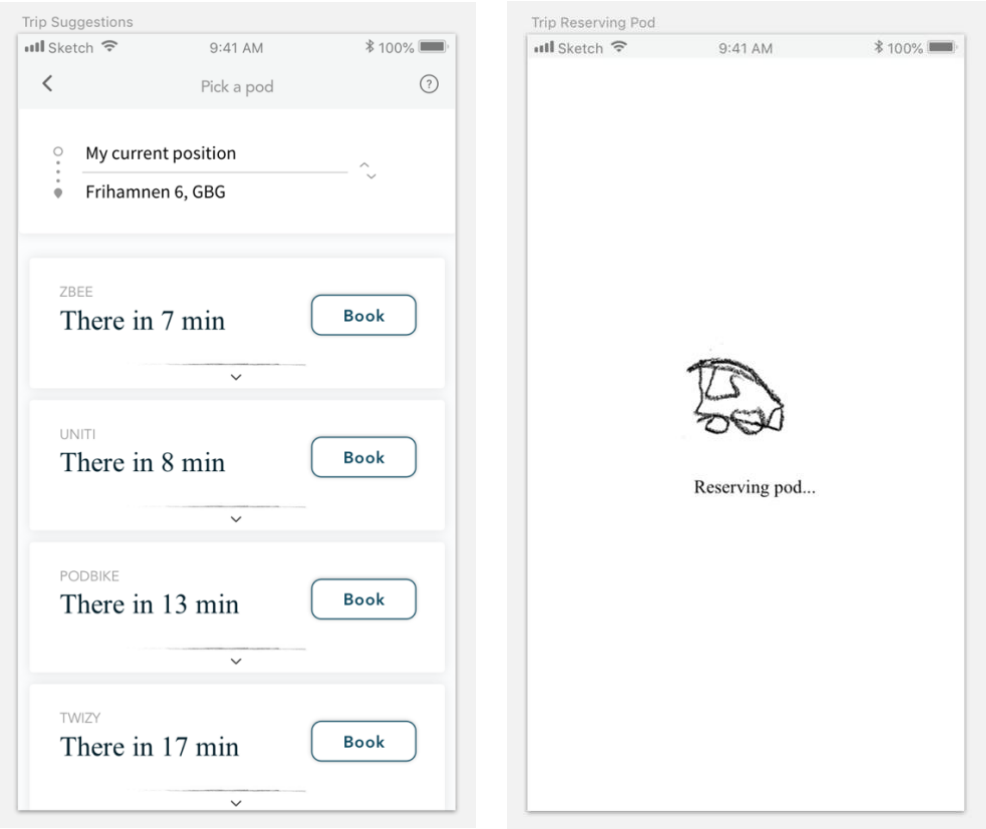


Figure F.24: The 'pick a pod'-frame. Figure F.25. Loading screen.

By pressing search, the user if faced with a list of available pod-taxis, displayed in Figure F.24. To book a pod-taxi, one presses 'Book'. Start and end destination is displayed above the list to aid the user's memory. If the user decides s/he wants to change the search settings, s/he can either press the back-button in the navigation bar, or press directly on the destinations. The user can get more information about a specific pod-taxi by pressing the downwards-facing arrow on the card.

When pressing 'Book', a loading screen (figure F.25) provides the user with feedback on that the pod taxi is being reserved.

The loading screen is then replaced with a confirmation, which ensures the user that the vehicle is on its way, shown in figure F.26. It displays were the pod-taxi will come to meet the user, and counts down an estimated time of when the vehicle will be there. From here, the user can either choose to do nothing, exit the main flow and return to the start screen, or change booking details. The last option, in combination with the information in the dialog box promotes error prevention and recovery.

By going back to the start screen, the user can book a new trip, e.g. a return trip for a later journey. The ongoing ride is however displayed on a card in the top of

the start screen, to remind the user that at the first ride is about to start in a couple of minutes. This is shown in Figure F.27.

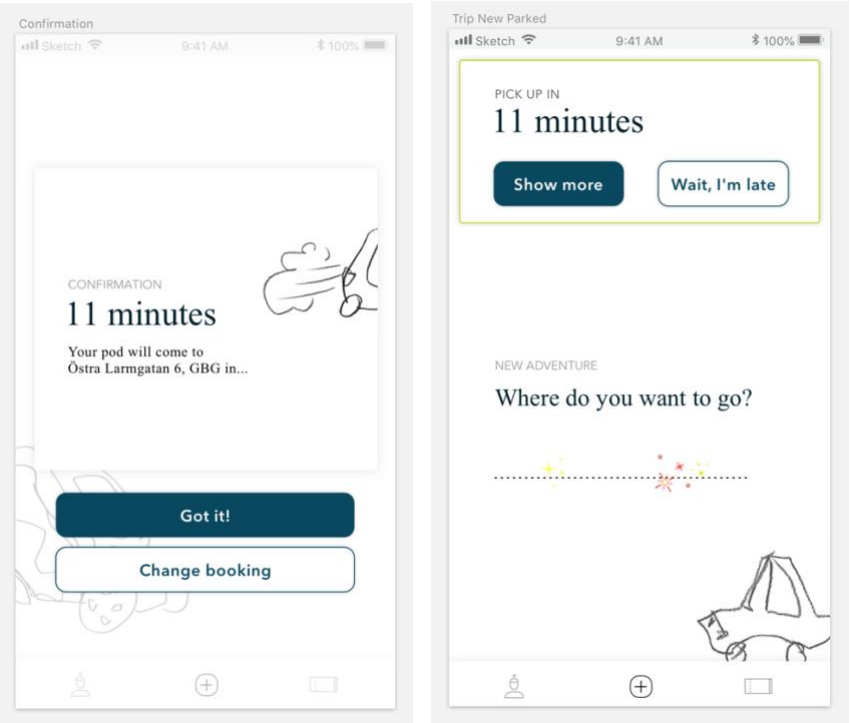


Figure F.26: Confirmation on that a booked bod-taxi is on its way. Figure F.27 The start screen when a booking has already been made.

By pressing ‘Show more’ on the card in the start screen, the user can view the pod-taxi’s live journey towards the user. (See Figure F.28) This is to provide the user with a better, slightly more eventful waiting experience. Also, this opens up for the possibility to meet the pod-taxi half way.

If the user realizes s/he will need a few extra minutes before starting the journey, s/he can press ‘Wait, I’m late’. This leads to a snooze-like functionality, which hinders the vehicle from leaving if the user does not show up in time. (See Figure F.29). ‘Wait, I’m late’ is available both before and after the pod-taxi has arrived.

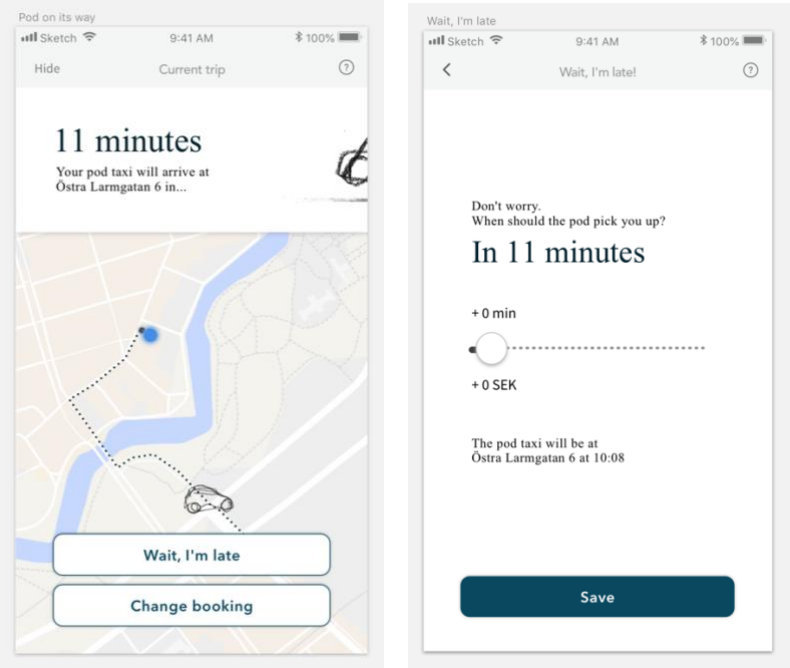


Figure F.28: The user can view the pods journey to the pic- up-point live in the map. Figure F.29: The user can snooze the pickup time, in case they need more time before leaving.

When the pod-taxi arrives, the phone will vibrate and a notification from the app will be shown if the app is not open. When the app is open it will display the frame shown in Figure F.30. The frame provides the user with quick insight on where the vehicle is standing, in relation to the user's position. In this frame, the user can unlock the vehicle to begin the journey by pressing 'Unlock'.

Feedback is given to the user as a loading screen confirms the unlocking (see Figure F.31), in combination with a visual and/or audio signal from the vehicle itself. This can give the user an experience of control, as the vehicle responds in a very noticeable way to an action made through the app by the user. It also shows compatibility with unlocking a car, which can heighten the users perceived value of the vehicle.

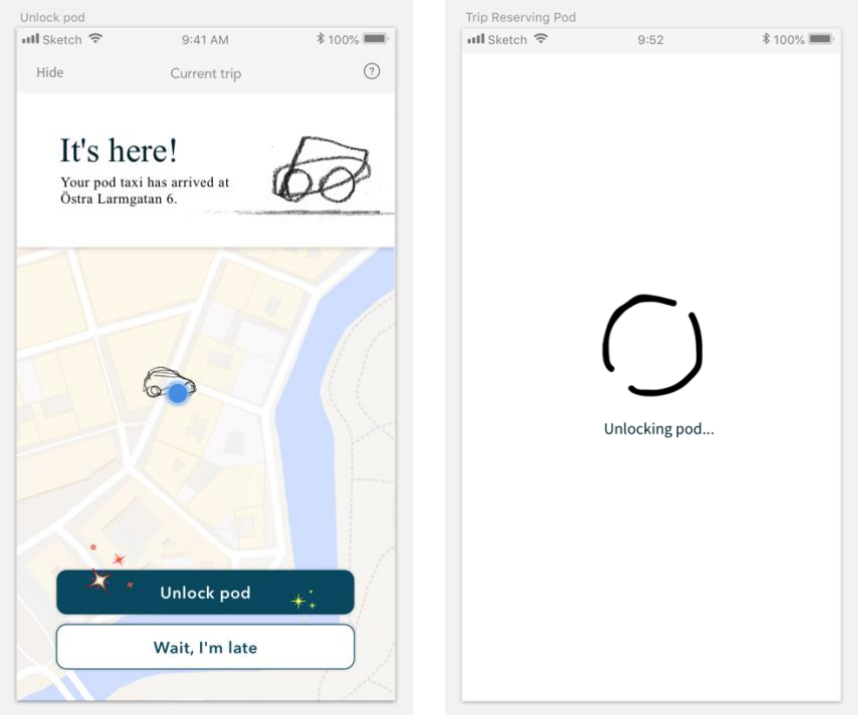


Figure F.30: The phone will vibrate to notify the user that the pod-taxi has arrived. The map can help guide the user to the vehicle if the s/he forgets the location.
Figure F.31: Loading screen.

A first-time user of a certain pod-taxi model will be given short, optional introduction on how to drive the vehicle, as well as information on pricing and payment. (See example in Figure F.32) This information can be skipped and found again through the help button in the upper right corner of the driving interface.

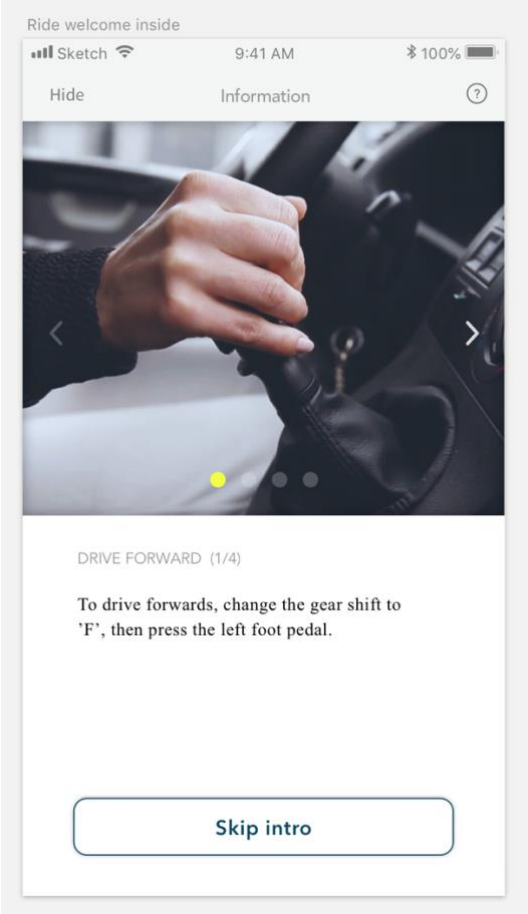


Figure F.32: Introduction for first time users.

The diving interface in Figure F.33, displays the current price of the journey, time elapsed since the vehicle was unlocked and the estimated time of arrival. In this frame, a faded, reduced, but active GPS-view is shown. To see the GPS-view in full screen, the user simply presses on it and enters the frame shown in Figure F.34. The GPS-view is secondary to the driving interface since the end destination is mainly a suggestion of were the trip could end, not something that must dictate the users' behaviour. In the driving interface, the present address of arrival is displayed. This address could be altered by pressing the pencil button. A keypad is revealed so that the user can pick a new final address. If the final address is changed, the instructions in the GPS view and the estimated time of arrival will automatically change.

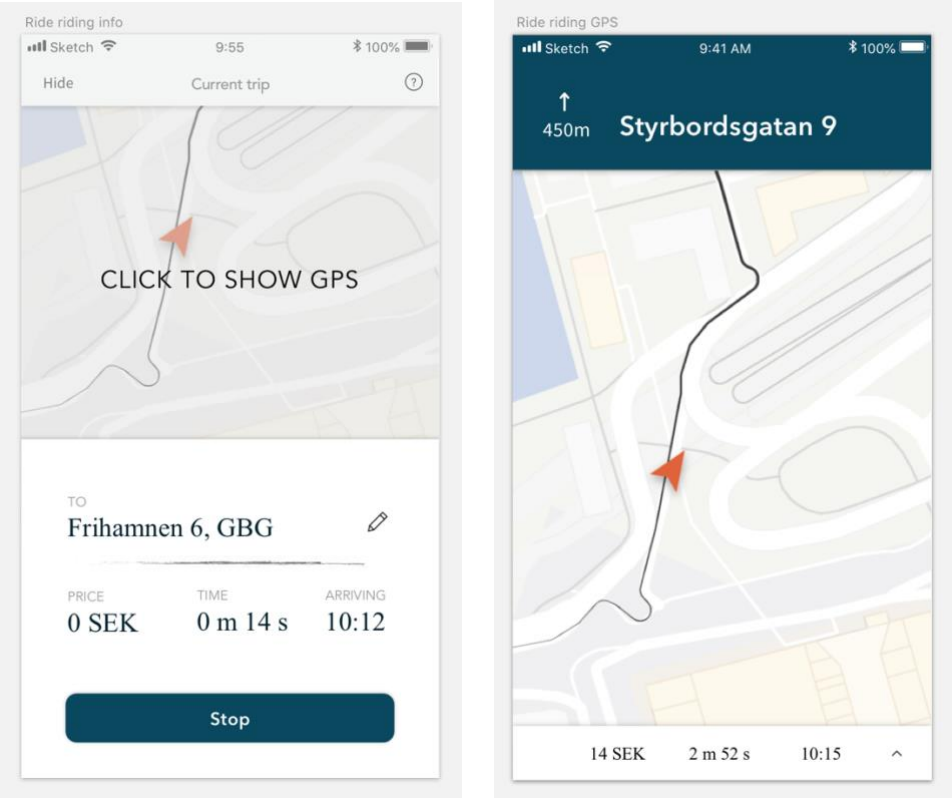


Figure F.33: Primary driving interface. Figure F.34. GPS view.

By pressing ‘Stop’ in the driving interface, the user can either choose to pause the ride quickly along the journey, or finish the trip completely in the frame shown in Figure F.35. In paused mode, the cost will be slightly reduced. The vehicle will wait where the user left it until his or her return, but remind the user through notifications every 15 minutes. The user can find where s/he left the pod-taxi through the map in the waiting frame in figure F.36.

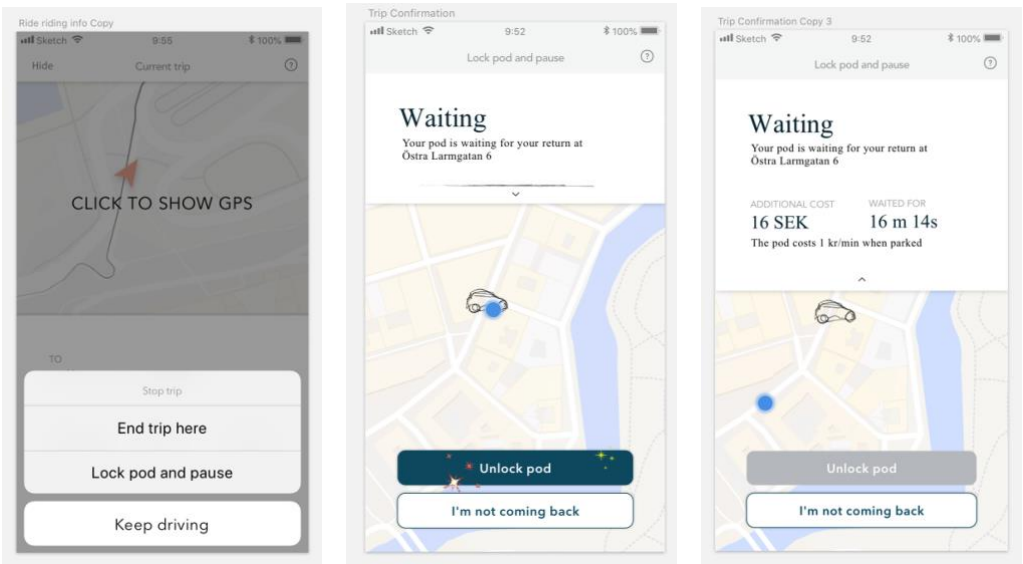


Figure F.35: When pressing stop, the user gets two options. Figure F.36. Interface when ride is paused, collapsed version. Figure F.37: Interface when ride is paused, expanded version, and the user is too far from the vehicle to unlock it.

If the user chooses to end the trip completely, s/he exits the main flow and the dialog box in Figure F.38 is shown.

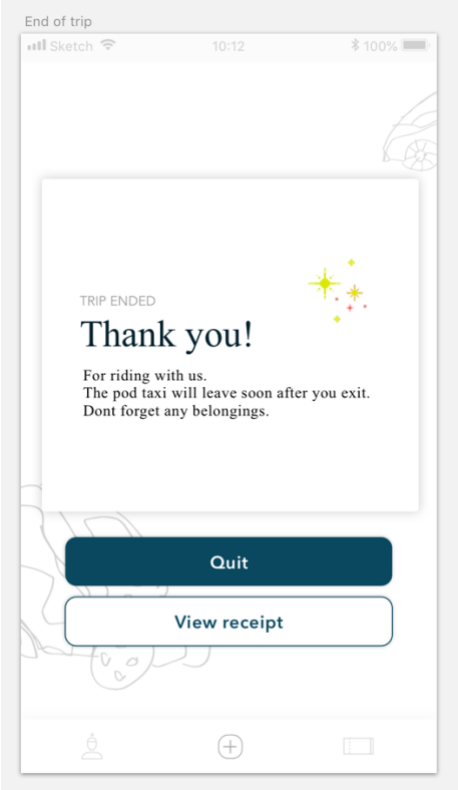


Figure F.38: Confirmation of ended trip.

Overall, the interface is optimized for guessability and re-usability. It uses an everyday tonality on button-titles and headings, rather than technical terms. Most frames contain a 'Help'-button in the upper right corner, which leads to a short explanatory text related to the frame or action currently active. The 'Stop' button is an exception, relying more on learnability for the user to realize they can pause. This is partly because a simple driving interface was prioritized before presenting many options, and partly since first time users were deemed less probable to perform a too advanced journey on their first adventure. Also, the 'Pause or Stop'-frame (in Figure F.35) works like a clarifying constraint for the user not to end the journey by accident.

Bookings and Recipes

Through the tab bar in the start screen, the user can quickly access the tab 'Bookings and Receipts' (see Figure F.39). Here, future bookings can be seen and altered, and the user can view historic trips by pressing the tabs in the top of the frame. Future and historic trips are displayed in lists with cards, and additional

information can be viewed by pressing the downwards-facing arrow. This ensures consistency with the main user flow of the app.

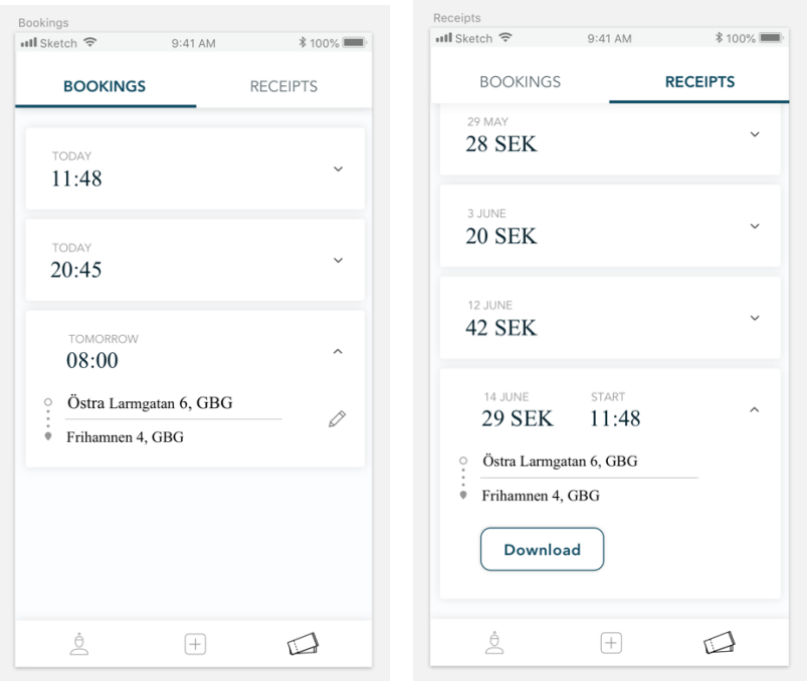


Figure F.39. a – b: Bookings and Receipt-frame. The bottom cards in both frames are expanded.

Profile and *flink Labs* teaser

The user can alter profile settings, payment settings and app settings in the tab-bar option ‘Profile’. From here the user can also logout, access support and refer a friend to the service. (See Figure F.40) All options are displayed in a list of cards. From this frame, the user can find a landing page for *flink Labs*. This button will be decorated in sparkling GIFs to draw excitement and attention.

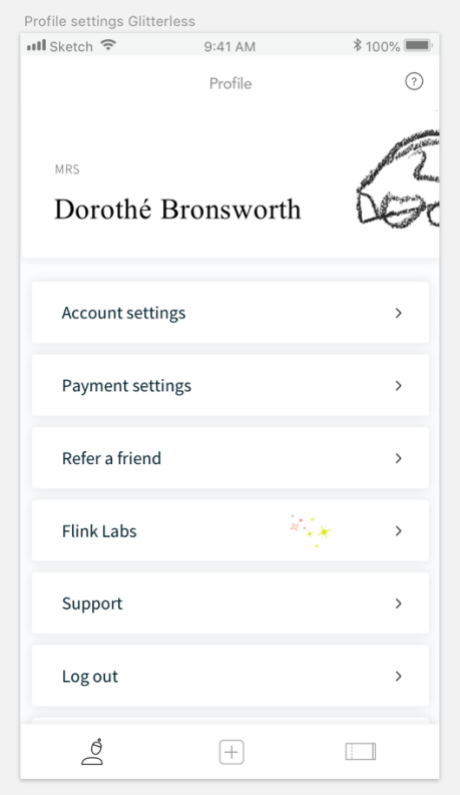


Figure F.40: Profile-frame.

If pressing *flink Labs*, the screen goes dark, and then zooms in on a map of the city where the user is located. Pins drop down on the map and a text greets them (see Figure F.41). This section of the app is intentionally less conventional in its interaction patterns, since it should be perceived a bit gamified and dramatic. By pressing a yellow pin on the map, a dialog box informs the user about a certain autonomous route, and gives him or her the option to go there and test the autonomous mode (see Figure F.42).

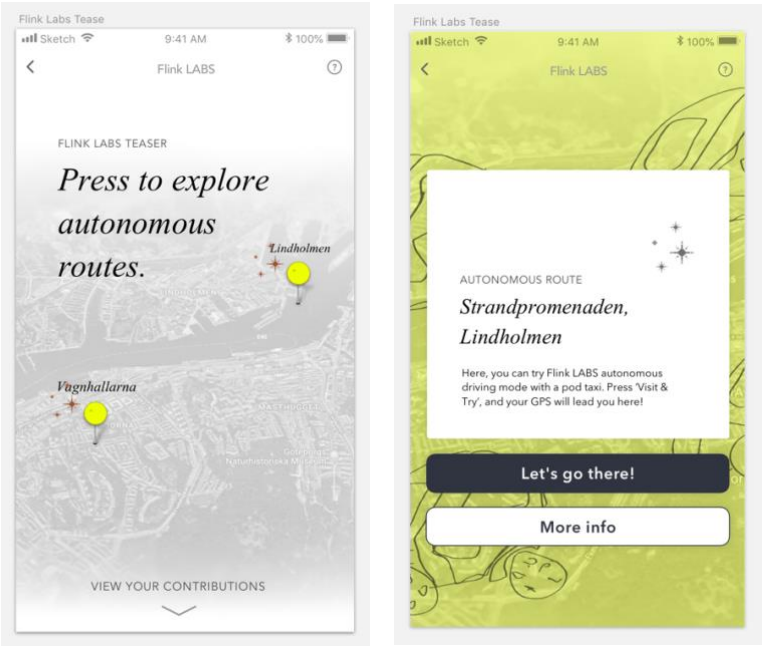


Figure F.41: flink Labs teaser, showing the destination of autonomous test routes.
Figure F.42: Map screen and after clicking on a yellow pin.

If instead pressing the downwards-pointing arrow in Figure F.43, the user is shown what routes s/he has already recorded by driving around town. Another click on the downwards-facing arrow will lead to the frame in Figure F.44. Here, the user can find short introduction to what *flink Labs* is, and press 'Download' to join *Labs* community and access the full experience.

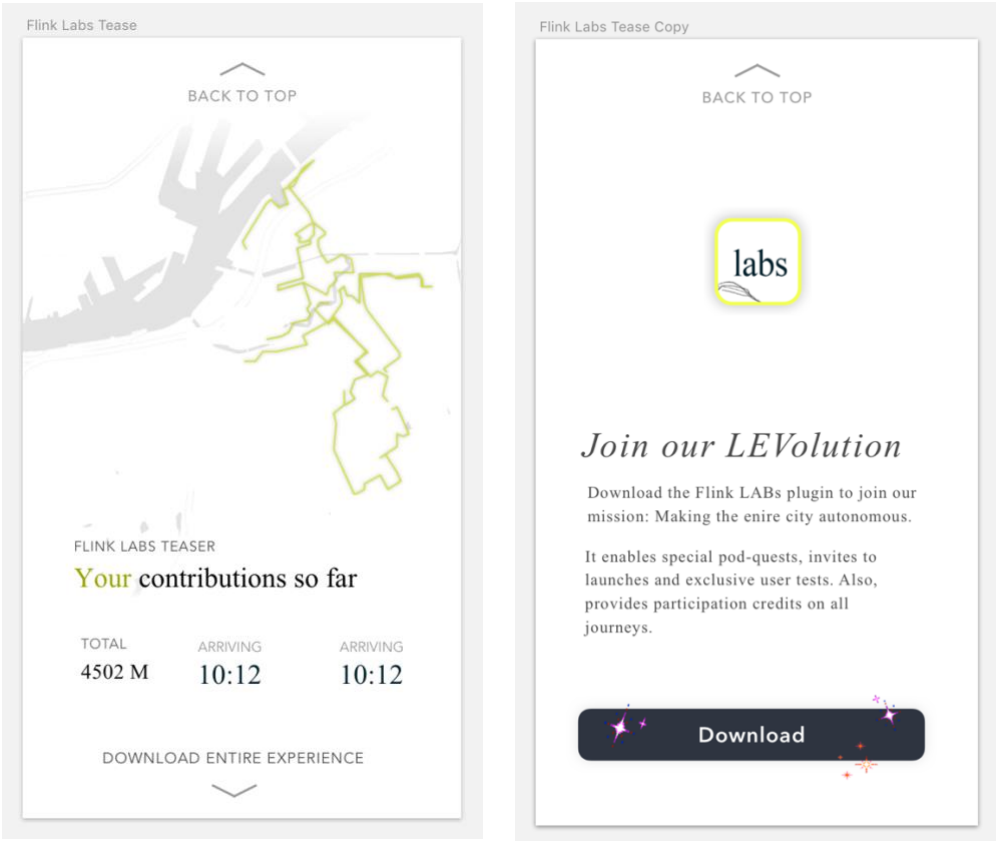


Figure F.43: The users recorded routes so far and a short intro on flink Labs' real app. Figure F.44: Short intro on the flink Labs app.

An animation was created in Adobe After Effects, by importing vector assets and imagery from *Sketch-app* and *Adobe Illustrator*, to showcase the experience. The animations are available at the project group members' *Behance* page at *https://www.behance.net/magpet02249e1a*

8.2.4 STYLE SHEET

To ensure continuity throughout the applications, a stylesheet was produced. It describes how fonts, buttons, colours, symbols and whitespace should be applied to follow *flinks* visual brand identity and can be found in Appendix 22: *Style Sheet*. It can serve as a reference when creating app or website UIs in the future.

8.2.5 AUTONOMOUS INTERFACE IN LEV

Interacting with an Autonomous Vehicle

Volvo Cars has developed an autonomous interface concept for vehicles with an autonomy level of stage three. When driving on a road where autonomous drive is available, the dashboard informs the user with a text message and an icon.

The user must then hold down two physical buttons on the steering wheel for about three seconds to engage the autonomous mode. Once in autonomous mode, the user is free to do whatever s/he desires. A timer is displayed on the dashboard, indicating for how long the autonomous will be available. A 60 second timer will count down during which the user needs to take control over the vehicle again (Rabe, 2015). If s/he does not, the car will stop. In other words, in this concept, the driver interacts with the vehicle itself to control its behaviour.

For vehicles with an autonomy level of five, there is no need for the user to be able to take control over the vehicle. Concepts that feature this include the *GM Cruise AV* that is expected to be commercialized in 2019 (Zacks, 2018). However, the *GM Cruise AV* is only at level four on the autonomy scale as it requires certain map data to function and is not expected to work during certain weather conditions. The *GM Cruise AV* is controlled via a single big touch screen, meaning that the user interacts with an extension of the vehicle, rather than the physical vehicle itself. Other concepts take the idea of not having to engage the user in driving to an even higher level by turning the car into a living room on wheels. *The Renault Symbioz* is an extension of the house itself, blurring the boundaries of the living space and car (Renault, 2018). In the concept video, the user controls the vehicle via a smart watch. Figure F.45 displays the input methods described above.

Figure F.45. Different examples of input methods in concepts for driving autonomous cars.

In this project, it was explored how the transition between manual and autonomous drive could be designed in test 2. The users could switch between manual and autonomous driving mode via the application by the press of a button. Some test participants found it strange to switch driving modes via the application and wanted to interact with the LEV instead. Perhaps the idea of interacting with an application that is connected to the vehicle is too far off from their mental model of how to drive a car. The examples above suggest that this could be the case. The more autonomous the vehicle is, the more disconnected the controls seems to be able to be from the vehicles.

For many participants, this was their first experience of an autonomous driving experience. This is likely to be the case for many of the customers that use the service in an early horizon. If the reasoning above holds true, this implies that the switch to autonomous mode should be done by interacting with the vehicle itself, and not through the phone. Some test participants were also hesitant towards

pressing the autonomous button because little information was available for them on what to expect from the autonomous drive mode. Further, the participants wanted clear guidance on how to make the switch.

Below in Figure F.46-47, an example is given on how the switch from manual to autonomous mode could be designed based on the insights above. The first example is meant for horizon 1, where users have little experience of autonomous drive. The second example is meant for horizon 3, when autonomous drive is mainstream.

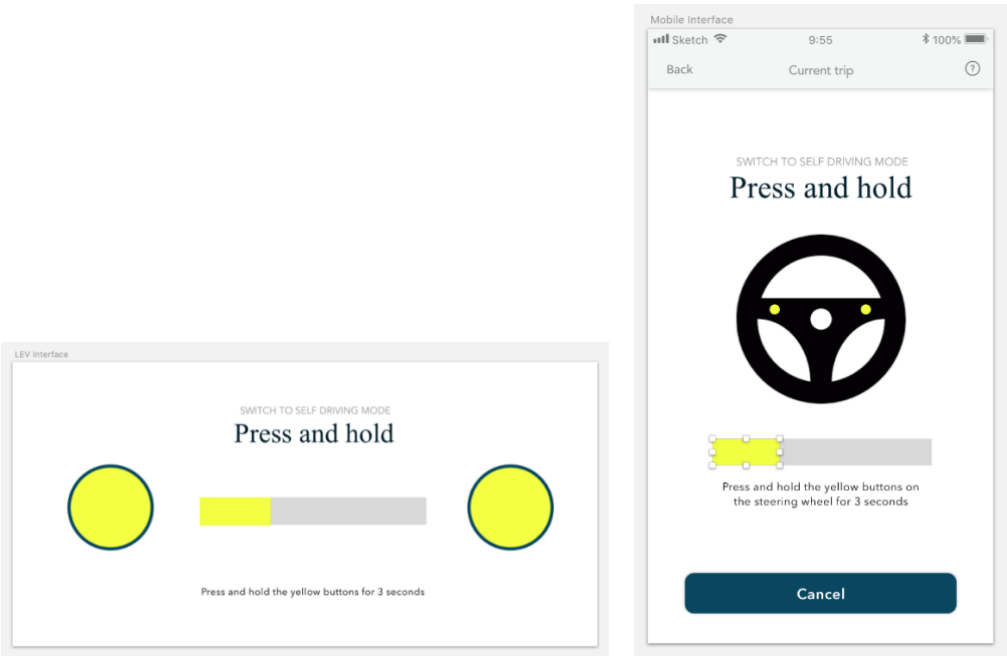


Figure F.46. Step by step-instructions and visual feedback is given on the dashboard of the LEV, to make the switch from manual to autonomous drive, by pressing and holding the two buttons down at the same time for three seconds. The same visual feedback is given in the mobile phone, in order to show that the two is connected. Auditory feedback is given from the LEV and phone when the switch has been successful.

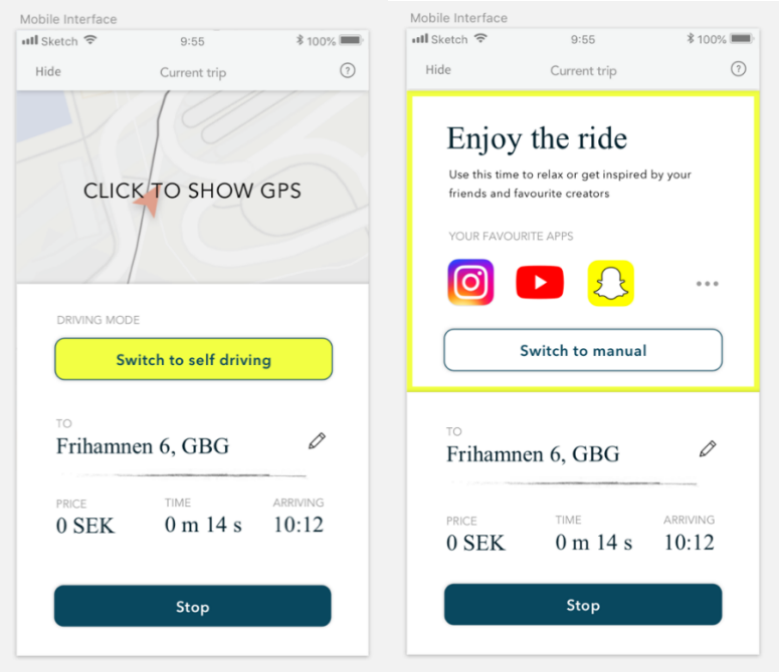


Figure F.47: In the image, the user is switching from manual to autonomous drive via a mobile device. The vehicle and mobile gives feedback that the switch has been successful. This switch is faster and simpler than the switch proposed for horizon 1 above.

Information and Driving Autonomously

In an early horizon, it is likely that users want to know how the technology works and how the LEV manages to drive autonomously. In order for users to feel safe and in control of the situation, they should therefore be given information on what the vehicle is doing. This information can be visualized in a number of ways and shown to the user. Based on the reasoning in the chapter above, it is believed that this information is best shown on a screen attached to the vehicle, rather than being displayed in only the phone application (see Figure F.48). The application can instead show information that is related to the trip itself and the transportation service; *Where am I going? How do I get there? How much does it cost? When will I arrive?* (See example in Figure F.49) It is also believed that when users become accustomed to autonomous drive, the amount of information they need regarding how the technology works will be reduced. In horizon 3, the LEV might not even need a screen because the users might not be at all interested in what the vehicle does and would rather surf the web on his or her mobile phone.

Figure F.48: The image shows an example of what the display of the LEV could show when a user is testing autonomous drive at one of flink's autonomous test routes. To create trust and a feeling of safety, the user gets to see how the vehicle thinks in order to drive autonomously.

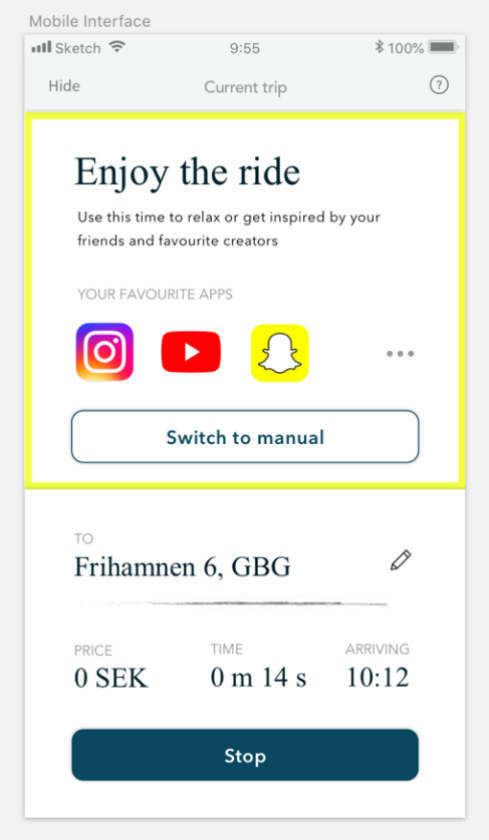


Figure F.49. The image shows an example of what the mobile interface and LEV could show when driving autonomously in horizon 3. The LEV indicates that it drives autonomously via visual feedback from the interior lighting. The mobile phone can encourage the user to do other things than paying attention to the road and what the LEV is doing.

8.2.6 USE CASES IN HORIZON 3

In horizon 3, it is expected that the service can attract other user types than the two primary IDC and recorders. Some user types and user scenarios are presented in the mind-map found in Appendix 4 Map of Opportunities. Below, an interesting user scenario is elaborated on and complemented by an example of how the interface could look in this case (see Figure F.50).

flink for Tourists

Somewhere in horizon 3, *flink* is well established in Gothenburg and autonomous drive is mainstream. A couple from France is visiting Gothenburg and was told at the tourist information centre that *flink* is the best way to get around in the city. In the application, the couple can browse between different tours. Beautiful imagery makes them excited about visiting some of the places presented. They order a LEV that is going to drive them through some of Gothenburg's most cosy streets. They can preview the route it will take and the vistas they will drive by. Half way through the tour, the decide to get off because they spotted a cafe they would like to visit. The couple only needs to pay for the time they spent in the vehicle.

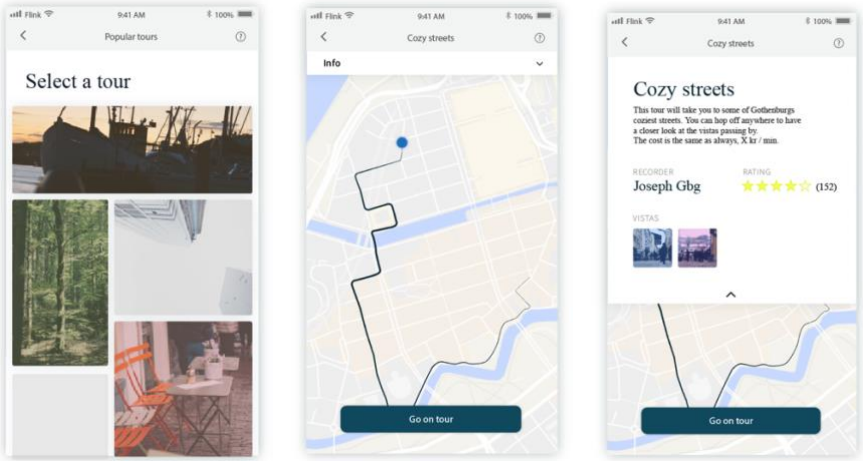


Figure F.50: Conceptual UI for a tourist version of flink.

8.2.7 PRODUCT SPECIFICATIONS

Throughout the project, user needs and other requirements and guidelines have been enrolled in a document that can be found in Appendix 24: *Product Specifications*. In it, needs and requirements are listed in relation to the different horizons presented in chapter 7.2.1 Horizons. The specifications mainly focus on the user needs identified in this project, but also enlists requirements on supporting systems, economic factors important for the user and safety.

flink Labs, Gamification Guidelines

An important thing to consider when applying gamification for *flink Labs*, is that the gamified aspects should align with the user's goals (Werbach, 2012). In the case of flink, the user's goal is to go from one point to another. If this goal can be reached, while at the same time building towards a goal in the game, the user is believed to feel more motivated to complete the quests and tasks of the game. Examples of what such quests and tasks could be in *flink Labs* are listed below.

- Recording brand new routes
- Re-recording routes that needs an update
- Drive a vehicle from one customer to another
- Give personal onboarding to a new customer
- Driving the vehicle to a location where it can be seen by a lot of people

The possibilities go beyond what is listed above. But it is important to consider what the purpose of the gamified elements are and not just gamify for the sake of it. It is also important to observe what the gamified elements are resulting in for the users. Is it having the desired effect (Werbach, 2012). In the case of *flink* the purpose of gamification could be to:

- Gather data for the startup
- Getting feedback from users on new functionality and the experience of the service
- Make horizon one more profitable by having users do some of the distributing of vehicles
- Giving customers a reason to open their app regularly
- Bring early adopters together, creating a strong community and making people talk about *flink*

8.2.8 CONCEPT MOVIE

A movie that functions partly as a commercial and partly as a teaser for the service was created. The movie features a main character standing by a cement wall looking into the camera. She goes through different situations that might arise in everyday life related to transportation. Some days are rainy, sometimes you have a lot to carry and sometimes you stay late at a party. A narrator is clarifying these situations while the movie plays. In the end, the main character has gone through a lot, which is clearly visible in the scene. She picks up her phone and taps the screen, ordering a LEV through *flink*. The movie does not clearly explain *flink* as a concept but acts as a way to catch the viewer's interest and attention. In a presentation, the movie is meant to make people want to listen to the rest of the presentation. On a website, the movie is meant to make visitors want to scroll down and read more about the service. See a snapshot from the movie in Figure F.51.

Figure F.51: Screenshot from a scene in the concept movie.

The movie is available at the project group members' *Behance* page at *https://www.behance.net/magpet02249e1a*

8.2.9 WHAT'S NEXT FOR OLAB?

Moving forward, the start-up should focus on:

- Finding investors, partners and a strong business case.
- Developing the technology so that it can be tested on LEVs.
- Testing the service with a real vehicle with voluntary customers paying for the service.
- Design *flink Lab*s, based on theory from gamification and the general guidelines given in this report.

8.2.10 SUMMARY OF PHASE F

A visual branding concept with serifs, GIFs and minimalistic use of colours was chosen. The start-up was named 'flink' and a flowchart of the final app was presented. High fidelity app frames were designed, and was also summarised in a style sheet. A concept movie and interface animations were produced for commercial purpose. The chapter also describes how the autonomous Human Machine Interface could evolve over time and references product specifications and further development steps for OLAB.

9 Discussion

9.1 The Design Process

The project was done for a start-up with an idea that they wanted to take to the next level. The goal of the project was to answer the research questions that were formulated based on discussions held with the client. The research questions are answered in the conclusion. But another goal with the project was to move the start-up forward, inspire people outside of the start-up and raise interest for the idea. Because of this, it was favoured to take the project as far as possible, focusing on delivering insights and visual content, rather than just making thorough research. This push and pull between making quick progress and reasonable assumptions based on little research or spending more time in the research phase before moving forward was a struggle for the members of the project group. The two, sometimes opposing, ways of executing a project were also favoured differently by the two stakeholders, the academia and the start-up. This resulted in some loss of time but many lessons learned. However, in the end, the project group believes they managed to keep the design methodology in the centre and deliver an inspiring and useful result.

Initially, three weeks was spent on researching the topic of light electric vehicles and ideating on different contexts where a transportation service using light electric vehicles could bring value. Because of the context of use, transportation of people in urban cities, being somewhat determined beforehand it can be argued that it would be more efficient to skip this initial exploration phase. However, it proved to be useful to explore the possibilities before deciding on which context to focus on as it made the project group members and stakeholders more certain that the chosen context was indeed relevant.

9.2 The Result

This project has resulted in identified user types, use cases, a user journey, thoughts on how the mobility service could evolve over time and a brand identity that fits the context of start-up and co-creation. The result is applicable for the start-up that this project is done together with but might be hard to use for others. The reason is that the research and user tests that were done are not very thorough. Instead they were brief and exploratory. They were done to guide decision making and help the project move forward quickly and with confidence. The positive aspect of this is that the project moved all the way from a very open idea to a defined and tangible idea in a short amount of time. The idea now has an identity, a name, visual content and arguments to why it is interesting and relevant. This is all very useful for the start-up when looking for attention, partners, investors and employees. The negative aspect is of course that the end result is still just an idea and that there is a lot of uncertainty left that needs to be researched further. Many of the uncertainties regard economy- and business-related topics as well as legislation.

The explorative research in this project does not focus on investigating how light electric vehicles compare to conventional cars in terms of what mobility and flexibility they provide. This has already been done in other studies referred to in this report. Instead, this project has focused on getting a basic understanding of the mobility need of people living in Gothenburg. By doing this, several cases of when the transportation options available today does not prove satisfactory was identified. The transportation service designed in this project was then designed to fill the identified gap. This is important because it creates value for citizens by meeting their mobility needs. In the long run, giving citizens an opportunity to try out new means of transportation can help in making their urban transportation habits more sustainable.

There is little quantitative data to retrieve from this study. This is partly because of the low number of participants in the user tests and workshops and partly because of the semi-structured nature of the workshops and interviews. This means that it might be difficult to compare these with results from other studies that has been done previously and with future studies. To be able to compare results over time could be useful in order to gain an understanding of how the market need is changing over time. Instead, the results from this project can be used as a starting point when setting out to collect more quantitative data and understanding. The designed application, branding material and ideas on how the service might evolve can be used as a starting point when launching a pilot of the service. The visual presentation material can be used to attract partners and investors.

This project was based on research done in the Gothenburg area. But the result is applicable to any geographical location thanks to the brand identity. By adapting the doodles to fit another geographical context, the impression of the service changes to reflect that certain context.

In the report, the concept developed in this project is referred to as “the transportation service” or “the service”. The word service refers to the entire experience and all touchpoints that the user might come across. However, only the application was designed in detail. This might set unrealistic expectations on the result of this project, implicating that it should contain results regarding all touchpoints. The customer journey, branding concept and the application is probably the most well-worked result. That area is also the one that the project group had most competence within. The service blueprint and development strategy of the service is not as well done and further work needs to be put into these areas in order for the entire service to be well designed. A pilot also needs to be set up in order to gather information on how touchpoints such as the website and customer support is experienced.

9.3 Research and User Tests

User Test 1 was done with people from a single workplace. All these people had quite flexible work hours which probably influenced their perception of their need to be able to book trips in advance, in a schedule like manner, versus booking trips spontaneously. Most participants felt that booking trips in advance did not fit their needs.

In User Test 2, there was a lot of things that were sought to find out. This resulted in the test procedure being very strict in order to guarantee that all situations that needed to be tested did in fact arise during the test. This left little space for variation and for the different test participants to react differently. However, in the end of the test there was time set aside for discussion. Another important thing to point out is that the preparation of the test was at least as value creating for the project as the test itself. Preparing the detailed test procedure forced the project group to make multiple design choices that otherwise might have been postponed for too long.

The ambition was to also test how the users reacted to being able to choose between manual and autonomous drive in User Test 2 and discuss which one they prefer and how well they understood how to switch driving mode. But because of the vehicle being borrowed and the test persons not being allowed to drive themselves, this proved to be very difficult. Instead, the test situation merely functioned as a mediating object. The project group later decided to briefly research the area of interfaces related to autonomous drive and gives examples of how the interaction and interface should look when switching between manual and autonomous drive as well as when driving autonomously. But of course, these are just examples and the complex HMI system of autonomous drive needs to be tested with a LEV fitted with OLABs technology in order to come up with a safe and proper design.

User Test 2.5 was done with only a single participant. This test was not planned for in advance. When User Test 2 did not seem to give any new insights, it was decided to quickly iterate the interface design and flow based on feedback from test 2, and let the last test person try the new version.

9.4 Design Choices

It was decided to design two separate apps. One targeted towards people only interested in the utility that the service brings. And one targeted towards early adopters who also find interest in being part of the community that drives the development of the service forward. This decision was taken because the app for early adopters would be a place for the start-up to try new functionality and get feedback before launching it in the main application. It was believed that early adopters are more forgiving towards beta functionality and performance. It was also believed that by having a second app meant for early adopters, the feeling of

being specially chosen to be a part of the development and a community would be increased. A counter argument could be that it is not suitable to launch two apps for a start-up as it takes more time to develop and costs more money. Also, if the service should be launched in an early stage, it is perhaps better that everyone uses the early adopter version anyway. Which decision is the best might come down to how well developed the service is before it launches. It might be unreasonable to differentiate between early adopters and others if the service launches in a very beta-like stage. However, if the service turns out to be developed behind closed doors for some time and launch in a mature state, it might be more suitable to launch two separate applications.

9.5 Moving Forward

Some of the things that need to be done when moving forward for the start-up is mentioned in chapter 8.2.9 What's Next for OLAB. Adding to that, it needs to be discussed how to best move the project forward in terms of strategy. Is the service best suited to be developed in a controlled environment via a research project? Or is it better to quickly make a minimum viable product and launch the service the start-up way? The results from this project does not indicate which one might be better. However, it was found during the interview with the CEO of a LEV manufacturing company that it can be difficult to find investors and a business model that is profitable even in the early years for LEV services. Hence, whichever way attracts investors might be a good way to move forward. The goal of the next step would be to investigate how big the market and demand for this type of service is, so that a forecast can be made on how long investors should expect to wait before seeing a return on the investment.

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10 Conclusion

In order for a transport service with autonomous LEVs to be attractive it needs to complement the citizens current means of transportation and provide a solution in situations where they fall short. In other words, the service does not need to compete with public transport, biking and other promising means of urban transportations, but instead grow alongside them to facilitate a mixed mobility behaviour.

There is a need for door to door transportation within the city, but few find it reasonable to regularly pay the full price of a taxi or Uber. The mobility need that was identified is both spontaneous and planned, meaning that the transportation service should be responsive and able to provide a user with a vehicle within ten minutes. The service should also facilitate a planned mobility need by allowing customers to create bookings. However, the spontaneous mobility need was found to be stronger. Therefore, when first implementing the service, the minimum viable product does not need to include the possibility to book vehicles. Another important issue that needs to be solved in order to create a true door to door experience is to relieve the customer from having to park the vehicle. When autonomous drive is allowed, the vehicles can drive away from the customer and pick up the next one by itself. But until then, other ways of providing a door to door mobility service needs to be found.

The two main user types identified are labelled *I don't care* and *Recorders. I don't care* users have a strong door to door mobility need and are only interested in getting from A to B as fast as possible, meaning that they happily drive the LEVs manually if that results in them getting there faster. On the other hand, *recorders* have an interest in technology and autonomous drive. They find value in helping the service grow and becoming a part of the development. *Recorders* typically also finds it intriguing to drive autonomous. In reality, many users are a mix of the two defined user types.

Another important thing to consider is that at the time of writing, autonomous drive is not allowed by legislation and the trust and perceived value in autonomous LEVs, versus LEVs driven manually, was found to be low. This is most likely going to change as autonomy become more mainstream in the future. But until then, the service has to function without the aid of autonomous drive. Luckily, many people have a great interest in technology and autonomous drive. This can be used to the service's advantage by attracting early adopters and involving them in the development and growth of the service. In this way, large amounts of data can be gathered, tests can be run and iterations can be done, making sure that the service is optimized, ready and already loved and used by the citizens for when autonomous drive can be introduced.

In order to communicate that the start-up is based on this user involvement, continuous improvement and growth at the same time as it is live and provides an attractive transportation solution, the brand identity defined plays with combining

trustworthiness and playfulness. It is designed in a way so that it is easy and cheap for the start-up to create new content for the interface and marketing.

To bring the project forward, the autonomous technology used needs to be finalized. The start-up needs to find partners and investors and a strong business case. Also, challenges regarding recharging infrastructure and legislation on autonomous drive also needs to be looked into.

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12 Appendix

Table of Appendices

Appendix 1: *Interview Questions*

Below, the questions used during the semistructured interviews are presented.

Interview 1

CEO, LEV manufacturing company
Semi structured interview 19th of January 2018
Questions are presented in swedish

- Berätta om företaget. Hur går det med er LEV? Vad händer härnäst?
    - Var används fordonen?
    - Varför GBG/sthlm, någon annan stad ni övervägde/inte valde?
    - Någon annan kontext ni övervägde (flygplats, mässor, förort)
- Vilka användargrupper tror ni är viktiga på kort, och så småningom, lång sikt?
    - Någon som inte är viktig/svårflörtad
- Vilka olika ägandeformer har ni övervägt?
- Acceptans för fordonet: Har ni horisonter på hur ni vill introducera fordonen till folket.
- Vad möter ni för reaktioner när ni berättar om det? För folk i branschen? För folk utanför branschen (vanliga människor)? (Entusiasm/Motstånd) Ser man potentialen eller behövs den motiveras?
- Vilka är möjligheter och utmaningar med små fordon i urban miljö?
- Vilka värden kan dessa fordon att ge användarna och staden?
    - Pitchargument?
- Hur ser ni nu på en möjlighet att göra en LEV som är delvis/helt autonom?
- Tips till oss? Något vi absolut ska titta närmare på? Någon fallgrop vi ska undvika.

Interview 2

Team Lead and Software Development Process Therapist, LEV taxi service company
Semi structured interview 8th of February 2018
Questions are presented in swedish

- STHLM & reklamare + Chalmers Campus: Vad fick er att välja dessa två användargrupper?
- Fokus på innerstaden. Varför det? Potential att utöka till utanför stadskärnan? Till de närmsta förorterna. Vad är problemen med det? Utmaningarna
- Kommer ni expandera användargruppen? Hur? Har ni horisonter på hur ni vill introducera fordonen till marknaden?

- Vilka utmaningar har de mött för en liten fordonstyp i en svensk storstad? (i mån av folks intresse och infrastruktur?) Vad tycker Stockholms kommun?
- Komplettera inte konkurrera
- Taxiverksamhet alltid - eller utvecklas mot andra ägandeformer? (collaborations?)
- Vilket problem vill ni lösa? På kort och på lång sikt?
- Vilka länder/världsdelar är fokus i framtiden?
- Vad möter ni för reaktioner när ni berättar om det? För folk i branschen? För folk utanför branschen (vanliga människor)? (Entusiasm/Motstånd) Ser man potentialen eller behövs den motiveras?
- Hur ser ni på autonomitet? Vad har era förare för roll i varumärket?

Interview 3

Front Figure and Art Director at a LEV manufacturing and sales company
Semi structured interview 1st of February 2018
Questions are presented in swedish

- Var inom transport ligger ert fokus? Pendlare, inom centrala staden, både och?
- Hur autonom är den?
- Vilka länder/världsdelar är fokus?
- Vilket **problem** vill ni lösa? På kort och på lång sikt?
- Vilka **användargrupper** tror ni är viktiga på kort, och så småningom, lång sikt? Implementering. Nischar ni er mot någon grupp först för att sedan nå ut till massan? Eller förväntas man upptäcka nya användargrupper efter en viss tids användning och medvetenhet hos befolkningen/politiker?
- Vilka olika **ägandeformer** har ni övervägt?
- **Acceptans** för fordonet: Har ni horisonter på hur ni vill introducera fordonen till marknaden?
- Vad möter ni för **reaktioner** när ni berättar om det? För folk i branschen? För folk utanför branschen (vanliga människor)? (Entusiasm/Motstånd) Ser man potentialen eller behövs den motiveras?
- Vad har varit de främsta utmaningarna vad gäller att ni introducerar en ny fordonstyp? När ni behöver ta beslut om användningen av fordonet. Styrning, funktionalitet, interface-frågor.

Appendix 2: *Workshop 1 Procedure*

Aim

The aim of the first workshop was to:

- Exploring different contexts in which an autonomous LEV service could be used
- Map out common journeys the participants make on a regular basis.
- Investigating the participants wishes regarding travelling in the city

Selection of participants

For this workshop, participants that were known to have the ability to think freely and be creative were chosen in order to be able to fulfill the first aim described above. Seven participants were recruited. All of them were students at Chalmers University of Technology and several of them studied a program where creative thinking is key.

Procedure

Before the workshop started, the participants were served food and drinks and were given a moment to introduce themselves to each other.

Exercise one
The participants were given two cards where they should fill in a journey they make regularly on one of the cards and a journey they make less regularly on the other. There were also four questions on each card that needed to be answered:

1. What is your errand
2. What do you occupy yourself with during the journey
3. Which means of transportation do you choose? Please motivate
4. How do you prepare yourself for the journey?

A short discussion in groups of four was held after the first exercise, giving the workshop coordinators the possibility to ask questions.

Exercise two
This exercise focused on eliciting wishes about transportation, given that anything is possible. The participants were encouraged to think about unrealistic ways of being transported from A to B, but had to motivate their wishes and thoughts clearly. The participants were given cards containing a place of departure and arrival. These were decided beforehand to make sure that many different scenarios was covered to see how different errands and contexts influenced their wishes. The participants tasks was to explain how they would get from A to B and provide a motivation.

A discussion in groups of four was held after exercise two where the different imaginative ways of transportation were discussed and compared to means of transportation available today. The goal with the discussion was to elicit the underlying needs and wishes.

Exercise three
The last exercise was done in groups of two. Big papers were hung of on the wall with one question on each, formulated as *how-might-we* questions.The four different questions were:

1. How might autonomous LEVs bring value in other contexts?
2. How might autonomous LEVs fulfill your every day needs?
3. Where might autonomous LEVs bring value?
4. How might autonomous LEVs be used for other purposes that people transport?

Appendix 4: *Summary from the KJ-method*

Below, the categories of qualitative data that resulted from the KJ analysis are presented.

LEV is not for me

- Several early adopters in WS2 felt they currently have sufficient means for transportation, and did not feel ALEVs were something they would use on a regular basis. Mainly due to living within a comfortable walking distance to school/work and public transport is “free” when they need it.
- Others disagreed and said they would prefer to use it in special occasions

Motivation for change

- In Hannas study, a big emotional motivation for change was environmental concerns, and a shame towards using cars
- A practical motivation point to use ALEVs would be if the journey generates more free time (WS2)

Flexibility

- People walk home at night in case no busses are available
- For people to use LEVs, they need to be highly accessible at inconvenient times
- The user should always be able to revert to manual drive
- For the service to offer something new compared to public transport it NEEDS to be a door to door service.
- Complement other ways of transporting. Routes to car pools.
- How can we complement current means of transportation?

Opportunities - soft values

- Providing a personal experience of a shared service. Personalization through log in. Or create a strong brand and make people want to be apart of that.
- Pay extra for solitude
- Experience starts during journey (exclusiveness)
- The choice of “flying low” and watch people or taking the highway
- People chooses not to take buss / certain route due to memories/ associations
- We against them mentality. People are not used to seeing LEVs. Some felt like they were intruding on others. Asking for car ride, being an obstacle on the road etc.

Parking

Having to park the vehicle is perceived as a huge drawback

- Finding parking should never be an issue or
- One should just be able to get out anywhere and walk away

Charging

- Battery-swapping seen as a more seamless solution that heightens the utilization-level, in comparison to having a garage.

- Own thought: The charging situations will improve later on when infrastructure is built up. By then, routes are drawn up and the vehicles can autonomously go to the closest charging station. How will

Economy

- People are more inclined to consider the service if it is cheaper than current public transport
- Cost vs efficiency is an important factor when selecting way of transportation
- People felt they would be more likely to use it on a regular basis if they had paid for a subscription.
- If they pay more, they expect high comfort or functionality.
- Should it be cheaper or rather bring other/new values?

Safety

- Perceived safety is the second most important factor when choosing transportation mode (Källa Johanna). Perceived risks with ALEVs are: Fast, heavy, big cars that competes with available lane space, snow, Puckos in traffic,
- People feel less prone to use vehicle during stress, due to low trust. Riding in bike lanes increases people's perceived safety.
- Basic active safety (e.g. emergency brake) might make people more relaxed during journey, due to consequential trust in the autonomy

Choice of mean of transportation

- Based on fastest way from A to B. Saving time on transportation is perceived as positive as it frees up time that can be used for other activities.
- Perception of safety is a deciding factor for many when considering LEVs as a transport
- A fleet with vehicles of different type, performance, free space etc is key if a larger number of trips should be accommodated by the service.
- A vehicle's condition (winter gear, battery life, luggage space etc) needs to be visible when browsing for nearby vehicles. Filter option?

Flexibility

- The general idéa of the service should be that there is always a vehicle available at close distance
- Cars enables flexibility - if the ALEV is to replace the car people either have to plan more, or ALEVS needs to be flexible
- Möjlighet att ändra route under autonomt läge, samt att boka biljett i sista minuten är faktorer som potentiellt kan bidra till en känsla av ökad flexibilitet.
- In terms of flexibility two types of journeys were found
    - *Unplanned* unordinary circumstances (rain, late night out, impulsive lunch in city centre) makes people want an on-demand-service
    - *Planned* unordinary circumstances makes people more accepting of waiting, if they have the ability to book something in advance. (E.g. interview, train ticket, grocery shopping during weekends)
- When having reached the destination, minimum interaction and tasks should be required to be able to leave the vehicle and the service.

Choice in user group / use cases / Opportunities

- People are more accepting towards waiting in extraordinary circumstances → Service could aim to satisfy these situations in an early horizon. (eg. midnight, rain)
- A magical vehicle that appears when you sigh at the realisation at something annoying - missing the last bus, a blizzard or a stuffed tram.
- Could be a mix of car fleet and styr och ställ (Smell, placement, charging)
- The service could be seen as a more attractive choice if we use soft values in the experience (might be something that cars of future also applying - H3 users will expect it)
- People use public transport and styr och ställ impulsively. If a bus comes, I will jump on. To accommodate these journeys, we can not demand planning from the users, but need to provide quick, on the fly access. These people would walk or use other means of transport anyway? Therefore it is not a good focus?
- Define what our unique aspect is. For instance, Bzzt has a crazy brand identity and the sociable drivers.
- What is our USP? For instance, Uniti is a cheaper alternative. When they start talking about money, everyone gets onboard.
- Should it be cheaper or rather bring other/new values?
- In a later horizon, people who dislike/fear driving manually in central parts will adopt this vehicle if they deem it seamless enough.

Which trips can a LEV service replace

- Impulsive trips, the goal is to get from A to B as quickly as possible counting from when realising needing to go. For these trips to be accomodated, the service needs to be very responsive.
- Are the LEV service the choice for last resort trips or planned trips?
- Trips under the influence of extra ordinary circumstances are interesting. Bags from the mall, heavy rain, need time alone etc. Suck-moments are an opportunity.
    - Use big data to predict behaviour and suck-moments.

Appendix 4: *Map of Opportunities*

In this document, a list of different opportunities for a LEV transportation service found through workshop 1, workshop 2 and idea generation within the project group are presented.

Tours

City Tour
Samsung HQ
Caribbean Islands
The Valley of Kings

In It for the Ride

Share experience with others
Find new picnic spots
Randomize button - get me anywhere!

Controlled Environments

Business parks
University campus
Mall
The Olympic Village
Big hospitals
Airports

Transportation of goods

Farmers market service
Impulse shopping delivery
Götta från stan ;)
Sharing products with others in a shared economy

Order ride for others

Lisebergs camping → Liseberg
Order one for grandma so that she shows up at dinner
Order LEV to drive the kids to kindergarten
Have LEVs pick up people for the blood bus
Have LEVs drive drunks home from parties
Have LEVs pick up clients for business meetings at companies
Have LEVs pick up patients that needs to go to the hospitol

Ways to get attention

Future driving teacher
Free coffee at starbucks when expanding the network
Product placement inside the vehicles

Use LEVs on golf courses
Test an LEV for a weekend! :D
Product placement based on GPS.
Drive LEVs to certain places where a certain commercial will be successful

Uncontrolled environments

Podcast on LEV, in LEV, about LEV with famous people
Commuters
Multimodal public transport
On the countryside instead of local bus
Opportunity to recharge your own batteries
Taxi
One time users

Appendix 5: *Interview notes*

Uniti

Uniti is a startup sprung from a research project that aims to change our behaviour patterns within transportation. By designing a cool product, the Uniti car, they want people to choose LEVs instead of cars. Uniti claims that the car will sell by looking at actual needs and numbers together with the customer. An LEV can get the job done almost any day of the week and is considerably cheaper to drive and own. Long term, uniti wants to solve problems like congestion and local air pollution.

Uniti is building an IoT service together with Tele2 to enable a shared ownership business model in the future. However, because of a vast number of people still being unfamiliar to and uninterested in shared living, they will launch the product for independent ownership. The car is designed to be able to adapt to the individual user even though the vehicle is shared. By using NFC technology the car interface, interior lighting and seating position can be adjusted to fit the users preference. The product will also launch with a new innovative control unit that facilitates gestures such as swiping to provide a more intuitive experience driving the car. This control unit is there to attract early adopters. To complement this, the car will be available with a standard steering wheel aimed at a more conservative audience. Focusing on the last mile journey, the car ships with a modular battery that the user can charge at the office. This is a solution that enables the car to bring value to urban cities even before charging stations are widely available.

Bzzt

Bzzt is a company providing a taxi service in Stockholm using only LEVs. Currently they only offer the Zbee from Clean Motion. The service is accessed through an application, where a ride can be booked. There is no possibility to book a ride for later use. The ride will arrive at the customer's position as soon as possible. According to Johan Lindberg, team lead and software development process therapist at Bzzt, the chauffeurs are very important for Bzzt. They are sociable, talented in making conversation and have a genuine interest in their passengers. This is key, as the Zbee is very small and brings the chauffeur and passenger close. Also, many of the customers are regulars, which means that the chauffeurs meets certain customers several times.

Bzzt has the most customers between 5 PM and 4 AM on fridays and saturdays. However, Bzzt has decided to make the service available at all times because they are not trying to make the largest possible profit. Bzzt wants to change the transportation behaviour of urban citizens. In order to do this, it is important to be available to the citizens and stay visible, says Johan. He is also very clear with the fact that Bzzt wants to complement the public transport system, and not compete with it. People who needs to go long distances are much better of with the subway. The average distance for a Bzzt ride is two kilometres, meaning it is being used for last mile journeys in a mixed mobility behaviour. Bzzt have been in contact with Stockholms stad to explore possibilities of creating an attractive mixed mobility solution. A key aspect regarding mixed mobility mentioned by Johan, is to be able to book a ticket that is viable across different means of transportation, so that the user does not need a number of different applications to get from A to B in an efficient way.

A challenge for Bzzt is the battery life of the vehicles. Today, the battery lasts for two hours and it takes four and a half hours to fully charge it. This results in a utilization rate of 33%, not counting the time is takes to drive the vehicles to and from the charging stations. However, this figure should be compared to the utilization rate of cars which is 6%. Higher battery capacity has the potential to increase the utilization rate.

Another challenge mentioned by Johan is to move from having chauffeurs to allowing customers to drive the pod taxis themselves in a shared economy based business model. Potential problems could be to ensure that the vehicles are clean and inviting, protecting from damage and theft and knowing when that the vehicles are fully functional and safe to drive. However, sharing the vehicles show great potential once the number of customers and vehicles have increased.

Johan finds interest in building a concept where the vehicles could be distributed autonomously. A business model where three parties work together is believed to be successful. One party provides the technology, one provides the vehicles and the last provides the service itself.

Clean Motion

Clean Motion is a company that produces and sells an LEV called Zbee (See chapter XX). The CEO of Clean Motion, Göran Folkesson believes that LEVs is the answer to many of the problems that is arising in urban cities related to transportation. There are many examples of pilots that show promising results. However, there are a number of challenges to overcome in order for these pilots to grow to a commercial scale.

Göran thinks that having chauffeurs can initially bring value to the passengers and the service as a whole. It functions as a way to incrementally make people accustomed to a new type of vehicle. The passenger gets to ride along while someone else drives the LEV. Perhaps after a few rides, the passenger feels comfortable riding in LEVs and can more easily imagine driving one him- or herself and consider to try it. Compare this to being faced with a new type of shared mobility service as well as a new type of vehicle. This hurdle could potentially be to big to overcome for some people, resulting in them never trying out the service.

The biggest challenge according to Göran, is to get sufficient funding to start up an LEV service at the scale that is needed in order for it to work well, be noticed and adopted by more people than early adopters. The question is, who are the actors that have enough money and incentive to invest in an LEV mobility service? One answer could be the big actors on the car market. But Göran suggests that they are not interested in LEVs and shared economy business models. Sharing vehicles would result in considerably less cars being sold and these big companies needing to transform their businesses. They currently invest their money in advanced and expensive technology that will, in some future scenario, allow their customers to commute autonomously to work and drive safely and autonomously in cities. But that does not address the problem that is emerging within the cities regarding congestion, sound pollution and low utilization rate of vehicles. Additionally, electric companies and municipalities are investing in powerful charging stations built for big cars. This becomes yet another incentive to keep car traffic within the cities and strengthens the big car companies positions even further.

Another challenge that Göran has noticed is that, compared to other european countries, sweden is reluctant to adopt new habits and innovative solutions within transportation. For instance, shared mobility services such as BMW DriveNow and Mercedes Car2Go have gained traction in a number of cities in Europe, but has not been successful in Sweden. However, other factors such as swedish cities being very small in comparison to other major european cities could indeed be the cause of failure. It is also important to note that even though these shared mobility services have found success in some countries, they are still based on regular cars and does not increase the diffusion of LEVs. But the big car companies are the only ones with enough money to roll out such a service. Göran talked about how it is very difficult to find a business model for an LEV service that is profitable from the start and scaleable. In order to make a free floating LEV car pool service attractive, many vehicles are required. However, to produce a lot of vehicles and not sell them right away results in tremendous loss the first years. In the long run, a shared service should be profitable but there is no actor on the LEV market that has the capital to make the initial investments and losses. Because of

this, small scale projects are moving the LEV industry at a pace that is slower than what is possible given the available technology and market potential.

Appendix 6: *Workshop 1 Findings*

The workshop partly resulted in ideas on where an LEV service could be used and partly in findings regarding the participants travelling habits within the city of Gothenburg.

A few of the ideas on where LEVs can bring value were considered to be extra interesting. For instance, an LEV transportation service could be implemented on big high school campuses, fair areas or in business parks. In these contexts it is believed to be easier to implement the service given that these areas are somewhat restricted and controlled. Another context of use could be in cities or other places where tourism and sightseeing is popular. The LEVs could transport the customers along a predetermined route. This route could be defined based on where it is easy to drive an LEV autonomously. Another common idea was the possibility to transport goods with the LEVs.

Regarding travelling habits in the city, the participants had several things in common. Most of them had a few destinations within the city that they go to very regularly. These were typically their home, the university, the grocery store and the gym. A full list of the most common destinations can be found in appendix XX. Many participants preferred to walk to their destinations if they were nearby. If a bus or tram happened to arrive with good timing, most participants would hop on to save themselves some time and effort. It is important to note that only one of the participants paid for public transport. Having free public transport probably makes it a more attractive alternative than what is actually true. Generally, cost in relation to efficiency is the most important factor when selecting way of transportation (Hasselqvist, J. 2014). Workshop participants felt more inclined to consider the service if it would be cheaper than current public transport. They also thought they would be more likely to use a transportation service on a regular basis if they had paid for a subscription.

One participant said that she often pays extra to retrieve a solo seat when travelling to her parents by bus. This could indicate that the privacy an LEV can offer is attractive to some users. This private, and sometimes luxury, experience was also brought up multiple times when ideating on how the perfect travelling experience would be when going to certain destinations. For example, in the case of going to a fancy restaurant, they wanted to be able to have a good time with their friends on the way to the restaurant. The positive experience of a special night out could begin even before arriving at the restaurant. Another participant said that she does not enjoy going by bus to her parents because it brings up memories from a time of her life that she rather not think about. Also, she might bump into people that she does not want to meet. To get around this, her parents picks her up with a car. This indicates that having control over which route to take to get to a destination can be important for some users. This kind of freedom and flexibility can be facilitated by an LEV service, given that they can be driven and dropped of anywhere.

The following diagram summarizes the trips that were mentioned to be made during workshop one and workshop two.

Errand	#	Uncommon trip	Destination	Common trip	Uncommon trip
Friend	7		Prinsgatan	1	
Shopping	6		Domkyrkan	1	
Culture	1		Lindholmen	2	1
School	7		Chalmers	5	
Gym	2		Delsjön	1	
Recreational	3		Munkebäck	1	
Girlfriend	1		Valand	1	
Groceries	5		Lundby	2	
Family	6		Johanneberg	1	
Political	1		Andra Lång	2	1
Work	3		Airport		4
Religion	1		Brunnsparken	6	
			Centralstationen		1
			Högsbohöjd	1	
			Korsvägen	1	
			Delsjömotet	1	
			Kviberg	1	
			Botaniska	1	
			Guldheden	1	
			Åvägen	1	
			Summary		
			Trips to other city	2	6
			Trips to surrounding manicupalities	1	
			Trips to or within city centre	22	3
			Trips slightly outside city centre	8	4
			Total number of trips	46	

Appendix 7: *Workshop 2 Procedure*

Aim

The aim of the workshop is to gain understanding of urban citizens' common needs and habits concerning traveling within the city. Also, understanding what possibilities and limitations citizens find in an urban transportation service with autonomous LEVs was sought to be answered.

- Map out common journeys citizens make on a regular basis.
- Discover what preferences and wishes people have before, during and after their journeys.
- Define eventual pain points and subjects of joy occuring before, during and after journeys.
- Investigate were participants imagine that autonomous LEVs (autonomous lightweight electric vehicles) might bring value in relation to their current and future travelling habits.
- Investigate attitude towards adopting these vehicle service in an early stage.
- Shallow investigation on participants opinions regarding sharing of data when using the transport service.

Selection of participants

For this workshop, plausible early adopters of a transport service for the urban environment were sought after. People who have an interest in technology and care about sustainable development and sustainable living. These are also people who wants change and are driven to contribute towards it happening. The participants selected were tenants at HSB Living Lab in Gothenburg. More information on HSB Living lab can be found in the documents referred to in the appendix. In order for the workshop to run smoothly, seven participants were selected.

Procedure

Before the workshop started, the participants were served food and drinks and were given a moment to introduce themselves to each other.

Exercise one
The first exercise was deliberately made very easy, to function as a warm up exercise. Participants were handed seven blue card, out of which two had a more saturated color. The task was to write down a destination to which they travel on a regular basis on each desaturated card and a destination to which they more rarely travel to on each saturated card. The errand or purpose of the trip was also noted on the cards. A short discussion followed covering their choice of means of transportation.

Exercise two
The participants were asked to pair up their destinations meaning one card could be discarded. This created journey scenarios, giving them a place of departure and arrival. Exercise two was a discussion during which the participants were given different addons to their journey. The first category of addons were common changes in circumstances such as rain. The second category of addons were a bit more laborious to handle such as a heavy bag or the situation one finds oneself in after a party. The third category of addons were things the participants might not have experienced such as bringing a child or having a broken leg. The discussion was used to elaborate on how these different circumstances changed their prefered mode of transportation. Aspects discussed also included safety, pricing, preparation and more.

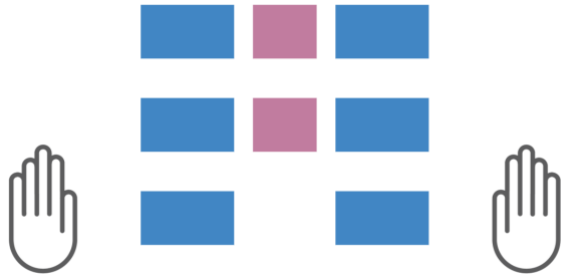
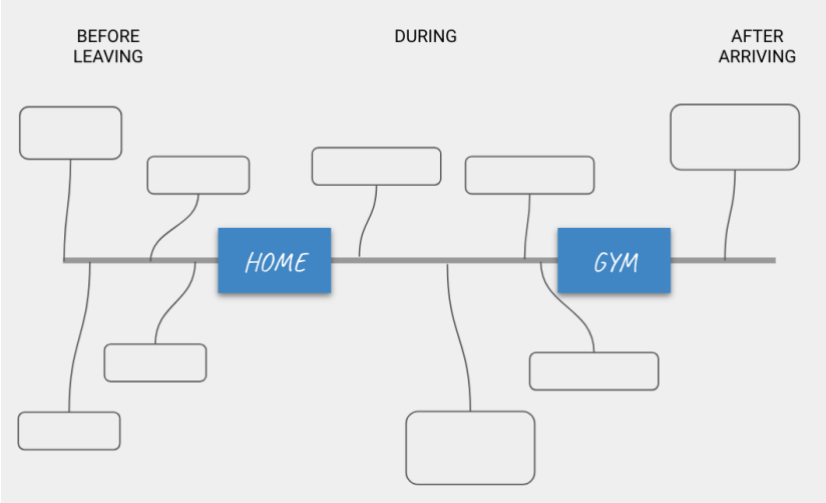


Image XXThe picture shows how the cards were positioned. In the image, two of the addon cards have been introduced.

The participants were then introduced to the master thesis and the vehicle category of LEVs. Finally, the participants had to choose one out of the three journeys that they would an LEV on. A discussion was held to find out why certain trips were more attractive or unattractive to make with an LEV.

Exercise 3



The participants pasted the journey that they chose to make with an LEV on a big paper. The task was to fill out what they imagine needing to do before, during and after the journey. The participants were also encouraged to note anything that they feel might be an issue or a possibility with this kind of vehicle service.Image XX

Four questions were used to help the participants with the exercise:

- What do you imagine is the best part about travelling with a LEV?
- What do you imagine is the worst part about travelling with a LEV?
- What would make this journey less enjoyable?
- What would make this journey really great?

Final discussion

During the final semi structured discussion these questions were used:

- What makes this service an attractive or unattractive alternative in comparison with other transport options?
- What would make you want to use these vehicles?
- How much would one be willing to pay for an ALEV transport service?

- How would you feel about having to map out your route before being able to drive them autonomously?
- In a later stage, many routes will be available throughout the city by sharing. Are you more or less likely to adopt the service then?
- Do you want to be among the first people in a city traveling autonomous to work? Or would you rather start when others have started?
- How do you feel about knowing that your journeys will be recorded and available for everyone using the service (without linking your name and details to the routes)?

Appendix 8: *Workshop 2 Findings*

The participants proved to be quite diverse when it comes to motivation for using an LEV transportation service. Many found it motivating to use a means of transportation that can get them straight to the destination, without the need of making stops in between or walking. This would save them both time and energy. One participant was member of a carpool to access such effortless transportation. He found the idea of an LEV service very attractive, saying *"If I had this as an option, I would leave my carpool right now".* One participant was used to walking everywhere she is going because of her destinations being close to home. She did not find any value in an LEV transportation service, saying: *"I walk and take the tram. A service like this wouldn't be necessary for me."* What the participants had in common was that they seem to carefully reason about which means of transportation to choose for a certain trip. For example, in order for an LEV service to be considered when deciding to go somewhere on the spot, it needs to arrive faster than the time it takes to catch the next bus. But if it was raining outside, most participants would accept a longer waiting time just to escape the rain.

When participants of the workshop was coming up with conditions that would make an LEV service less enjoyable, needing to look for parking and park the LEV was brought up by almost all of the participants. Because of most LEVs having open sides, many also said that bad weather would worsen the experience. Finally, LEVs that move slowly was also identified as a possible negative aspect. Other, less common, conditions that would impact the experience negatively included worrying about who is responsible in case of a crash, that the battery would run out and the vehicle smelling bad or being dirty inside because of them being shared. According to literature (Hansson, J and Härdfeldt, P. 2014) perceived safety is the second most important factor when choosing transportation mode. This opinion was brought forward only by a few workshop participant, as they expressed fear for riding an LEV among bigger vehicles or in snow. They perceived it as risk to compete for lane space with cars and doubted the vehicles prestanda in snow.

When listing what makes an LEV service desirable many participants mentioned the possibility of doing other things while driving in an autonomous vehicle. The fact that the vehicles are electric and a sustainable alternative to fossil fuel based transport was also common. Other commonly mentioned positive aspects include not having to carry bags from the grocery store, being able to achieve door to door transportation and a flexible and effective way of moving about in the city. If the user can go wherever s/he decides within the city and not needing to care for parking spaces, an LEV transportation service becomes very attractive.

Two participants considered themselves to be early adopters and would like to use the service in an early phase, to show that they are trying out a new, exciting, sustainable means of transportation. For these participants, trying out all the features of the service is motivating and the end goal of getting to a certain destination is not all that matters.

Appendix 9: *Test 1 Procedure*

The tests were held in a casual setting. Two project group members hosted the test for a single participant at a time. One project group member conducted the test and the other took notes on a computer. The test participant was asked to think aloud during the test and interact slowly with the prototypes. Then, they were introduced to the service. They were told that the application they are going to test is used to order small electric vehicles that can be used throughout the city centre of Gothenburg. Also, to use the service, one must download the application and register an account. The participants were told that they had already done this and were going to order their first trip during the test. The participants were then shown a picture of different LEVs, and told that the LEVs can be driven autonomously only along certain routes, and be driven manually wherever.

The participants had to complete tasks on each of the three prototypes. The order of the tasks were always the same. The first task was to order a single trip from A to B. The participant was told they were heading to a meeting and needed to leave as soon as possible. The second task was to order a recurring trip from A to B. The vehicle should pick the participant up at 09:15 every weekday.

Figure X.X: XX

When the tasks had been completed, the test participants were given print outs of the different prototypes to use as mediating objects during the discussion. The following questions were answered and discussed during the end discussion.

- Where do you live?
- How often do you travel within the city centre of Gothenburg?
- Which mode of transportation do you frequently use?
- Did you prefer ordering the trips on the spot or in advance? Which way of ordering trips do you think suits your lifestyle and transportation habits the best?
- How much would you pay for a service like this?
- Do you think that you would prefer riding autonomously or manually?
- Describe a person you imagine uses a transportation service like this one.

Appendix 10: *Landing Page Questionnaire*

Sent to people who signed up on the landing page

- How old are you?
    - 0 - 20
    - 21 - 30
    - 31 - 50
    - 50 - 65
    - 66 - 80
    - 81 or older
- I am a…
    - Female
    - Male
    - Other
- What is your occupation?
- Where do you live? (City + area)
- How do you usually travel?
    - By foot
    - With public transport
    - Styr och ställ
    - Own bike
    - Car
    - Uber / Taxi
    - Other
- Which are your three most common destinations? (e.g. work at Lindholmen, the gym at Nordstan)
- Why does our service with small, electrical, self driving vehicle spark your interest? (max two sentences)
- When and why would you like to use our service? (max two sentences)

Appendix 11: *Test 1 Findings*

In general, ordering spontaneous trips fit better with the test participants' habits. To book trips were perceived as attractive by only a single test participant who usually plans all her trips that she needs to make throughout the coming week on the sunday before. Many of the other participants had flexible work hours, which they really appreciated. Other recurring trips participants made, other than getting to and from work, were not very frequent and did not occur at the same time each time. For this reason, it is more cumbersome having to edit the booking each time compared to ordering a trip spontaneously each time.

A few test participants did commute to work but had already found other means of transportation that worked well and did not feel the need to change. These participants lived outside central Gothenburg and travelled distances longer than what is reasonable in an LEV. The test participants also found ordering a trip spontaneously to be efficient, as they are used to similar processes when for instance searching for public transport departures and using a navigation application. Also, one test person did not feel that booking in advance is matching with his self concept. A spontaneous lifestyle was perceived as more attractive. On the contrary, another test person thought that the possibility of booking a return trip on the way to e.g. the grocery store would make the service feel more considerate. She could then be certain that there will be a ride available, and not have to think 15 minutes in advance when time is short.

In conclusion, the possibility of booking a trip spontaneously should be the highest prioritisation in an MVP-product when the service is to be launched. However, allowing the users to book in advance can increase the value provided by the service considerably, and the functionality should be considered for later horizons as the service grows more established.

Eliciting information on how the participants perceived having to walk the last bit of a journey and not receive a complete door to door transportation was difficult. Some didn't mind walking, some would prefer being able to drive all the way depending on circumstances such as luggage and weather. Because of these vague findings, this was, along with investigating the willingness of users to expand the route system by recording new routes, looked into further in the next prototype test which is done it the right context with an actual electric vehicle.

Appendix 12: *Landing Page Quantitative Results*

All Quantitative data can be found at:
https://analytics.google.com/analytics/web/#/report/visitors-overview/a114845472w170839609p170591497/_u.date00=20180227&_u.date01=20180417/

The table below displays all quantitative data from all respondents of the questionnaire:

ID	Gender	Age	Car	Occupation	Means of transportation	Lives	Destinations
LP1	M	21-30	No	Traffic planner	Walking, PT		Ullevi, Johanneberg, Järntorget
LP2	Man	21-30		Traffic planner	Walk, PT		Göteborg Gårda
LP3	Man	21-30	No	Projektanställd i miljöprojekt i Göteborgs stad	Walk, PT, SS, Bike		Göteborg + Johanneberg
LP4	Man	31-50	No	Snickare	Walk, PT, Bike		Mölndal
LP5	Man	31-50	Yes	Systemutvecklare	Walk, PT, Car		Göteborg, Eriksberg
LP6	Man	50-65	No	Verksamhetsutvecklare	Walk, PT		Göteborg, Södra Centrum
LP7	Man	66-80	Yes	Retired	Walk, PT, Car		Centrum stad
LP8	Woman	21-30	No	Engineering Student	walk, bike, PT	Johanneberg	Johanneberg, Gårda, Almedal, Kvillebäcken
LP9	Man	31-50	No	Automation Engineer	bike, PT	Göteborg, Härlanda	Lindholmen, Järntorget, Kviberg, Frölunda, Hisings Backa, Marstrand
LP10	Female	31-50	Yes	Engineer / Boss	Car	Mölndal toltorpsdalen	Lindholmen
LP11	Female	31 - 50	Yes	Senior Researcher	Car, PT	Göteborg, Hisingen	Jobbet på Lindholmen, dagis i Skogome, mataffären i Bäckebol
LP12	Female	31 - 50	-	Development Engineer	Car, walk, PT	Mölndal, Stensjön	Jobbet i Halland, Göteborg centrum, Mölndal centrum

Appendix 13: *Landing Page Qualitative Results*

Landing Page Quantitative Results

L1	3 most common destinations	Why interested	Why and when	connection to the area	Key words
LP1	Jobbet på Ringön, Sahlgrenska, träning i Skatås	Jag jobbar själv inom området (MaaS) som mjukvaruarkitekt/-utvecklare på Bzzt (el-tuktuks) så tycker er tjänst låter väldigt spännande. Är också intresserad av att träffa ev. partners för egna projekt inom MaaS och blockchain.	När jag har mer med mig än jag orkar bära eller ska till ställen dit det är krångligt att ta sig kollektivt.	Jobbar själv på området	orkar inte bära PT insufficient
LP2	Jobbet vid Ullevi, johanneberg, järntorget	Nyfikenhet på ny teknik.	På vägen hem kvällstid	technology interrest	at night
LP3	Jobbet i Biskopsgården, restauranger kring Järntorget, vänner i Majorna	För att det är ett stort steg mot hållbar mobilitet som på riktigt kan konkurrera med biltrafiken i en gles stad som Göteborg. Jag har följt utvecklingen av autonoma fordon i snart tio år och kan konstatera att utvecklingen gått otroligt fort de senaste åren, så nu jag vill vara med när science fiction omsätts i verklighet.	När kommunikationerna med kollektivtrafiken inte är tillräckligt bra, exempelvis i stora delar av staden på söndagar/kvällar. För att spara tid men ändå hålla nere energiförbrukningen.	sustainable mobility science fiction goes reality	PT insufficient save time sustainability
LP4	Maxi stormarknad, Annedal, Gunnebo Slott	Det är fantastiskt med detta framtidstänk, det känns precis som vi lever i en mycket spännande tid där allting händer, nya sätt att transportera sig och ny teknik gör att vi kan transportera oss smartare, enklare och tystare i stadsrummet	Jag skulle vilja sätta denna maskin och teknik på ett riktigt nytto-test -i vardagen klarar denna elektriska Pod att transportera mig till Gunnebo från Mölndal, upp för den stora backen i Kvarnbyn?	science fiction goes reality technology interest	-
LP5	Oslo (jobb), Lindholmen (båtplats), Nordstan/Brunnsparken (socialt, shopping)	Praktiskt och miljövänligt transportmedel istället för bil eller taxi	Till båtplatsen på Lindholmen när jag har för mycket att bära för buss eller cykel och inte vill ha bilen stå där länge.	practical sustainable option for car/taxi	to my boat much to carry dislike parking car for long in some places
LP6	Jobbet i centrum	Kunna resa privat från dörr till dörr.	På morgonen till jobbet när man behöver mindfulness. Hem från krogen när nästa vagn kommer om tjugo minuter.	travel privately	mindfullness PT insuficcient / after the pub
LP7	Carlanderska, Stadsbiblioteket, Sahlgrenska	Med ökande ålder kör mindre och mindre egen bil som bara står stilla i garaget	Tror det är perfekt lösning för framtidens innerstad när miljön ska,bli,bättre och trängseln mindre.		uses car less when older less trängsel
LP8	Chalmers på Johanneberg, Vänner i centrala göteborg (Gårda/Almedal/Kvillebäcken), gymmet på Landala	Upplever det som ett smidigare alternativ än kollektivtrafik och car sharing	Till vänner på kvällar för att inte behöva göra ett byte med kollektivtrafiken	more flexible than PT and care sharing	PT insufficient At night

LP9	Work@Lindholmen, Pubs@Järntorget, Gym@Kviberg, Family@Frölunda, Makerspace@Hisings Backa, Family@Marstrand	I think it's the most sustainable and smart way for urban transportations as a compliment to human powered transportation.	When going to/from work and when I need to move between locations for which no good public transportation exists or when the climate prevents using a bike. It would give me a more freedom of transportation than a car, without the cost and space required for a car.	sustainable option to biking/walking	PT insufficient bad weather more freedom than with car cheaper than car space efficient
LP10	Jobbet på lindholmen	-	Till jobbet o stan som komplement till buss för att slippa ha 2 bilar.		as a compliment to PT instead of owning 2 cars,
LP11	Jobbet på Lindholmen, dagis i Skogome, mataffären i Bäckebol	-	I jobbet när jag ska på möten som är krångliga att ta sig till (ex Torslanda), hem sent från stan, till/från tåget udda tider (händer en del).		PT insufficient at night
LP12	Jobbet i Halland, Göteborg centrum, Mölndal centrum		Vid hemtransport från stan/köpcentrum när jag köpt saker som gör det stökigt att använda kollektivtrafik. Då kan jag fortfarande åka buss dit, slippa ta egen bil.		much to carry to/from mall

Appendix 14: *Test 2 Procedure*

The TP was first greeted by the test leader (TL). They sat down in a calm, public place and the TP was given the same information as if s/he had been a first time user. S/he also got to try to touch an example prototype, to get an idea of prototype 2's limitations. After the introduction the TP was given the first task:

> *Task 1*
>
> *Travel from your current position to your home at HSB Living Labs as soon as possible. It's raining outside and the time is 11:30.*
>
> *(HSB Living Labs is at the other side of campus)*

The participant was given prototype 2, and the test started. During test 1, the test person got to try to find the pick up point, unlock the vehicle, ride autonomously and manually, and to extend the autonomous network. Throughout the test, the TL walked next to the vehicle and asked questions. To ride autonomously, the other project member acted as the self driving technology, and drove the vehicle on a standard route at the speed of 5 km/h. When the TP shifted to manual driving mode, s/he was asked to direct the driver regarding vehicle speed and direction. This limited experience of manual driving was a compromise, since the company that provided the LEV wanted to control who drove it, for safety reasons. In manual driving mode, the vehicle driver asked complimentary questions.

In task two, the same procedure was tested, but without requiring the TP to find the vehicle. This second task had a higher focus on testing whether the user would prefer manual or autonomous driving mode in a situation were manual driving was obviously beneficial timewize. The second task was also to a way of testing whether the TP interacts differently with the interface when s/he is not entirely first time user. The task was as follows:

> *Task 2*
>
> *Travel from your current position to Chalmers Library as soon as possible. You are attending a meeting there. It rains outside, and the time is 11:55.*

Throughout the entire test, sound recordings and video recordings were done using the same phone as the prototype was displayed on, and a GoPro camera.

Appendix 15: *Test 2.5 Procedure*

The TP was first greeted by the test leader (TL). They sat down in a calm, public place and the TP was given the same information as if s/he had been a first time user. This time, it described a service for sharing LEV-vehicles that were delivered the vehicle right at the user's desired position, and was driven manually by the user throughout the entire journey. S/he also got to try to touch an example prototype, to get an idea of prototype 2.5's limitations. After the introduction the TP was given the task:

> *You're going home after a rough day at work. Travel from were we are now to HSB Living Labs. On your way home, stop by at Alpha's Baguettes to buy some chewing gum.*

Meanwhile, the TL notified the other project member, who placed the LEV right outside the door of where the TL and the TP initiated the trip. During the journey, the TP was asked questions to evaluate the new presumptions, and asked to think aloud. Sound and video was recorded simultaneously.

Appendix 16: *Test 2 Findings*

Acquiring a vehicle

Many thought that screen X it displayed the only available travel option. This resulted in a not so flexible impression of the service. The test participants (TP) experienced ordering and locating a vehicle as a rather easy and familiar procedure. However, since the GPS-functionality was limited, the test leader (TL) helped to orient the TPs relation to the GPS-wireframe when locating the vehicle.

People expected having to walk to get to the vehicle and did not mind doing so. However, the walking distance was no longer than 100 meters and the weather was fairly nice. Worse conditions and a longer distance could change that and result in the service being perceived as less attractive.

Autonomous vs. Manual

When asked afterwards, all TPs thought autonomous driving was the primary driving mode, due to the fact that the test always started in autonomous mode.

All participants understood the limits of the autonomous routes, based on the blue lines in the interface, the colour coded blue sign in the vehicle and the onboarding information before the test. However, it was not obvious to the users that they could deviate from the proposed route through manual driving. This might be due to the fact that they wanted to follow the test agenda and not try something unexpected whilst being observed, but could be implicated in a stronger way through the interface or the onboarding information.

When the user shifts between manual and autonomous driving, some more information regarding what will actually happen when they press the button could have been presented. Also it became apparent that stronger visual stimuli than just a colour shift in the interface could be helpful to provide clear feedback to the user, despite the very limited screen area. During the shift, the user is very focused on getting ready to take over the controls and check the surroundings. A visual or auditory stimuli from the vehicle itself would be clarifying.

A big takeaway from test 2 was that all test users said they would prefer to drive manually on an everyday basis, but might be curious about trying autonomous driving for the sake of trying new technology. T2P2 said '*I prefer manual because of the higher speed, but I'll try autonomous for fun!'*. The major common denominator for all TPs were that they experienced autonomous driving in 5 km/h as a too slow alternative. The majority also felt that they were in the way of cars while riding autonomously on semi-busy roads. In order to be an attractive option for everyday journeys, the autonomous mode at least have be able to travel noticeably faster than regular walking speed.

TP's were also expressed uncertainty when approaching roadwork, a road crossing or an occupied pedestrian crossing in autonomous mode. T2P5 said *"I feel slightly unsafe in autonomous mode because I fear I might lose attention".* For the autonomous mode to generate a positive experience, the technology needs to communicate clearly what situation it can handle by itself, and were it might need help.

Appendix 17: *Test 2.5 Findings*

The test participant in test 2.5 had broad experience with BMW's car rental service Drive Now. This had made a strong impression on her mental model in similar services. She was over all positive to the service idea, especially to the concept of not having to spend time on searching for a proper parking spot:

"My problem with Drive Now is the parking bit. As long as the vehicle itself knows where I can park it doesn't matter."

However, she also mentioned that the stress in finding a parking spot might correlate with the size of the vehicle:

"The size affects my experience/experienced level of stress when I navigate in a city centre. A SUV in Stockholm city were I'm not used to the routes stresses me out. We should have picked a mini which is easier to park with."

On the topic of choosing between a slower autonomous and a quicker manual mode, and only being offered manual driving, this was her response:

"If I had the choice to ride self driving I would do it, bcs then I could do other stuff. But if one of the options were quicker I would select that one. I'm already driving on a path I would normally walk in, so why not?"

Information

Over all, the information provided in the interface was sufficient for the user to perform a journey. However, a some usability-aspects regarding internal consistency was lacking on button titles.

One larger finding was that the user should be provided with the option to find information on how to start, steer and park the vehicle whilst waiting and when entering the vehicle. A first-time user should be given this automatically, but a more experienced user should know where to find it easily, in case they forgot.

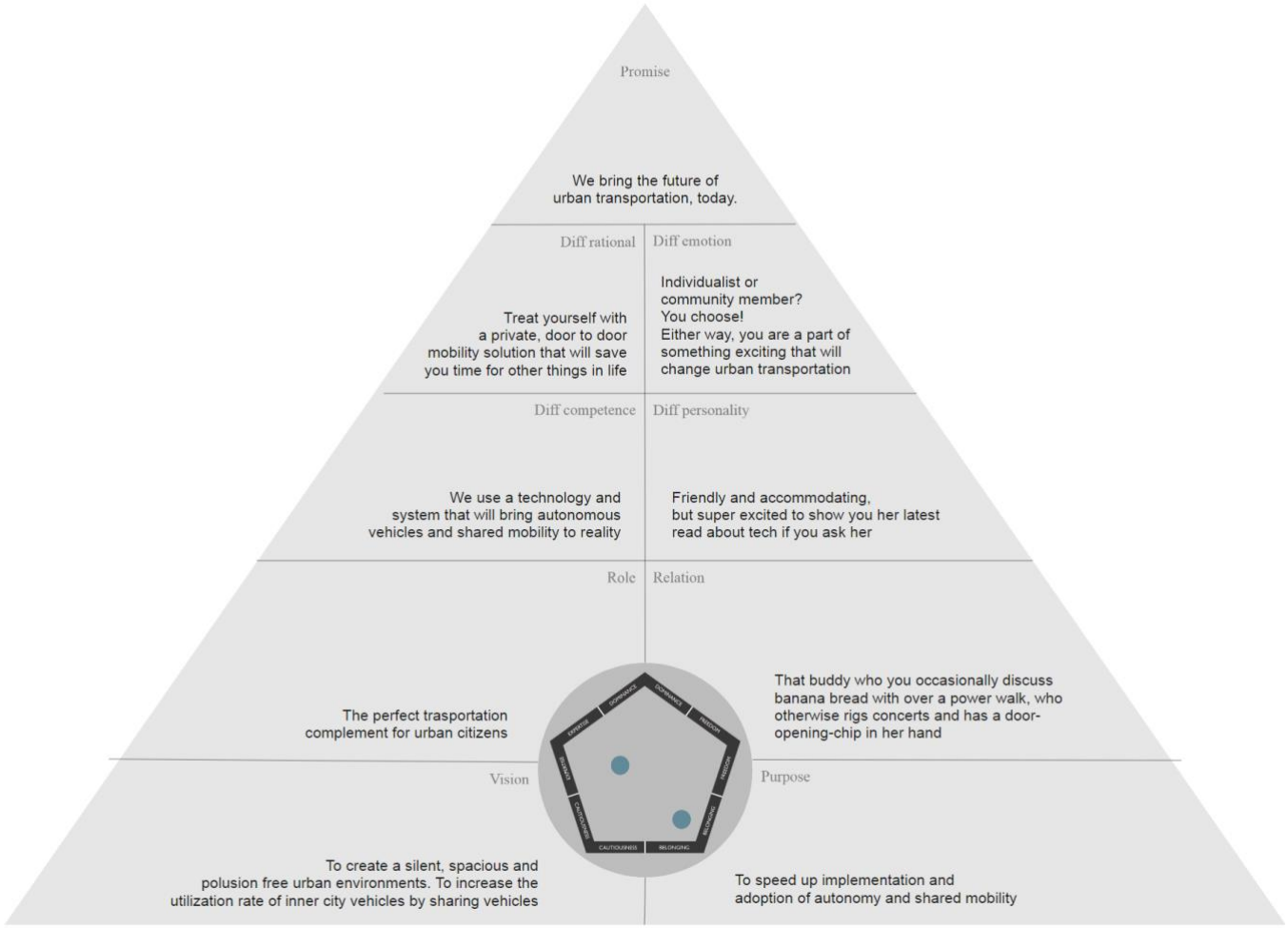
Also, the interface needs to be more clear regarding were the user is allowed to leave the vehicle. The TP talked about how flexible the idea of dropping the vehicle of anywhere, but still chose to back up into a parking spot at the end of the test. If the service can allow people to jump off anyware it will have to signal this more clearly, to change the users old mental model of how vehicles needs should be vacated. If the service can't allow people to jump off anywhere, a big compromising value would be to offer the user guidance on where s/he might find the closest available drop-off area.

Additional Functionality

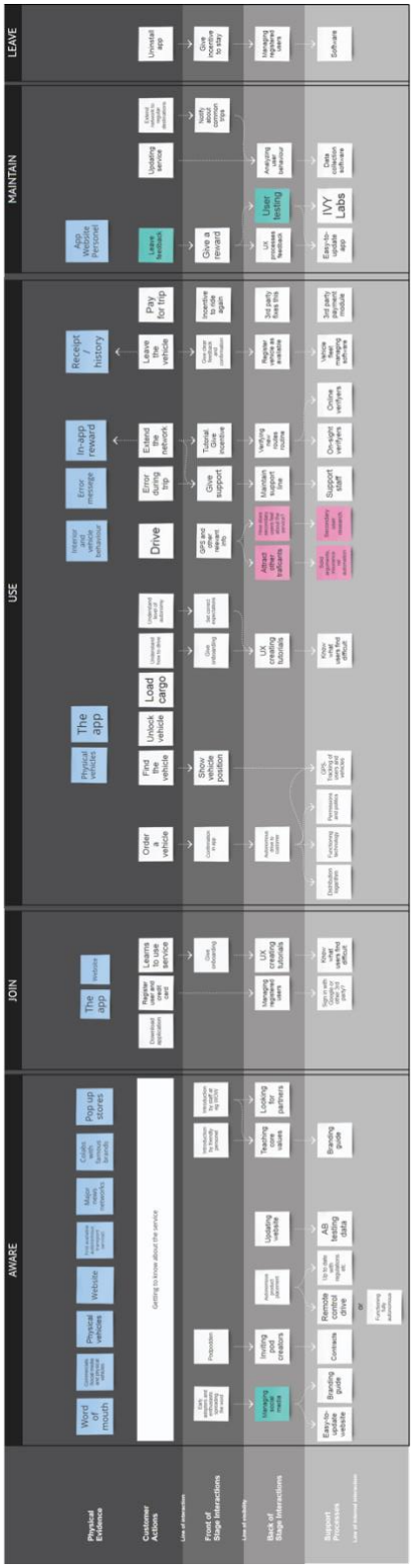
A few insights on potential additional functionality was discovered. When stopping at Alpha Baguetteria, the user pressed 'pause' and responded:
"But wait, do I only have 3 minutes?? I think it's counting down.. Hey, I'm paying, wait until I'm done! I wouldn't dare to go inside and stand in a line and not know if i'll make it." Here, unlike Drive Now, the prototype did not allow for a longer inactive pause of the vehicle, and was therefore experienced unadaptable to the users needs. The user expected that she would be able to leave for as long as she'd like, and get a reminder every 15 minutes or so that she had a reserved vehicle on parked mode. Additional to this functionality, it was discussed weather she could be sent a new vehicle if the pause was pre-set to a longer time.

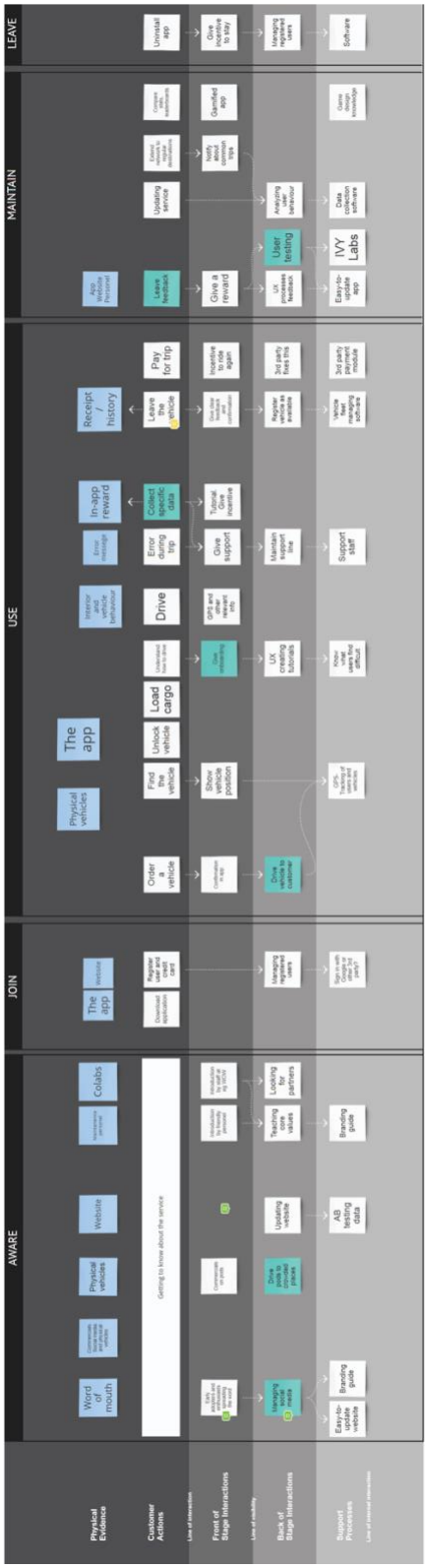
While maneuvering in narrow spaces, the TP sometimes seemed uncertain of the size of the vehicle. It was noted that in case the service goes for a more high-end brand personality, the functionality of audio feedback from backing sensors should be considered, as it is common in most modern cars.

Appendix 18:


Promise
We bring the future of urban transportation, today.
Diff rational
Diff emotion
Individualist or community member? You choose! Either way, you are a part of something exciting that will change urban transportation
Treat yourself with a private, door to door mobility solution that will save you time for other things in life
Diff competence
Diff personality
We use a technology and system that will bring autonomous vehicles and shared mobility to reality
Friendly and accommodating, but super excited to show you her latest read about tech if you ask her
Role
Relation
The perfect trasportation complement for urban citizens
That buddy who you occasionally discuss banana bread with over a power walk, who otherwise rigs concerts and has a door-opening-chip in her hand
Vision
Purpose
To create a silent, spacious and polusion free urban environments. To increase the utilization rate of inner city vehicles by sharing vehicles
To speed up implementation and adoption of autonomy and shared mobility

Appendix 19: *Service Blueprints*





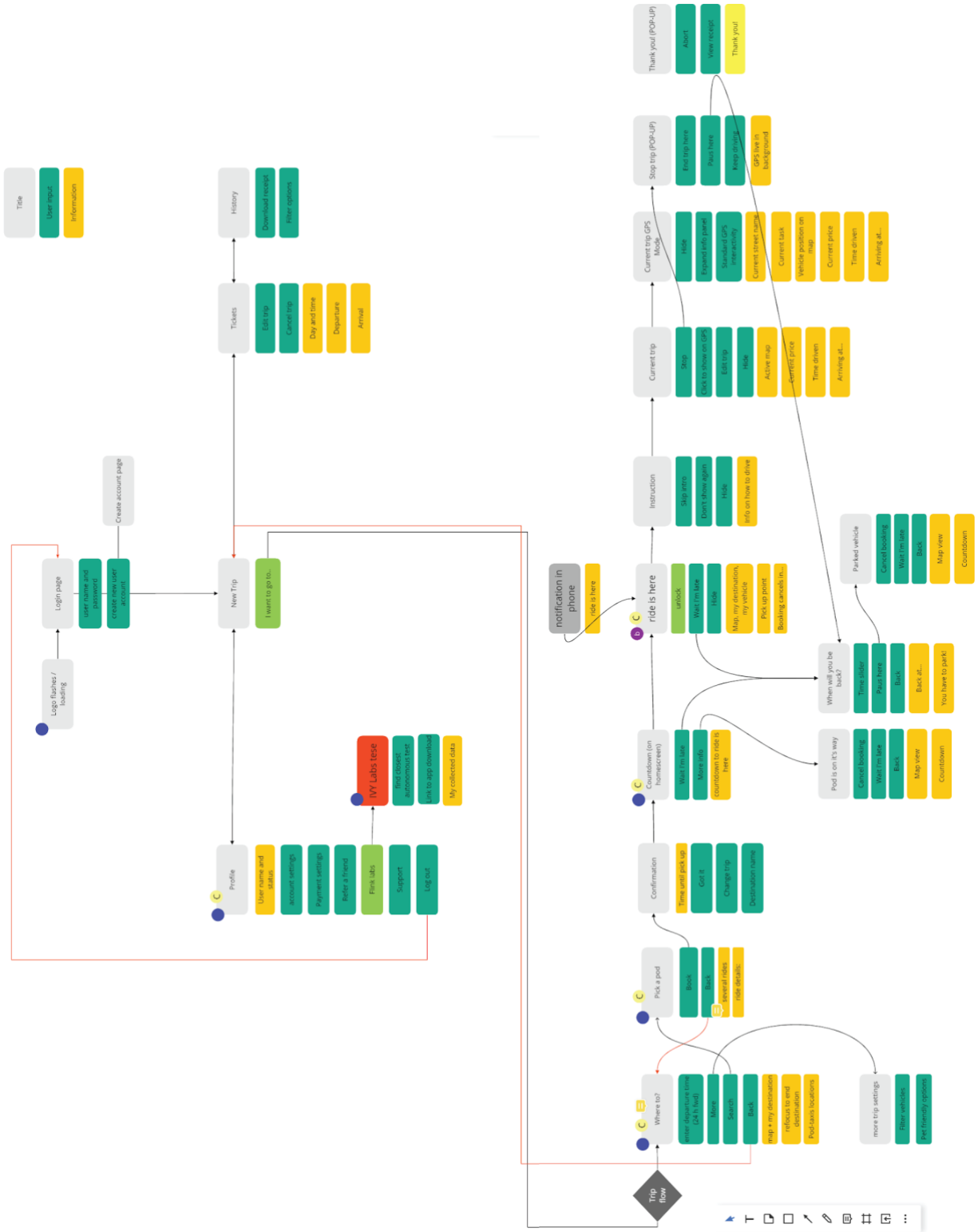
Appendix 20: *Service Blueprints Findings*

The first thing to notice is that the blueprint for horizon 1 is smaller. There are a few less customer actions in horizon one. This is because it is expected that the customer needs less introduction to the service when only manual drive is available, compared to when an autonomous drive feature is available as well. There are also significantly less support processes needed for horizon 1. This has to do with that there is most likely need for permissions and as extensive insurance agreements when launching a service that utilizes no autonomy. In horizon 3, the company also needs to have a functioning autonomous technology, a software that calculated how to distribute the vehicles in an optimal way, a routine on how to verify routes recorded by the users, a well designed app and vehicle that deals with the many challenges associated with autonomous driving and so on.

Another important finding, is that there is an opportunity to involve the users in many aspects of the service in horizon 1. For example, as the blueprint shows, when a customer orders a vehicle it needs to be driven to the customer in some way. This could of course be done by employees, but it could also be done by recorders in exchange for a reward, such as a voucher or a badge. When someone is about to make their very first journey, onboarding can be given through the application. But a more engaging and memorable way of getting introduced to the service, could be by a recorder giving personal onboarding. In this way, the community becomes and important part of the service, making new customers feel welcome and part of the community.

These service blueprints can be used throughout the development of the service. By involving people with skills in areas such as strategy, marketing and economics the blueprint can be expanded and developed in detail, perhaps bringing value to the entire organization.

Appendix 21: *Final Flowchart*

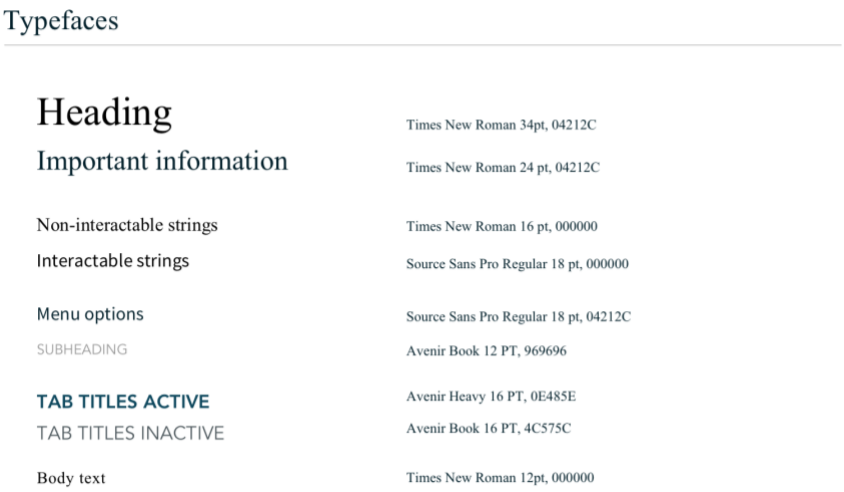


Appendix 22: *Style Sheet*

To ensure continuity throughout the applications, a stylesheet was produced. The following chapter describes how fonts, buttons, colours, symbols etc. should be applied. This can serve as a reference when creating app or website UI's in the future.

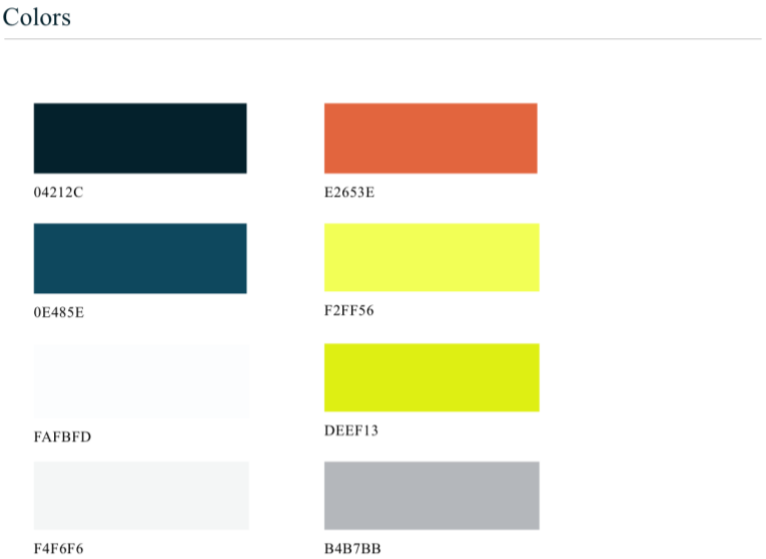
Fonts

Figure XX displays all fonts used in the application, and notes when to use them.



Colours

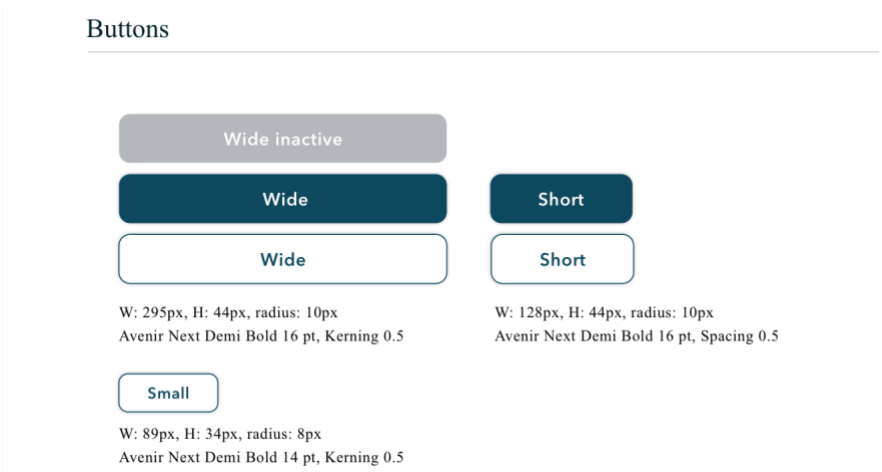
Figure XX shows all colours used in flink and flink LABS. Yellow nuances are used to a higher degree in the LAB-app, and less often in the regular app.



Buttons

Buttons occur in 3 different sizes, displayed in figure XX.. Wide buttons are placed in the bottom of the frame or bellow a dialog box. Small buttons are used on cards. Short buttons are used XXX. Buttons

come in 3 different colours. The dark blue version leads to the next step of the customer journey, and is the primary choice. It is for example used to unlock the pod. The white version leads to side-functionality, such as changing booking settings. It is also used when booking a pod and several options are available. There can only be one dark blue button in an interface, but several white ones. The gray version indicates that the button is inactive, e.g. when the pod-taxi is on its way and 'unlock' is yet unavailable.



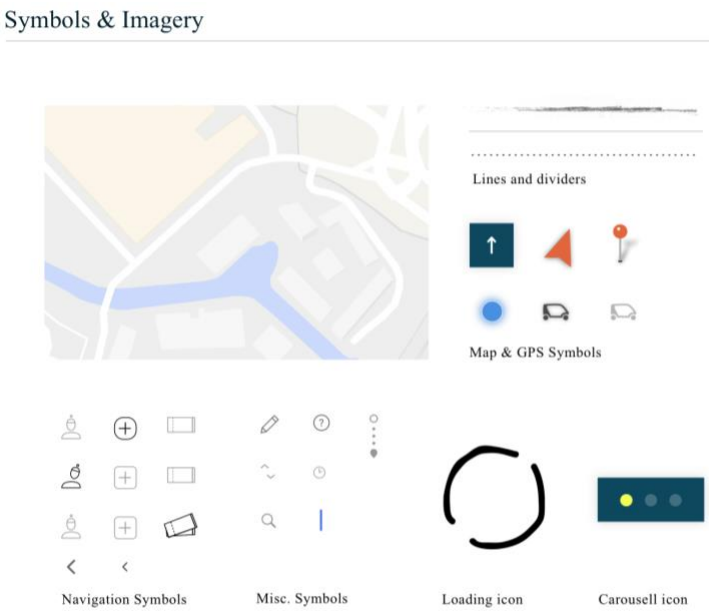
Bars & Cards

Cards are used either in the start screen, when initiating a second trip, or when listing several options of navigation, pod taxis or receipts. Pop-ups are used for dialog boxes as confirmation, for example when a pod-taxi has been booked. Cards and bars are shown in figure XX below.

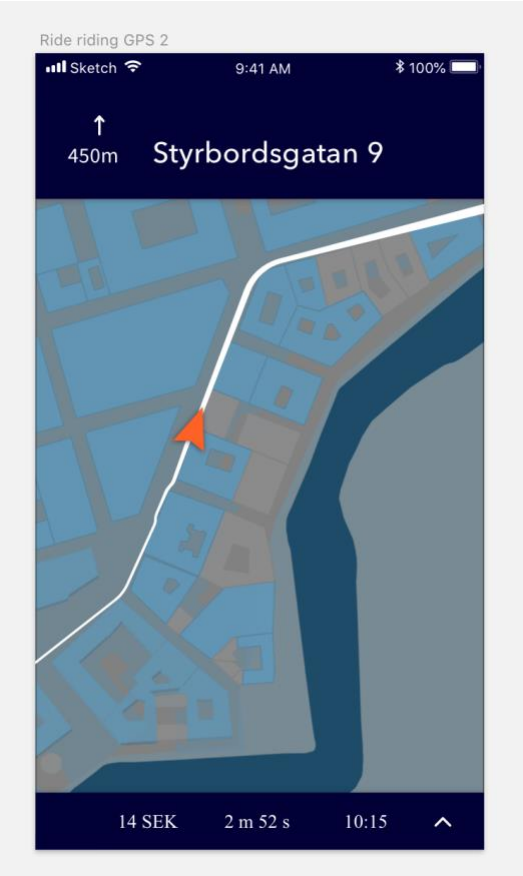
The status bar and the navigation bar are standard components from Apple's IOS Design Kit, with a personalized background colour. The tab bar is slightly broader than IOS Standard, and uses icons that shift shape when clicked, to fit the brand identity.

Symbols & Imagery

The symbols in flink and flink LABS are kept minimalistic if on a white background. If a symbol is placed on top of an image or in a map, colour contrast and shadows have been used to ensure good readability. Symbols used in flink and flink LABS are shown in figure XX.

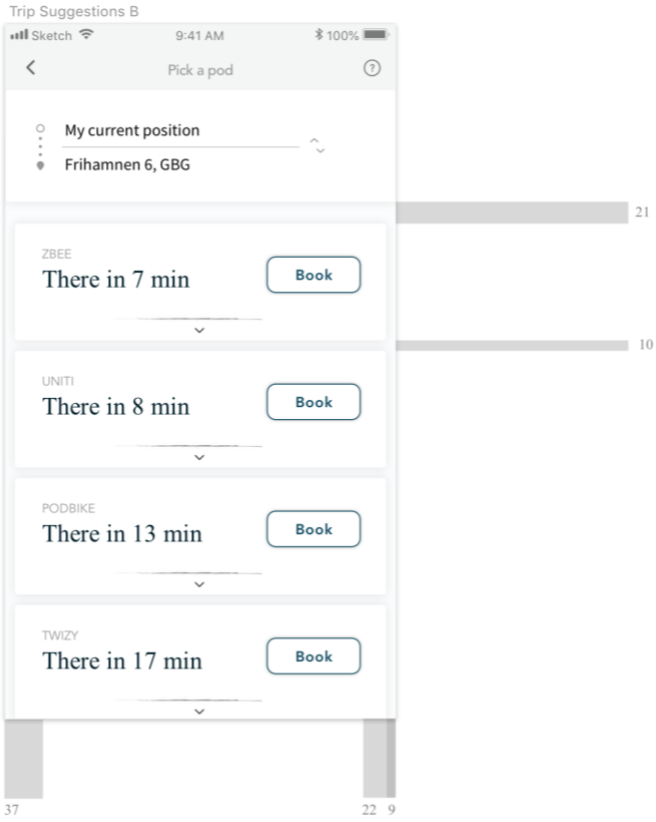


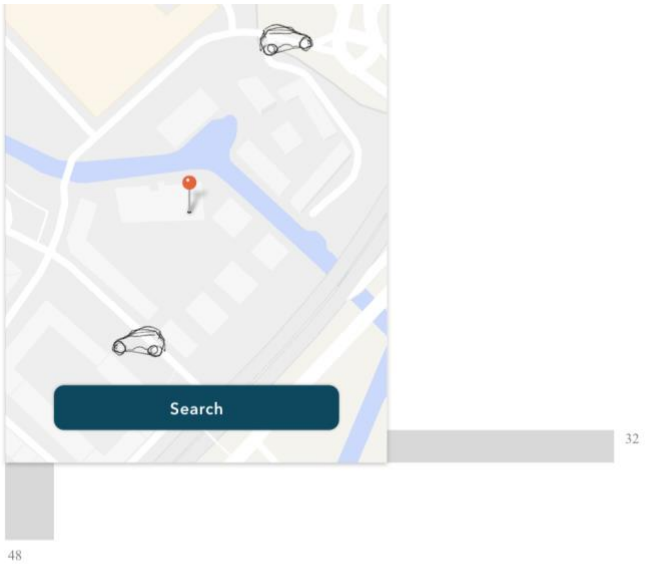
The map design used in the apps is called ‘Ljus politisk’ from Google Maps. (See figure XX for an example) In future iterations of the product, the map could be altered with more geographical details or titles. It should however always strive for an as minimalistic impression as possible. In night mode, an example with the map design ‘Mörk Landmassa’ from Google Maps is proposed, shown in figure XX.



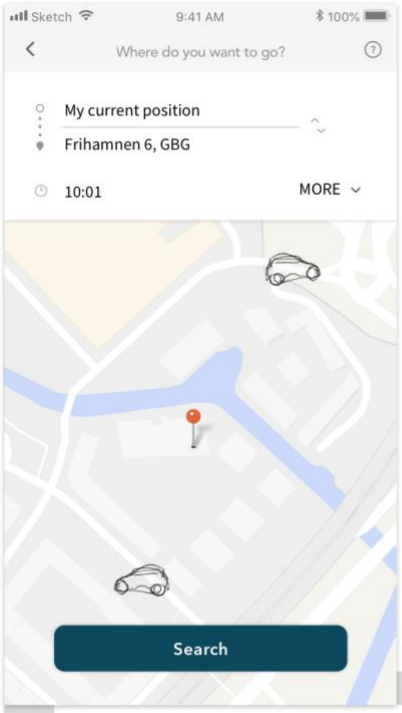
Whitespace

All texts should be right-aligned except for when showing data in the driving interface. White space areas should be coordinated to generate a tasteful impression to an as large extent as possible. It is most probable that users different screen sizes will require the use of breakpoints. Therefore, figure XX below enlists a few guidelines on basic white space dimensions.


Trip Suggestions B
Sketch
9:41 AM
100%
Pick a pod
My current position
Frihamnen 6, GBG
ZBEE
There in 7 min
Book
UNITI
There in 8 min
Book
PODBIKE
There in 13 min
Book
TWIZY
There in 17 min
Book
21
10
37
22
9


Search
32
48

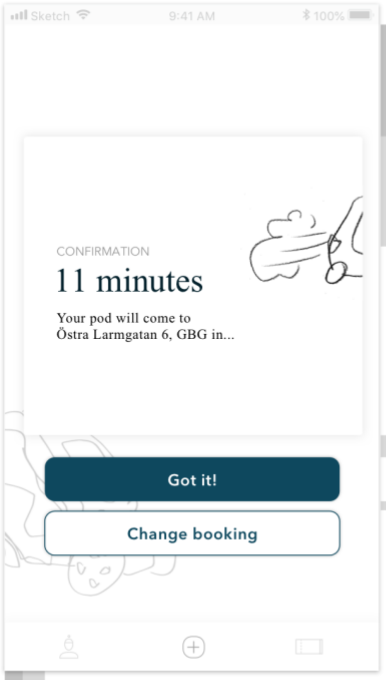
Trip Search 2



32

48

Confirmation



112

110

22

9

18 22

Appendix 23: *PUGH Matrix*

		Veckans Gubbe	Potato Oyster	French Fashion	Behance ++
Risk	Might lead to bullying	0	1	-1	-1
	Creates too high expectations early on	0	1	-1	-2
	Not tech-y enough	0	1	1	1
	Too weird/childish - scares some away	0	1	2	2
	Will not be remembered / too ordinary	0	-1	-2	-2
	Potentially low usability	0	0	0	-1
	RESULTS	0	3	-1	-3

		Veckans Gubbe	Potato Oyster	French Fashion	Behance ++
Carrots	*Emotional carrots*				
	Startup-story vibes	0	-1	-2	-2
	Something is bubbling-vibes	0	-1	-1	0
	Community-vibes	0	1	0	-1
	Transparent with where we are and what we do-vibes	0	1	0	0
	Easy to remember / potential buzz in high places	0	-1	-2	-1
	Functional carrots				
	Easy to generate digital content for cheap	0	-1	-2	-1
	Makes app a strong brand touch-point	0	0	-2	-1
	Facilitates easing through slow/risky CJ-phases				
	Sustainability ?	0	0	1	0
	Wants to become a recorder!	0	1	-1	-1
	Wants to open the app over and over again	0	-1	-1	-2
	RESULTS	0	-2	-10	-9

Appendix 24: *Product Specifications*

		Guideline / requirement	Motivation	Horizon 1	Horizon 2	Horizon 3
	Customer journey demands			*Autonomous drive is not allowed on public streets.*	*The autonomous technology is on public streets in a controlled manner.*	*The autonomous technology legal, people ride without focusing on the road.*
	Booking a vehicle					
B		The vehicles should be available at inconvenient hours	As a safe compliment to public transport (for instance at night)	X	X	X
B		One should be able to book a vehicle in less than X seconds.	Geting hold of a vehicle should be considered easy and effortless	X	X	X
B		A vehicle should be able to arrive to the customer within 10 minutes after s/he booked the ride	To be able to complete with the preformance of public transport in urban cities	X	X	X
Ö		Before booking, the user should be able to see booked and available vehicles in the city.	To show the user that the service is upp and running and is being used by many already. Streghten the experience of joining with a network	X	X	X
F		If different vehicles are available, the user should be able to select preferences in regards of no. of seats and vehicle type.	To spare resources and streghten the experience of flexibility in the service.	X	X	X
Ö		The user should be able to be given route alternatives. Fastest, closest, beautiful view etc				X
F		The ETA should be shown when booking a vehicle	You use it for appointments and multimodal journeys	X	X	X

F		The user should be able to see the booked vehicles position in relation to him/herself		X	X	X
B		The vehicle should pick up the user within 10m of the indicated departure destination	Users don't want to spend lots of time searching for the vehicle, or walking in bad weather	X	X	X
Ö		The user should be able to choose to walk to the vehicle and pick it up	Sometimes, this could be alot quicker in some situations where the waiting time is long because of poor autonomous route connections or no personel	X	X	X
Ö		The user and vehicle should be able to meet up half way	If the user wants to save every minute possible	X	X	X
F		The user should be able to postpone the pick up time	In case he/she is late. People are willing to pay for this	X	X	X
Ö		The user should be able to see where the vehicle is when it's on it's way	Sense of control	X	X	X
Ö		If a reserved pod is on another mission, this should be communicated to the user	Otherwise possible irritation because the pod is not coming right away	X	X	X
	During journey					
B		The user should be able to change the route of the vehicle on the go	Flexibility, unexpected events	(X)	(X)	X
F		The user should be able to pause the journey and leave the vehicle for as long as they'd like during a journey	Flexibility, unexpected events	X	X	X
B		The user should always be able to switch between	Flexibility, unexpected events		(X)	X

		manual and autonomous drive				
B		The user should be given guidance on how to switch between the modes		(X)	(X)	X
B		The user should be given information on what can be expected after the mode switch		(X)	(X)	X
F		It should be very clear that the mode siwtch has been executed	Use animations and colors to bring attention to the change	(X)	(X)	X
B		The level of attention needed in by the user autonomous mode should be clearly communicated	Safety reasons	(X)	(X)	X
B		The limits of the zone for were a user is allowed to leave a vehicle should be clearly communicated through the interface	People are worrying about range and recharging	X	X	X
F		The user should be nudged to check out the autonomous possibilities	To stregthen the brand positioning as somethig extra and bubbly	X	X	
	Upon arriving					
B		The user should be able to get off the vehicle within 10m of the target destination	Inte leta parkering, bara gå ut	X	X	X
F		After arriving, as few interactions as possible should be required to quit the journey	You just want to get off and seamlessly continue life	X	X	X
F		After arriving it should be clear that no more money is being charged		X	X	X

B		The user should be able to quit and leave the vehicle anytime, anywear	Huge value for the client, differntiating functional value	X	X	X
F		The vehicle should not leave unless the user has told it to do so	A countdown timer induces stress. People might have luggage to offload.	X	X	X
B		Clearly communicate where and how the vehicles should be left	Not having to look for parking is perveiced as very important	X	X	X
F		Clearly communicate what will happen to the vehicle when the user leaves the vehicle	Sense of control / understanding on what is possable to do	X	X	X
	Other					
		The app should nudge users into going to autonomous test routes once they are familiar with the service	To broaden the users perspective on the startup-vision/potential and generate interested collaborators			
	LAB-app					
		The lab app should provide users with insights on how to conribute and what the company is currently doing	To appear transparent and recive feedback			
		The app should be able to guide users to autonomous test routes		X	X	(X)
		The app should aid users when trying autonomous driving	Audio + visual feedback			
		The app should give the users a feeling of joining the development team of autonomous routes in the city				
		The benefit of recording a new route should be clearly		X	X	(X)

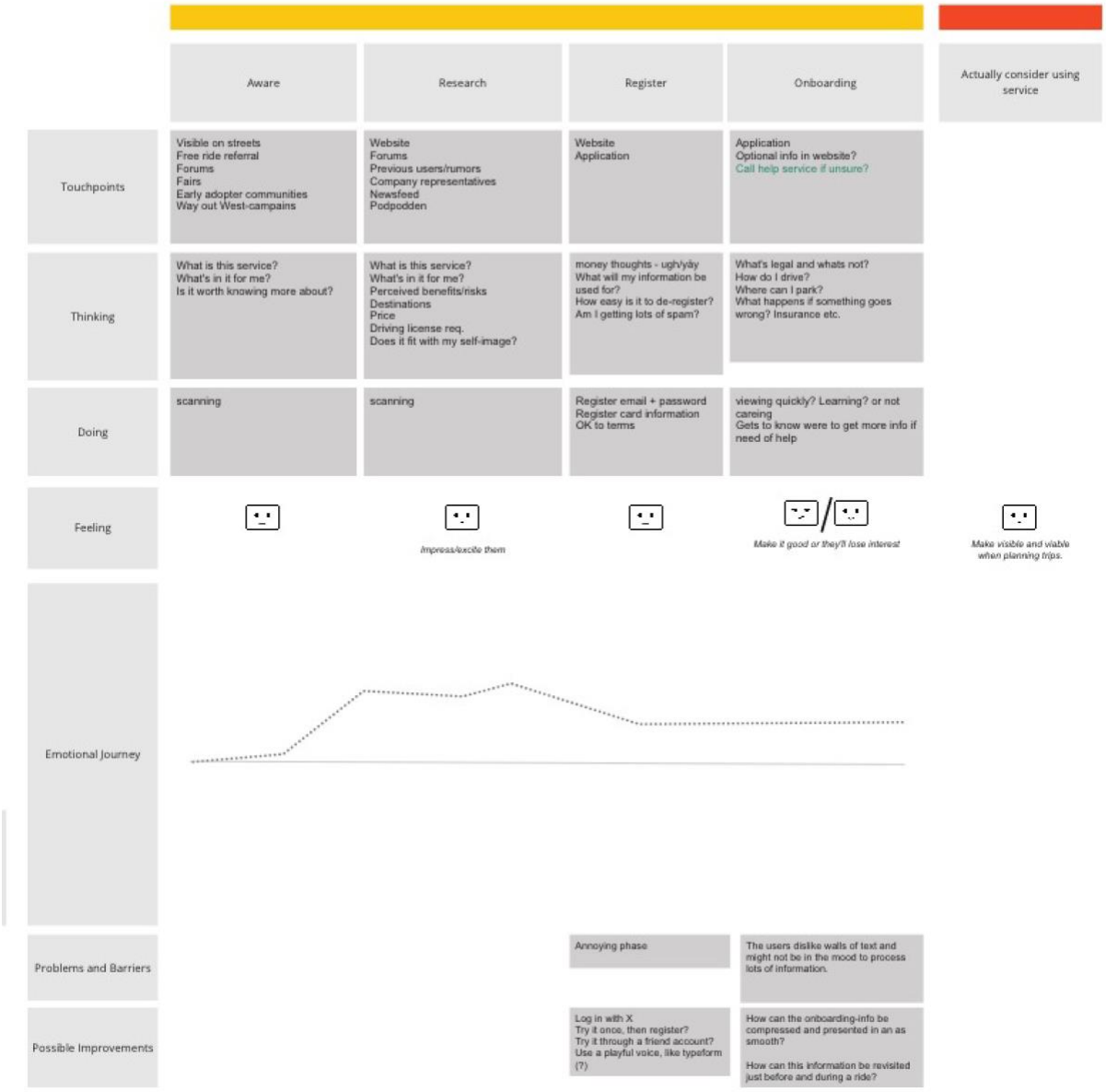
		communicated in this stage				
		The UX in flink Labs should make use of basic gamification-related nudges if it contributes to a more compelling experience				
	Service demands					
	The fleet of vehicles					
F		The service needs to facilitate X nrs of vehicles		X	X	X
B		The service needs to offer vehicles with space for luggage	Lot's off people imagine using when after shopping or when transporting stuff they wouln't be comfortable carrying in PT	X	X	X
B		The service needs to offer vehicles with space for more than one passenger	Space for people or luggage. Some want to share the ride aswell.	X	X	X
F		The available luggage / other space needs to be clearly communicated	You want to know beforehand how much they fit	X	X	X
B		The vehicles must shield the user from all sorts of weather conditions	Perceived as important unique aspect	X	X	X
F		The vehicles must provide a space to place the phone while driving	Neccessary if the user is to use the GPS functionality diring a ride	X	X	X
F		The vehicles must serve as a touchpoint in line with the service brand identity	To provide a holistic brand experience	X	X	X

B		The vehicles interior should signal when driving in autonomous mode and shifting modes to the driver	To provide the user with the feeling of being in control and knowing what the vehicle is doing. To make the vehicle feel responsive to what the user orders it to do through the interface.	X	X	X
Ö		The vehicles should signal to a user that it is being unlocked/locked at the end and beguinning of a journey	To make the vehicle feel responsive to what the user orders it to do through the interface.	X	X	X
Ö		The vehicles should signal to a user that it is booked/not booked to it's surroundings	Practical reasons	X	X	X
F		The vehicle should look and feel safe to ride in during late evenings	To ensure a good experience	X	X	X
	Economy					
Ö		Different ways of cutting the cost for the users can advantageously be introduced	People care about costs and love making good deals. % off when sharing vehicle, recording routes, recruiting friends etc	X	X	X
F		A user should always be presented with the cheapest route available in the GPS		X	X	X
	Supportin g systems					
		The technology should always record the route its on	To draw new routes or to update old ones	X	X	X
		The vehicle should be able to pass regular road crossings and pedestrian crossings seamlessly in	In order to make use of the central network to pick somone up		X	X

		autonomous mode				
B		A support system needs to evaluate the quality of routes, and signal when an update is required	To know where improvement is needed, launch missions for recorders etc.	X	X	X
B		Data should be recorded from day one in horizon 1	To provide a heat map of were most popular journeys throughout a week	X	X	X
F		The support system needs to show a clear overview of not connected route systems	To integrate people from outside the city owning their personal LEV		X	X
B		The network should connect most frequently visited destinations in the city center			X	
F		The network should connect the entire city center				X
B		A journey within the network should work on a fully autonomous level		X	X	X
F		The central network routes should priorotize bike lanes before car lanes whenever possible.	Bike lanes are percived as a more safe and less stressfull alternative.		X	X
B		The charging mechanism for the vehicles should allow as high utalization s possible. (Preferaby exchangeable batteyr packs instead of charging station)		X	X	X
	Safety					
		The vehicle should be able to pass regular road crossings	In order to make use of the central network to pick somone up		X	X

		seamlessly in autonomous mode				
		The vehicles should be available and safe throughout the different seasons		X	X	X
	Brand identity					
		The service should be percived as a new, more flexible way of traveling through city centres, with something exciting, beta-techy, bubbling underneath the surface		X	X	X
		The brand should not promise to much, but neither appear nerdy or silly	People might bully the vehicles	X	X	X
		In the role of a more flexible compliment to public transport, the service must be experienced as flexible and adaptive to the users desires throughout the journey.	In order to establish a competitive level of emotional value among the users, in comparison to the existing options on the market.			

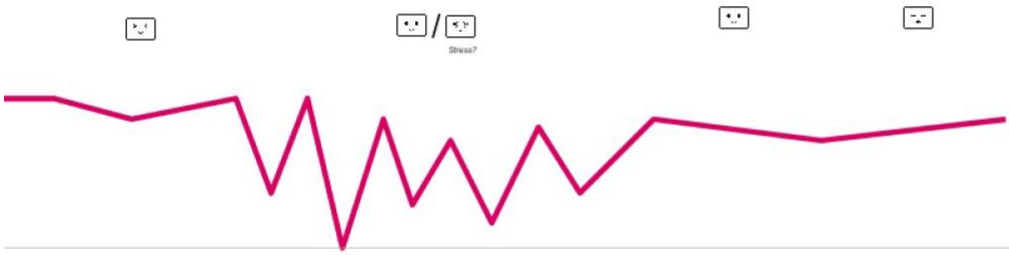
Appendix 25: *User Journey*



Planning trip	Booking	Confirmation	Waiting	Confirmation 2	find & enter vehicle
Application Tactical physical presence	Application Tactical physical presence	Application	Application	Application notification	Vehicle Application
Where do I want to go? What are my traveling options?/**habit** What will I do there? Am I in a hurry? What am I doing now? Weather? Luggage?	What is available? Is it worth it?	Is it booked now? - Yes What's next?	Thinking of other stuff / preparing	It's here! Where is it?	There it is! Is it mine? Can I just enter?
quick thoughts whilst doing other stuff or discussing with group or planning a bigger journey	opening app destination + search Y/N	possibly puttig phone away	preparing/waiting/walking	hearing notification - looking at phone again	locate, unlock, explore interiör, getting in place
					
Stressed, tired or excited				*Oh boy / Finally*	*It's marvellous!*

			If the user has to wait for to long it will affect her/his experience of the service.		
			This might be the right moment for placing info, "know more about IVY Labs" or commercials in the app	This might be the right moment for placing info, "know more about IVY Labs" or commercials in the app	This might be the right moment for placing info, "know more about IVY Labs" or commercials in the app

start driving	preform trip	stop somewhere	leave	between trips
Vehicle Application	Vehicle Application	Vehicle Application	Vehicle Application	Application Vehicle tactical presence Forums Other users/rumors Podpodden
How do I drive it? What are my legal responsibilities? What route should I take? Check out surrounding	What route should I take? Check out surrounding Experience driving it vs expectations Thinking of other stuff/ what happens after trip - stress? (Battery time?) cost	Can I stop here? - how long can it stand here? Cost Thinking of what happens after trip - stress?	Can I stop here? - how long can it stand here? Cost Thinking of what happens after trip - stress?	strongest memories of trip - perceived win/loss will i do it again?
testing gas, break, steer, looking around, placing phone somewhere mby checking GPS	driving, mby checking GPS, planning route, updating/changing route	navigating, checking phone for guidance?	gathering belongings, exciting, seeing whether vehicle stays or goes	.



Provide easy access to help + legal reminders	This is an uncertain and long period of the CJ. It's hard to control since lots of outer factors can influence the experience throughout the journey.			
Provide easy access to help + legal reminders	Make sure to carefully collect feedback from users on this part once the service is up n going. How can the application, pod-interior/exterior, suggested routes and the society's opinion be altered to improve the experience?		Last chance to leave an impression on the experience. Should it signal that we're still improving the experience? (leave us feedback with just a click away/sound recording) Or just a friendly goodbye/welcome back?	hard to estimate - important to investigate when up n running. What could potentially hinder people to come back for a second trip?