



Development of design guidelines for Human Machine Interfaces and User Experiences in cars designed for carsharing

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Design Guidelines for Shared Cars

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Design Guidelines for Shared Cars

Master of Science Thesis in the Master Degree Program, Industrial Design Engineering

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Abstract

Lynk & Co is an automotive brand, which is trying to challenge the old automotive industry. In 2016 they entered the market with a new car model and carsharing concept based on the platform and business model of Airbnb. The new carsharing concept of Lynk & Co puts demands on the design of their cars - how should cars that are aimed for multiple users be designed?

This project was made in collaboration with CEVT, the company developing the Lynk & Co cars. The aim of the project was to investigate how the HMI and UX should be designed for cars specifically developed for sharing and sharing services. Further, the aim was to implement the findings at the UX department of CEVT by creating a design tool.

The result of the project is 15 design guidelines for HMI and UX in shared cars that are to be used in the design process of shared cars. To facilitate the use of the guidelines at the UX department a design tool was developed. The design tool consists of 15 guideline cards presenting the design guidelines. Two additional cards clarifies the layout of the cards and communicates how the cards could be used at the UX department.

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Terminology

CEVT (China Euro Vehicle Technology AB)

The Swedish based company developing the brand of Lynk & Co and the Lynk & Co cars

Lynk & Co 01

The first Lynk & Co car model

Scrum Team

A multi disciplined team within the process framework of Scrum

UX (User Experience)

A person's perceptions and responses that result from the use or anticipated use of a product or service

Interaction

An action, which occurs when a user communicates with and/or reacts to a product

HMI (Human Machine Interface)

A device or software that allows you to interact with a machine

Collaborative consumption

A set of resource circulation systems, which enables consumers to both obtain and provide products and services

Utilization rate

How much of its lifetime a product is used

Sharing

Distributing and/or letting someone else use your resources

Sharing service

A business model that enables products and services to be used by several people

Carsharing

A car rental model where people use cars for a period of time and defined by its environmental and social purpose rather than business and financial objectives

Design for Sharing

A research field within design that focus on how products and services should be designed to enable sharing and induce a sustainable behaviour by consuming less resources

Design guideline

A guidance of how products and services should be designed for a particular purpose

Design tool

Object, media or computer program, which can be used to facilitate the design process and its activities

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1. Introduction

1.1. Background

After the Industrial Revolution a long period of strong economic growth followed. A period, which was characterized by a linear economy in which natural resources were extracted and products were produced, consumed and wasted. To handle natural resources in such way have now shown to be unsustainable and a circular economy has started to take ground. In a circular economy no waste is produced and extracted natural resources are retained within the society or returned to nature in a sustainable way (Sveriges offentliga utredningar, 2017).

Collaborative consumption is one way to retain natural resources within the society and reduce the production and consumption of new products. In collaborative consumption the access to products is more important than the ownership itself. The past few years information technology has enabled individuals to give away, share, rent and lend products to others. Several companies have followed the trend and are now offering services that facilitate a collaborative consumption (Naturskyddsföreningen, 2017).

A collaborative consumption behaviour have started to grow among car users due to new services on the market. In the 21st century carsharing began to take ground and in December of 2012 the amount of carsharing members was estimated to 1.7 million in 27 different countries (Steinberg et al., 2016). The original carsharing systems have over the years been challenged by new carsharing concepts. In 2016 Lynk & Co entered the market with yet another new carsharing concept (De Feijter, 2016).

Lynk & Co is an automotive brand owned by the China based company Zhejiang Geely Holding Group and developed by their Swedish subsidiaries China Euro Vehicle Technology AB (CEVT). Lynk & Co is trying to challenge the old automotive industry by addressing the needs and preferences of a young connected generation through innovative purchasing models and applying the platform and business model of Airbnb (Lynk & Co, 2016). The Airbnb business model is based on a community-based online platform that facilitates the process of renting local homes by connecting hosts and travelers (Business Model Toolbox, 2017).

The innovative business model of Lynk & Co puts demands on the design of the car. How should a car, which is aimed for multiple users with different needs and preferences be designed? Some design features will be necessary to meet the demands of the business model while other features could facilitate and encourage a collaborative consumption behaviour. This project will focus on the Human Machine Interface (HMI) and User Experience (UX) in the Lynk & Co cars and how the HMI and UX could be designed for shared use.

1.2. Aim

The aim is to investigate how the HMI and UX should be designed for cars specifically developed for sharing and sharing services. Further, the aim is to implement the findings and ensure the use of the findings at the UX department of CEVT.

The project will result in a list of design guidelines for HMI and UX in shared cars and a design tool, which will facilitate the use of the design guidelines and support the design process at the UX department of CEVT.

1.3. Research Questions

- How should the HMI and UX be designed in shared cars?
 - How does attitudes towards sharing affect the design of HMI and UX in shared cars?
 - How could existing and possible future car features be used in the design of HMI and UX in shared cars?
 - How could future carsharing models be designed?
- How could a design tool for HMI and UX in shared cars be developed for the UX department of CEVT?

2. Process

In collaboration with the UX department of CEVT this project was carried out during the spring term of 2017. The execution of the project was divided into five major phases as shown in Figure 2.1. The design guidelines were under development throughout the project while the design tool were developed at the end of the project.

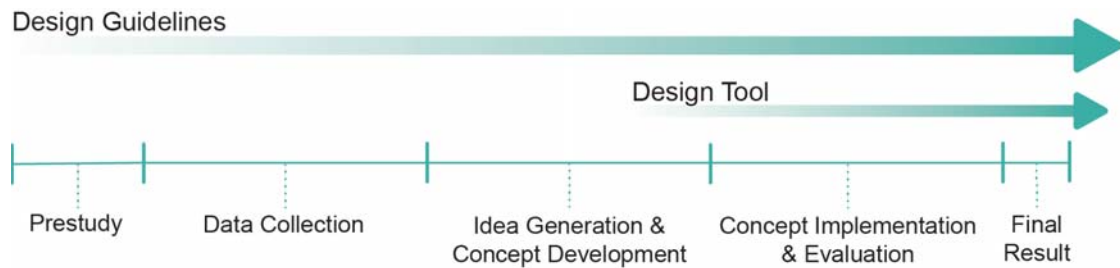


Figure 2.1. Project process

The Table 2.1 lists the methods used in each phase as well as the results and outcome of each phase. Firstly, a prestudy was carried out to gather initial knowledge and establish a direction for the future work. Secondly, data was collected to be used for developing the first concept in the phase of idea generating and concept development. The first concept was implemented and evaluated, which resulted in improvement proposals. Finally, based on the improvement proposals a final concept was created.

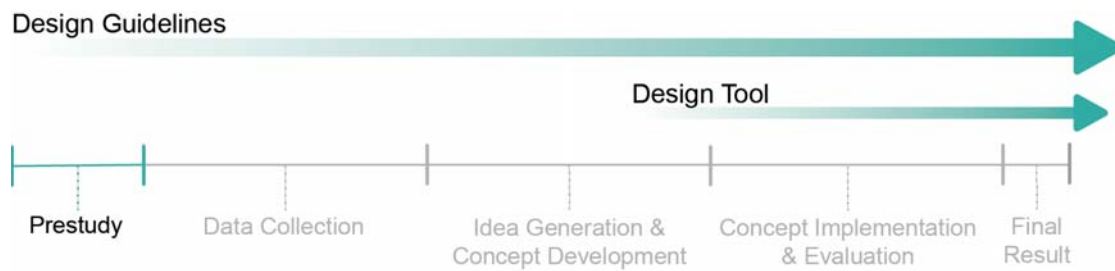
The report structure follows the execution of the project. Each phase of the project correspond to a chapter presenting the methods used and how the methods were implemented. At the end of each chapter the result of the phase is presented. The report ends with a discussion in which the projects execution, outcome as well as the environmental and ethical aspects of the project are scrutinised.

	<i>Prestudy</i>	<i>Data Collection</i>	<i>Idea Generation and Concept Development</i>	<i>Concept Implementation and Evaluation</i>	<i>Final Result</i>
<i>Method</i>	Semi structured interviews with two employees at the UX department of CEVT	Survey regarding people's attitudes towards sharing and sharing services with over 100 respondents	Brainstorming within the project group concerning how cars and the HMI and UX of cars could be adapted to shared use	Workshop with the Scrum Team at the UX department of CEVT evaluating the design guidelines and the design tool	Brainstorming within the project group concerning improvements of the design guidelines and the design tool
	Literature study of Lynk & Co, UX, HMI, HMI in cars, carsharing, sharing services and the research field of Design for Sharing	KJ analysis of the survey	Workshop with students concerning sharing and how cars and the HMI and UX of cars could be adapted to shared use		
	Participant observation of the Lynk & Co model 01	Mindmaps to visualize the KJ analysis of the survey			
	Semi structured interviews with four persons connected to the Lynk & Co target group	Semi structured interviews with four persons sceptical of or not familiar with sharing services			
		Literature study of people's attitudes towards sharing			
		Benchmarking of existing car design solution for sharing			
		Participant observations of the in-car HMI of Tesla			
<i>Result</i>	Lynk & Co (see page 10)	Sharing Scenarios (see page 19)	Design Guidelines for HMI and UX in Shared Cars (see page 29)	Description of Workshops (see page 37)	Design Tool (see page 42)
	The Lynk & Co Primary Target Group (see page 11)	Sharing Experiences (see page 21)	Design Tool (see page 31)	Used Brainstorming Methods (see page 37)	
	UX Department of CEVT (see page 12)	Design for Sharing Cases (see page 24)		Ranking of the Guideline Cards (see page 38)	
	UX and HMI (see page 12)			Result of the Questionnaires (see page 39)	
	HMI and UX in Cars (see page 13)			Content of Design Guidelines (see page 40)	
	Carsharing (see page 15)			Format of Guideline Cards (see page 41)	
	Design for Sharing (see page 16)				
<i>Outcome</i>	Project direction	Concept basis	First concept	Improvement proposal	Final concept

Table 2.1. Method, result and outcome of each project phase

3. Prestudy

In this phase of the project a prestudy was carried out and a wide range of project related fields were studied. The brand Lynk & Co, its target group and organization were studied as well as UX, HMI, HMI in cars, carsharing, sharing services and the researched field of Design for Sharing. By conducting a broad prestudy, initial knowledge was gained and future relevant fields for the project identified. The most valuable findings are presented in this chapter.



3.1. Method and Implementation

To identify research areas for the next phase of data collection a prestudy was conducted. Initially, information concerning the brand Lynk & Co was collected from CEVT. To get a better understanding of Lynk & Co and the organization at the UX department of CEVT interviews were held with two employees. One Product Owner and one Interaction Designer were interviewed. Besides the organization at the UX department, the design process used at the UX department was discussed during the interviews.

Interviews can either be carried out face to face or over the phone. Both open and closed question can be used during an interview. Open questions opens up for more detailed answers while closed questions can be answered by only a yes or a no. It can be strategic to start an interview with general open questions, not too personal to the interviewee. This gives space for the interviewee to take a stand and for example describe a requested situation. The technique probing can be used to help the person being interviewed to deepen the answers. Probing involves asking the interviewee why, how and in what way (Egidius, 2008).

The interviews with the two employees were semi structured with open questions and carried out face to face. How tasks are distributed and carried out at the UX department was described by the interviewees. Questions concerning the design process, inspiration sources and design challenges were asked. Additionally, the subject of sharing was discussed regarding how it is approached at the UX department for the moment and how it will be approached in the future.

The information obtained about Lynk & Co was complemented with a literature study. A literature study aim to search, take part of and analyse published material. The material can be gathered from research, webpages and encyclopaedias. A literature study can be carried out to learn about previous research in a field and to support the choices made during a development project (Bligård, 2011). To find information about Lynk & Co online literature was screened such as the Lynk & Co webpage and different car forums and reviews.

Further literature studies were carried out to deepen the knowledge in areas relevant to the project. Areas that were studied were among others UX, HMI, HMI in cars, carsharing, sharing services and the research field of Design for Sharing. Existing solutions and possible future trends within the examined areas were studied. To get an initial understanding of the primary target group of Lynk & Co the Chinese culture and Chinese car usage were investigated. As in the initial literature study of Lynk & Co information was found primarily online but now in research articles, newspaper articles and on blogs.

To complement the literature study a participant observation was executed to deepen the knowledge of car HMI, in particular the in-car HMI of the Lynk & Co model 01. The observation was executed also to get a better understanding of the design process used at the UX department of CEVT. The project group attended a user clinic in which a concept of the Lynk & Co 01 was evaluated. One member of the project group acted as a test pilot and one member observed and documented the clinic.

Observational methods are beneficial to use when it is difficult for the user to orally communicate perceived needs, requirements and problems. By observing the user it is possible to study work sequences, work postures and interaction patterns. The degree of participation in observations may differ between complete participant, participant-as-observer, observer-as-participant, complete observer (Egidius, 2008).

To get more familiar with the primary Chinese target group of Lynk & Co and their attitudes towards shared use of possessions interviews were held. Semi structured interviews with open questions were held with one person within the target group living and working in China and three people familiar with the target group. The people familiar with the target group had lived in China and either been working or studying there for at least one year.

The analysis of the data from the literature studies, the interviews and the observation was an ongoing process throughout the prestudy. At the end of the phase the most interesting and project relevant data was compiled and presented to the supervisors at the UX department of CEVT. Together with the supervisors

and based on the prestudy a decision was taken regarding the future direction of the project.

3.2. Result

3.2.1. Lynk & Co

Lynk & Co is a automotive brand press released in October 2016. The brand is owned by the China-based company Zhejiang Geely Holding Group and developed by their Swedish subsidiaries CEVT. Lynk & Co is trying to challenge the old automotive industry by addressing the needs and preferences of a young connected generation. This is done by using an innovative purchasing model and applying the platform and business model of Airbnb on cars (Lynk & Co, 2016).

Lynk & Co is planning to use a direct-to-consumer sales model, which means that the cars will be either sold or leased directly to the consumer without any intermediaries. The buyer will have the option to either try and buy a car in company-owned stores or order one on the Internet. In both cases Lynk & Co will deliver the car to the home of the buyer. It is an uncommon sales model in the car industry but the automotive brand Tesla has shown that it is well functioning. Additionally, whenever the car needs service it will be picked up and returned by Lynk & Co. Further the cars will be offered just in a few fully equipped variants with fixed prices, by Lynk & Co called collections (De Feijter, 2016). Due to the direct-to-consumer sales model and the use of a limited number of collections the price of the cars are expected to be reduced by 25% (Redaktionen, 2016).

Lynk & Co have developed a system in which the ownership of a car can be shared or one owner can share the car with others. The system is based on a smartphone application that replaces the ordinary key and which is connected to the Lynk & Co cloud. If a group of people owns a car the application can be used to reserve the car and to automatically split the ownership costs. If one person owns the car the application can be used to rent out the car when it is not used by matching the owner with potential renters (De Feijter, 2016).



Image 3.1. Lynk & Co 01

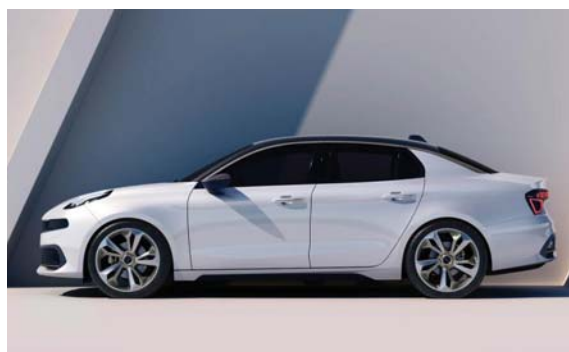


Image 3.2. Lynk & Co 03

The press release of Lynk & Co brand and the presentation of the first concept model called Lynk & Co 01 (see Image 3.1) took place in Berlin the 20th of October

in 2016 and received a mixed response. Lynk & Co 01 is a SUV and is said to be either a hybrid vehicle or a plug-in hybrid electric vehicle with a manual 6-speed transmission or a 7-speed dual clutch transmission. The sale of the Lynk & Co 01 will start in China in the fourth quarter of 2017, followed by Europe and the U.S. but yet without an exact timetable (De Feijter, 2016). The primary target group of Lynk & Co 01 is young Chinese adults living in big cities, familiar with technology and are open to new innovations. The next car model, the Lynk & Co 03, will have its official release at the Shanghai Auto Show in November 2017. A concept car of the Lynk & Co 03 (see Image 3.2) was released in April 2017 (Auto Motor & Sport, 2017).

3.2.2. The Lynk & Co Primary Target Group

The Chinese society has been through a big change in a short time due to economic growth and urbanisation. Shanghai is one of the largest cities in China and is called the Asian New York. According to the interviewees within or familiar with the Chinese target group, the young adults living in the big cities are under heavy pressure and are not allowed to show any signs of weakness. It was described as “Work-life balance does not exist” by one of the interviewees. A centrally located apartment and exclusive German car brands are status symbols. Still, not many young Chinese people living in the big cities do own a car and are instead using taxi or different carsharing services for transportation.

The most common carsharing services in the big cities of China are Didi Chuxing (see Image 3.3) and Uber (see Image 3.4). This was confirmed by one of the interviewees within the target group of Lynk & Co, “I go with Uber or Diddi almost every day and sometimes several times per day”. The services are based on people ordering taxis from private persons via a mobile application. In year 2015, this kind of carsharing services reached approximately 2 billion orders in China. The users of Didi Chuxing and Uber are mostly young and early middle age people (PRNewswire, 2016).



Image 3.3. Didi Chuxing logo

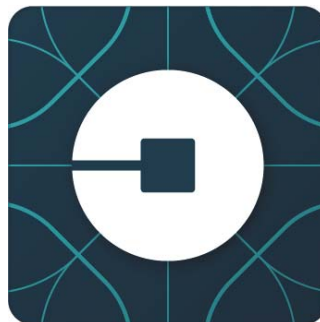


Image 3.4. Uber logo



Image 3.5. WeChat logo

Mobile phones are frequently used among young adults in China and WeChat is the most popular application (see Image 3.5). WeChat is a free, cross-platform and instant messaging application developed by Tencent. The application was released

in 2011 and has currently 864 million active users. WeChat enable you to among other things send text and voice messages, post images and text, share music, perform mobile payments, book doctor appointments and pay your electricity bill (WeChat, 2017).

3.2.3. UX Department of CEVT

The UX department of CEVT is using a process framework called Scrum. The Scrum framework is used to manage complex product development and consists of several Scrum Teams. Each team is assigned to a Product Owner and a Scrum Master. The Product Owners are responsible to maximize the value of the work and products of the teams. The Scrum Masters are responsible for ensuring Scrum is understood within the teams by ensuring that the teams follow the rules of Scrum. The teams are self-organizing, cross-functional and such multi disciplined teams have all competencies needed without depending on others. Additionally, self-organizing teams can decide how to best accomplish and distribute the work and its tasks. The team model of Scrum is developed to optimize the creativity, flexibility and productivity (Scrum Alliance, 2017).

The UX department of CEVT consists of three Scrum Teams. Each team works with different Lynk & Co car models and the teams are therefore in different stages of the design process. The number of members varies but a team consists of approximately eight people. Additionally, two Attribute Leaders work at the UX department. The responsibility of the Attribute Leaders is to determine product requirements and to make sure that the requirements are fulfilled. Lastly, there is a Team Leader who has the overall responsibility at the UX department of CEVT.

3.2.4. UX and HMI

The field User Experience (UX) can be interpreted in several ways. All definitions include that UX has to do with a person's responses and perceptions that result from the use or anticipated use of a product, service. Nielsen et al. (2014) state that "UX encompasses all aspects of the end-user's interaction with the company, its services and its products". They mean that exemplary UX requires the needs of the customer to be met in an exact, simple and elegant way, which only can be achieved "by seamlessly merging services of multiple disciplines, including engineering, marketing, graphical and industrial design, and interface design" (Nielsen et al., 2014).

UX is a broad field, which should be distinguished from Human Machine Interface (HMI). HMI "includes any device or software that allows you to interact with a machine" (MachineDesign, 2015). It could be a traditional push button or a touch display mounted on a machine as well as a smartphone or smartwatch (MachineDesign, 2015).

3.2.5. HMI and UX in Cars

In-car HMI is concerned with how the driver interacts with the car when sitting behind the steering wheel. It consists mainly of physical controls and digital displays, which both are based on interaction patterns (see Image 3.6). The main physical controls are the shift lever, steering wheel, pedals and small twist and push buttons. The main digital displays are the Center Stack Display (CSD) and the Driver Information Module (DIM). The display positioned in the middle of the car, in between the driver and passenger seat, is the CSD. The DIM is the display positioned behind the steering wheel. Infotainment, comfort and drivers assistance features are three different scopes that the in-car HMI deals with but it is under constantly change due to new technology (Becker et al., 2014).



Image 3.6. Example of in-car HMI

Head Up Display (HUD) is a display projected onto the windshield of the car (see Image 3.7). It is based on a technology within the trendy and upcoming field of immersive technology. Immersive technology refers to technology that blurs the line between the physical and digital world and in that way creates a sense of immersion (Immersive technology, 2017). Other immersive technologies are Augmented Windows, Holographic Displays and Ultrahaptics. Augmented Windows are windows that display and enhance information concerning the outside environment to the driver (see Image 3.8). Holographic Displays are displays that use light diffraction to create a virtual three-dimensional image of an object (see Image 3.9) (Holographic Display, 2017). Ultrahaptics creates invisible but tangible three-dimensional shapes in the air using ultrasound (see Image 3.10). Sensations are projected through the air and to the user through an emission of sound waves (Prisco, 2015).

Beside immersive technology an upcoming car HMI trend is to activate all five senses of the car driver. The five senses are sight, hearing, taste, smell and touch. So far HMI in cars has focused primarily on sight and secondly on hearing. Tactile

feedback (see Image 3.11), conditioning scent (see Image 3.12) and 360 speakers (see Image 3.13) are examples of new solutions that activate the senses touch, smell and hearing (PCH Innovations, 2015).



Image 3.7. Head Up Display

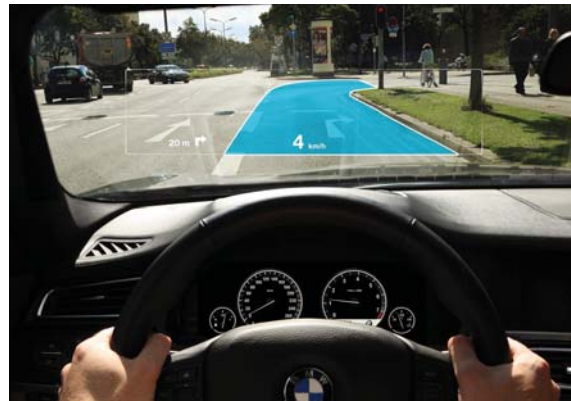


Image 3.8. Augmented Windows



Image 3.9. Holographic Displays



Image 3.10. Ultrahaptics



Image 3.11. Tactile feedback



Image 3.12. Conditioning scent



Image 3.13. 360 speakers

With the new technology and trends presented above the driver experience in cars will change. A new experience is emerging that minimizes driver distraction while optimizing and enhancing the experience. The new experience should make drivers feel relaxed and all time balanced. Future cars are predicted to be knowledge hubs, experience machines, health advisors and transaction platforms rather than only a transportation option (PCH Innovations, 2015). The following quote (see Quote 3.1) completes the rapidly evolving trends of HMI and UX in cars.

“The entire stack of technologies and behaviours associated with automobiles may be ripe for reinvention” (PCH Innovations, 2015)

Quote 3.1

3.2.6. Carsharing

Carsharing can be defined as “a membership based service available to all qualified drivers in a community” (Carsharing association, 2017). The service typically attracts people who only make occasional use of a car or people who want to have access to a car different to their daily used car. Carsharing services can be organized in different ways. For example, it could be a commercial business renting cars or users organized, such as a cooperative (Carsharing, 2017).

There exist several carsharing models. Three of them are termed the two-way, the one-way and the free-floating model. In the two-way model the user access and return the car at the same place. In the one-way model the user can drop the car at any of the carsharing stations. In a free-floating system the user can access and return the car freely within a defined zone (Carsharing, 2017).

In year 2012 the amount of carsharing members were 1.7 million in 27 countries and the carsharing industry is on the rise (Carsharing, 2017). It is expected to continue to grow in its current markets and into new markets. The amount of global carsharing members is expected to approach 23.4 million by year 2024. Most of the expansion is expected in the Asia Pacific region but also in Europe and North America (Navigant Research, 2017). Factors pushing the growth of the industry are a shifting generational mindset of car ownership, escalating levels of traffic congestion, and the increasing cost of car ownership (Navigant Research, 2013).

The benefits of carsharing are several. Carsharing makes the amount of car trips decrease since people get more aware of the cost when using a car and also since they have to plan their trips in advance. Carsharing also provides people who primarily would not choose to go by car or cannot afford a car to have better access to cars. Additionally, the increased utilisation rate of individual cars, less car intensive cities and the reduced need of parking lots are benefits from carsharing (Sveriges offentliga utredningar, 2017). According to the Economist (2012) the carsharing industry can reduce car ownership by replacing 15 owned cars with one shared car.

The large companies in the car industry approach carsharing differently. Some companies believe that autonomous cars have to be reality before carsharing is possible. Other companies are already developing carsharing systems for their cars. Tesla is an example of a company that will wait to release their sharing system until their cars have become fully autonomous (Fortune Tech, 2016). Fully

autonomous car are expected to enter the market not earlier than in year 2020 (Driverless Car Market Watch, 2017).

3.2.7. Design for Sharing

Design for Sharing is a research field that is getting more attention due to the rapid growth of collaborative consumption. How should products be designed to enable, facilitate and encourage sharing and thereby contribute to a sustainable consumption behaviour are examples of research questions, which the field of Design for Sharing aims to answer.

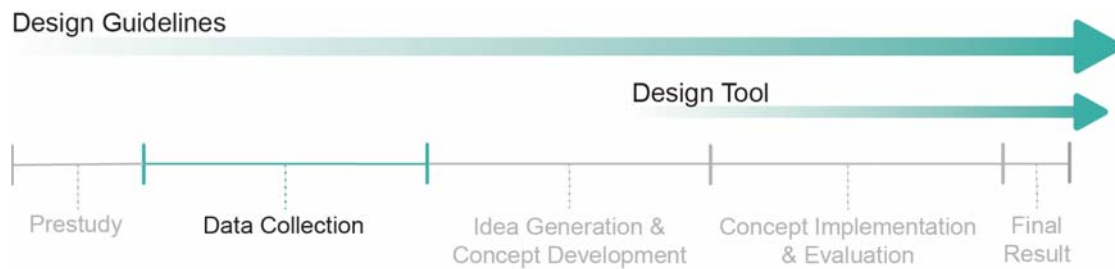
Use2Use is a ongoing research project at Chalmers University of Technology. The aim of the project is to develop a design tool that in an efficient way can help organizations and companies to develop more sustainable products and services. The design tool will be based on a three step model. In the first step current consumption models of a product is analysed. In the second step possible alternative consumption models of the product are investigated with focus on increased utilization rate and environmental benefits. Lastly, in step three the consequences of the alternative consumption models are identified with focus on the design of the product (Bergstrand & Jönsson, 2017).

As a part of the Use2Use research project, different consumption models with corresponding design guidelines have been identified. Due to the multifaceted Lynk & Co concept its consumption model is an combination of several of the identified consumption models. Identified consumption models that correspond to the Lynk & Co concept are rented consumption, joint ownership consumption and service consumption. Proposed design guidelines for the Lynk & Co are therefore the following (Bergstrand & Jönsson, 2017):

- Facilitate the use of the product
- Facilitate sharing of the product
- Facilitate cleaning of the product
- Facilitate maintenance of the product
- Optimize utilisation of the product
- Optimize distribution of the product between users
- Make the product flexible

4. Data Collection

In this phase of the project data collection was carried out based on the findings of the previous prestudy phase. A survey was initially conducted followed by four interviews and a literature study. This was done to get a better understanding of people's experiences and thoughts related to sharing and sharing services. Finally, a benchmarking was carried out to identify existing design solution of sharing in the car industry. The findings of the data collection are presented in this chapter.



4.1. Method and Implementation

Initially a survey was conducted to get a better understanding of people's experiences and their thoughts about sharing services and sharing in general. To use survey as a data collecting method is preferable when collecting data from a large amount of users. In a survey a number of questions are put together and to be distributed in strategically chosen channels (Egidius, 2008).

An online survey was compiled and distributed on Facebook and LinkedIn via the project teams' profiles. The survey was also posted on Facebook pages administered of organizations emphasizing sustainability related issues. The initial questions of the survey concerned the experiences of existing sharing services. Further in the survey more general questions concerning sharing were asked (see Appendix I). The survey got 119 respondents of which 58% were women and 42% men. More than half of the respondents were between 24-34 years.



Image 4.1. Analysing using the KJ method

The quantitative result of the survey was analysed and visualized in diagrams. The qualitative result in form of comments was analysed using the KJ method (see Image 4.1) and visualized in Mindmaps (see Appendix II-VI). The KJ method can be used to structure gathered information in a way so that an overall picture can be obtained. Keywords and key sentences of the information are identified and categorized in different groups. It is preferable to work with the KJ method together with others using Post-it. The process with its discussions is as important as the final result when using the KJ method. That to understand and get a complete picture of the gathered information. Mindmaps on the other hand is a beneficial method when a large amount of data has to be visually organized. An overall category defines to which associated words and statements are added in different levels of details (Karlsson, 2007).

To complement and better understand the findings of the survey four interviews were conducted. The interviewees were between 24-30 years old, three were female and one male, all living in Gothenburg. They were chosen to be persons sceptical of or not familiar with sharing services but in the generation being curious of them. The semi-structured interviews were conducted both face to face and over phone. Open questions were used in combination with probing. The interviewees were first asked if they have ever taken part of sharing services. If they had, they were asked to describe the purpose, frequency and overall experience of the services. Additionally, how the design affects the use of the services was also discussed in the interviews.

A literature study was carried out to theoretically complement the findings of the survey and the interviews. Research articles concerning people's attitudes towards sharing were studied to identify incitement and barriers for sharing.

To create an overview of what exists in the car industry today concerning design solutions for sharing a benchmark was carried out. Benchmark as a method includes comparison of existing companies and solutions. That in order to gain valuable knowledge that can be transformed into improvements in your own business (Westling, 2012).

The benchmark was performed by a literature study, an interview and a participant observation (see Image 4.2). The literature study was done to identify design solutions for shared cars, in particularly the design solutions of the Bollorée Bluecar. To identify the design solutions of shared car HMI a semistructured interview was held with a Product Specialist at the Tesla Showroom in Gothenburg. Tesla was chosen since these cars are seen as the most forward thinking and connected cars on the market (Hot Topics, 2017). Open questions were used in the interview together with probing. Questions concerning the functionality and purpose of the different car features were posed together with questions

concerning the vision of Tesla and upcoming updates of the car and HMI features. In addition, a participant observation was carried out by test driving a Tesla Model S together with the Product Specialist. The in-car HMI was tried out when driving to better understand its features and interactions. The observations were documented with photos.



Image 4.2. Participant observation of the Tesla in-car HMI

The creation of sharing scenarios was an ongoing process throughout this phase. New perspectives of how cars could be shared were documented when they emerged. When finalizing the sharing scenarios the result of the survey and interviews were considered together with trends and new market opportunities of the carsharing industry found in the literature study. To make the sharing scenarios more understandable for the employees at the UX department of CEVT the sharing scenarios were descriptive documented.

4.2. Result

4.2.1. Sharing Scenarios

The sharing of the Lynk & Co cars could be organized in several ways. Below six different sharing scenarios of the Lynk & Co cars are proposed. The scenarios differ in type of owner, the amount of Lynk & Co cars and whom the cars are available to.



Scenario 1: The family

The family consists of four adults, a couple with their two grown up children. They all live in the same neighborhood within a radius of two kilometres. They have decided to buy a Lynk & Co car together, since they think it is too expensive and too much responsibility to own one each. Since they have a car for different purposes, sharing it would be a perfect way of maximizing the use of it.



Scenario 2: The consult company

The consult company has 1000 employees. When the employees have appointments out of office they need easily accessible transportation. The management has now decided to buy five Lynk & Co cars for the convenience of their employees.



Scenario 3: The residential area

The residential area has 100 residents and 2 full-time employees working with administration and maintenance of the area. Since the residential area is located in the city centre and do not offer parking lots it is difficult for the residents to have their own car. The residential area has therefore decided to buy two Lynk & Co cars available to the employees during day time and to the residents during evenings and weekends.



Scenario 4: The airport

The airport is located 20 kilometres from the city centre and travellers need transportation to and from the airport. The airport is open twenty four-seven. The airport has therefore decided to buy several Lynk & Co cars to offer the visitors an additional transportation alternative to all hours.



Scenario 5: The commuter

The commuter lives in the countryside and does not have the option to use public transports to get to work. Since work is situated in the city centre it is expensive to have a car parked all day. The commuter is therefore considering to buy a Lynk & Co car. In that case, he could drive the car to work and someone in the city centre could use it during the day. The commuter will not have to pay parking fees and will also have the opportunity to lower other car-related costs.



Scenario 6: The public transport authority

The public transport authority of a one million city is looking for complements to the current public transport. The aim is to connect neighbourhoods that are difficult to connect in a profitable way with tram or bus. To buy 500 Lynk & Co cars and integrate them in the public transport system is now under investigation. It could be an alternative to modernize public transport and attract more users.

4.2.2. Sharing Experiences

Of the survey respondents 73% had used sharing services which provide and distribute either cars, bikes, tools, clothes, leisure equipment or accommodation such as AirBnb. The respondents, which had taken part of one or more of the sharing services rated the overall experience to 3.2 on a five-degree scale where five corresponds to awesome. The vast majority of the respondents had used sharing services to take part of other people's belongings (see Figure 4.1). Although, only 11% of the respondents had used sharing services to share their own belongings.

The main reasons for using sharing services to take part of other's belongings are related to the low cost, smoothness and accessibility of the services (see Figure 4.2 and Quote 4.1). The cost of the services is perceived to be low in comparison with the cost of buying the products that the services offer. Additionally, the services are perceived to provide a wide range of quality products at different price levels. The smoothness of the services is related to the possibility to be spontaneous and the easy and quick use of the services. The services always have products available and nearby, which make them be perceived as accessible. An additional positive aspect of sharing services that emerged from the survey and the interviews is the discharge, which is perceived to come with sharing services. Further, the lack of

need for storage, maintenance and insurance make the services to be perceived as free from responsibility (see Quote 4.2).

Why did you use sharing services?

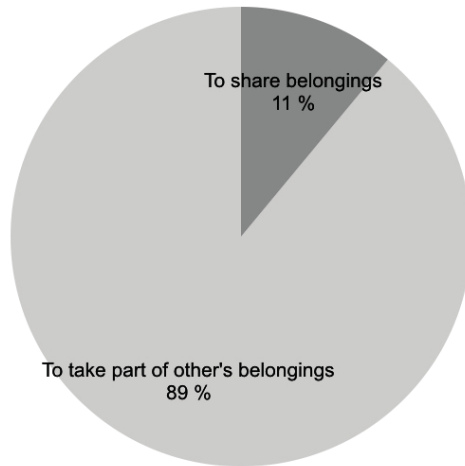


Figure 4.1

What motivates you to take part of other's belongings?

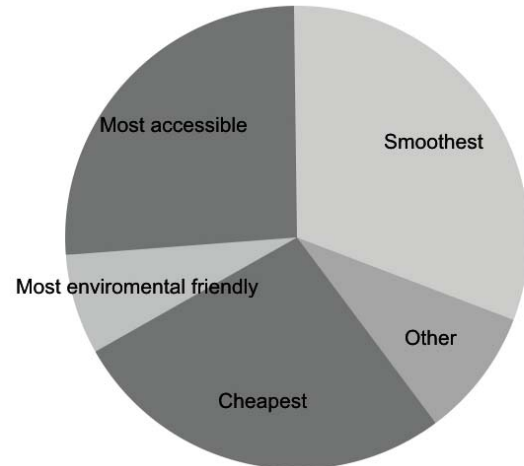


Figure 4.2

"It is often the cheapest option for what I need"
"I get access to products I would not afford otherwise"
"The service gives me the freedom to be spontaneous"
 Quote 4.1

"I can use a product without having to store it"
"I don't have to think about things like insurance"
 Quote 4.2

The main reasons not to use sharing services to take part of other's belongings turned out to be the opposites of what is mentioned above as positive aspects of sharing services. Sharing services are apparently not only perceived to be cheap, flexible, accessible and discharging but also expensive, demanding and inaccessible. Further, sharing services are perceived to require planning and to provide a poor range of low quality products (see Quote 4.3).

"There appeared unexpected additional costs afterwards"
"I needed to think much more about how I handled the product"
"It is often you have to be out in time and plan in advance to use the service"
"Sometime it takes time returning the product"
 Quote 4.3

What motivates you to share your belongings?

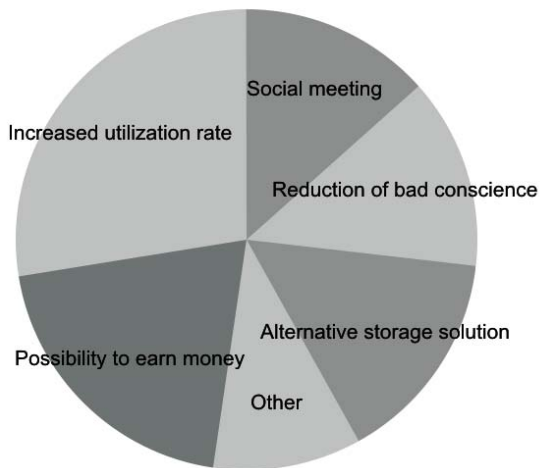


Figure 4.3

The main motives to use sharing services to share your own belongings are related to the possible income and the increased product utilization rate (see Figure 4.3 and Quote 4.4). To share belongings could reduce the cost of owning a product but also make it possible to make a profit. Social meetings, reduction of bad conscience and alternative storage of belongings also motivate to share belongings. Further motives to share belongings are the desire to be environmentally friendly and help others (see Quote 4.5).

"I find it interesting if I could make profit out of it"

"It's not about earning money, but to share the costs for expensive products"

Quote 4.4

"It isn't that sustainable if everyone buys everything"

"It's a way of helping others"

Quote 4.5

The main motives for not using sharing services to share belongings are the increased product wear and the perception that using sharing services is time consuming and complicated (see Quote 4.6). Additionally, there is a fear of belongings not being handled in a good way and in worst case getting damaged. The lack of trust to the ones using sharing services to take part of others belongings also contributes to the fear of getting tricked (see Quote 4.6). Different hygiene preferences and the allergy risk are also mentioned as motives not to share belongings.

"Is it worth the hassle?"

"I can't make sure how others would handle my things"

"There is a fear of getting tricked"

Quote 4.6

"I see the point, it just feels strange"

Quote 4.7

Recurrent in the survey and the interviews is the feeling of discomfort to share belongings (see Quote 4.7). To share belongings is referred to as an unusual behaviour. Belk (2007) tries to explain the feeling of discomfort related to sharing

in the article “Why Not Share Rather Than Own”. In the article three main psychological barriers of sharing are presented. The barriers are defined as the belief that your belongings are a source of happiness, the strong attachments, which we feel to our belongings and the fact that we identify ourselves by our belongings (Belk, 2007). Belk (2007) affirms, “If ownership allows sharing, feelings of possessiveness and attachment toward the things we own or possess discourage sharing”.

On the question of with whom you are willing to share your belongings with 83% of the survey respondents answered family and friends. Still, half of the respondents answered that they were willing to share their belongings with anybody. Except personal connection, the characteristics of the person the respondents are willing to share with should be responsible, trustful and easy to deal with. Additionally, the person should have ability to pay and have the right competence. Geographical location also proved to be important to the respondents. It was desirable that the person to share with was located near by (see Quote 4.8).

“To share with friends and family feels obvious”

“The person must be responsible”

“I want to be sure in advance the person has the ability to pay”

“I have no problem to share things with people knowing how to handle them”

“It’s much more practical to share with people in the neighbourhood”

Quote 4.8

4.2.3. Design for Sharing Cases

Car Design for Sharing

There are not many cars on the market designed with the intention to be shared. Instead, carsharing companies have been forced to adapt existing car designs by for example implementing electronic keys. The Bolloré Bluecar (see Image 4.3) is an exception and was originally designed to be shared. The car is a small four-seat and three-door electric car used by the French carsharing company Autolib’s in Paris (Gruen, 2017).

The Bolloré Bluecar is designed for sharing. The car is for example made in one model with a uniform design. That to facilitate for the user to recognize the car from the outside and enable the user to establish the impression of always getting in the same car each time using the car sharing service. The uniform design also enables the user to create routines. Such routines, which makes the user create a relationship with the car, similar to the relationship with his or her own belongings. To strengthen the relationship between the user and the car the design is based on co-creation. When entering the Bolloré Bluecar the on board computer displays your stored favourite radio stations and destinations but the seat position still have to be adjusted manually (Gruen, 2017).



Image 4.3. The Bolloré Bluecar



Image 4.4. In-car HMI of the Bolloré Bluecar

The Bolloré Bluecar is designed with reinforced door and seat structures to avoid damage despite the high utilization rate of the car. The driver seat of the car is elevated to empower and make the driver feel in control. Further, a variety of needs are considered such as the inbuilt system to house a child seat. Last, the Bolloré Bluecar is equipped with a button to contact the call centre in case of emergency (see Image 4.4) (Gruen, 2017).

Car HMI Design for Sharing

Valet mode is one of few examples on the market of HMI designs for external drivers besides the Bolloré Bluecar. The valet mode is a HMI share mode that makes it possible to lock out the driver from certain HMI and car features. The mode can only be activated by the owner of the car when the car is parked (Hanley, 2017). The name of the mode comes from the name of male servants who among other things park the car for their employer.



Image 4.5. The Tesla Valet Mode

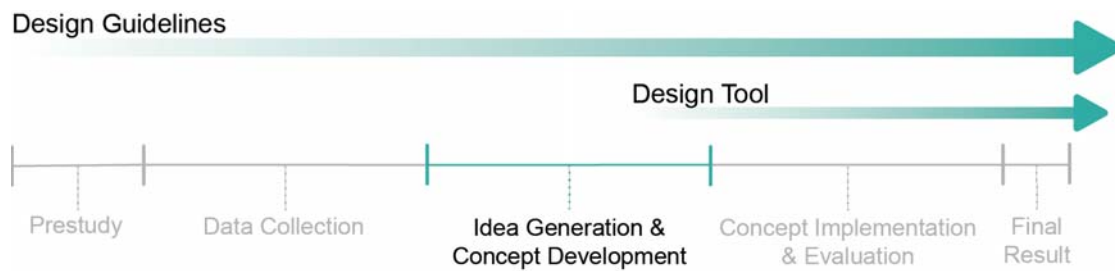


Image 4.6. The Tesla Valet Mode activated

The Tesla Valet Mode is one of the most developed valet modes on the market. The car features that are taken away when activating the Tesla Valet Mode (see Image 4.5 and 4.6) are the cruise control, auto steering and auto park. The HMI features that are taken away are the home links and the access to additional driver profiles. The Tesla Valet Mode also restrict the acceleration and the speed to maximum 113 km/h. Additionally, the Tesla Valet Mode makes it impossible for the driver to turn off the remote access which allows the owner to always keep track of the car (Hanley, 2017).

5. Idea Generation and Concept Development

In this phase of the project 15 design guidelines for HMI and UX in shared cars together with a design tool were developed. The guidelines are developed to guide designers when designing the HMI and UX in cars specifically developed for sharing and sharing services. The design tool is developed to facilitate and support the design process of the Scrum Teams of the UX department of CEVT. The guidelines and the design tool are presented in this chapter.



5.1. Method and Implementation

With the findings from the data collection in the previous phase as a base, brainstorming within the project group was performed. How cars and the HMI and UX in cars could be adapted to shared use were questions treated during the brainstorming sessions. Brainstorming is a method used to generate a large amount of ideas within a chosen subject area. By time limiting the brainstorming the participants are forced to generate creative ideas quickly without having time to be self-critical. No negative criticism is allowed during brainstorming (Karlsson, 2007).

To further expand the bank of sharing ideas and evaluate different design tools a workshop was performed. The participants of the workshop were 11 students from the master programme Industrial Design Engineering at Chalmers University of Technology. The workshop began with an introduction to sharing in which some of the findings from the data collection were presented. The aim of the introduction was to establish a minimum of knowledge regarding sharing among the participants.

The participants were then divided into three groups and each group was assigned different design tools. The tools were based on the findings from the data collection. One tool consisted of cards with quotes from the survey and interviews (see Image 5.1). The two other tools consisted either of cards (see Image 5.2) or a word tree (see Image 5.3) with different aspects of sharing that were identified in the survey and interviews.

Two 30 minutes brainstorming sessions were performed (see Image 5.4 and 5.5) with subsequent presentations and discussions of 30 minutes. In the first

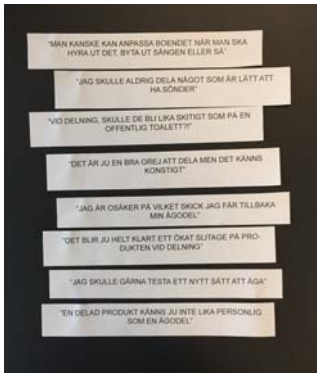


Image 5.1. Cards with quotes

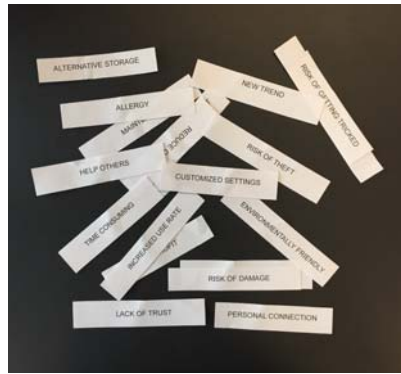


Image 5.2. Cards with different aspects of sharing



Image 5.3. Word tree with different aspects of sharing

brainstorming session the question was “How could cars be adapted to shared use?”. In the second brainstorming session the question was “How could the HMI and UX of cars be adapted to shared use?” asked. When changing question the design tools were also changed so that each group had the possibility to try out two of three tools. After the workshop the participants were asked which of the design tools they thought was most beneficial to work with.



Image 5.4. Brainstorming in group



Image 5.5. Brainstorming in group

Based on a categorization of the sharing ideas from the initial brainstorming and the workshop, a first draft of design guidelines for HMI and UX in shared cars was created. All findings from the prestudy and the data collection were then screened for information that lead to additional guidelines or new perspectives of already stated guidelines. The guidelines were then abstracted to be applicable to all sharing models described in the sharing scenarios of the data collection.

All guidelines were then specified and an explanation to each guideline was composed. By specifying the guidelines it became clear that some guidelines were too similar to each other and some not relevant enough. Finally, 15 design guidelines for HMI and UX in shared cars were stated and documented in an excel sheet. In the excel sheet the guidelines were explained and also categorized in three groups to facilitate an overview.

To make the guidelines easier to work with and to make them last beyond this project a design tool was developed. The design tool, which is based on the guidelines, is meant to be used by the Scrum Teams at the UX department of CEVT, not only in daily design but also at future workshops. The choice of design tool and card layout were based on the experiences from the previous workshop in which quote cards turned out to be the most popular tool when brainstorming.

5.2. Result

5.2.1. Design Guidelines for HMI and UX in Shared Cars

Below the 15 design guidelines for HMI and UX in shared cars are described. The guidelines are categorized in three levels of abstraction. Level 1 consists of the least abstract guidelines and do only concern the car. Level 2 consists of guidelines that concern the car but also the car owners and users of the sharing service. Owners refers to the ones owning and sharing cars and users refers to the ones taking part of the service by using other's cars. Guidelines that concern exclusively the owners and users are to be found in level 3. Detailed specifications of the guidelines can be found in Appendix VII.

Level 1

1.1 The HMI in shared cars should be designed to be easily cleaned

The high utilization rate of shared cars and different cleaning preferences of owners and users require easy cleaning. Both hardware and software have to be cleaned between the uses of the cars. Hardware refers to controls and displays and software refers to for examples personal settings. Easy cleaning would make both owners and users more willing to use the service since they would not have to spend time cleaning up after others and themselves.

1.2 The HMI in shared cars should be designed to withstand high wear

The high utilization rate of shared cars requires the hardware and software to withstand a high wear. If for examples controls, displays and memory capacity keep the same condition despite high wear owners would be more willing to share their cars. The users would in turn be more comfortable using the sharing service since they do not cause any larger wear of the cars.

1.3 The HMI in shared cars should be designed to minimize the risk of damage

The high utilization rate of shared cars requires the risk of damage to be minimized. If the possibility of damage is small owners could share their cars without worrying about something being broken when the cars are returned. Users would in turn be more comfortable using the service since they do not have to worry about causing damage.

Level 2

2.1. The UX in shared cars should be designed to be efficient

The time required for using the sharing service, for owners to share their cars and for users to get access to the cars, has to be minimized. Both owners and users should feel that the required time for using the service is acceptable. Otherwise, the service will not be competitive to other transport alternatives.

2.2. The UX in shared cars should be designed to be effortless

The mental effort required for using the sharing service for owners to share their cars and for users to get access to the cars has to be minimized. Both owners and users should feel that the required effort for using the service is acceptable. Otherwise, the service will not be competitive to other transport alternatives.

2.3. The UX in shared cars should be designed to appeal a wide range of people

The sharing service is dependent on a large amount of owners and users. The number of owners has to be proportional to the number of users but in general a large number of both owners and users is desirable. By appealing a wide range of people large number of owners and users of the service is ensured.

2.4. The UX in shared cars should be designed to facilitate first time users

The sharing service is dependent on a large number of users. It is therefore critical to facilitate first time users and provide first time users with a favourable impression. It would make first time users return to the service and secure a large number of users.

2.5. The UX in shared cars should be designed to enable recognition

The users will probably seldom use the same car when using the sharing service. It is even possible that the users will use different car models. Since different car models could be included in the service it is important to enable recognition. In that way users can feel comfortable independent of car and car model.

2.6. The UX in shared cars should be designed to be easily customized

The owners and users of the sharing service have different ergonomic needs and preferences. By enabling customization these needs and preferences can be met. To enable it in an easy way is important in order to make owners and users feel that the time and effort required for customization is acceptable.

Level 3

3.1. The UX in shared cars should be designed to encourage car owners to share

The sharing service is dependent on a large number of car owners, who are willing to share. Therefore, car owners have to be encouraged to share their cars and to be

a part of the service. It is especially important to encourage owners to share their cars due to the perception of sharing as being time consuming, unusual and strange.

3.2. The UX in shared cars should be designed to make owners feel in control

Owners using the sharing service can experience a feeling of losing control. The amount of lost control corresponds to which extent the owners know and trust the users. If the owners know and trust the users well, they experience to have more control than if the users are strangers. To boost owners and make them feel in control would make owners more willing to share their cars with others.

3.3. The UX in shared cars should be designed to make users perceive a sense of ownership

The users of the sharing service do not have the same relationship with the cars as the owners do. By making users perceive a sense of ownership, a owner to car relationship can be achieved. It would make users more comfortable using the service and make them treat the cars with more care.

3.4. The UX in shared cars should be designed to clarify responsibilities between owners and users

Owners and users can have different opinions about the sharing service and the obligations attached. The responsibilities should be clarified between them to avoid misunderstandings and dissatisfaction, and make both owners and users more comfortable using the service.

3.5. The UX in shared cars should be designed to create empathy between owners and users

Owners and users of the sharing service often do not know each other, neither have they met. By creating empathy between owners and users the gap between them can be reduced. The owners and users would then understand each other better, the users would treat the cars more carefully while the owner would be more willing to share.

3.6. The UX in shared cars should be designed to enable communication channels

If unpredictable situations occur when using the sharing service it is important that the people concerned can be informed. It is also important that help can be provided as quickly as possible. By enabling communication channels between the owners, users and the customer service unpredictable situations can be handled smoothly.

5.2.2. Design Tool

The 15 described design guidelines for HMI and UX in shared cars are presented below in a design tool consisting of 15 guideline cards. The cards contain a stated guideline, an explanation of the guideline and lastly a trigger quote related to the guideline (See Image 5.6). The different colours of the cards correspond to the three levels of abstraction that the guidelines are categorized in. The red cards represent guidelines in level 1, the green cards represent guidelines in level 2 and the blue cards represent guidelines in level 3 in an ascending abstraction level.

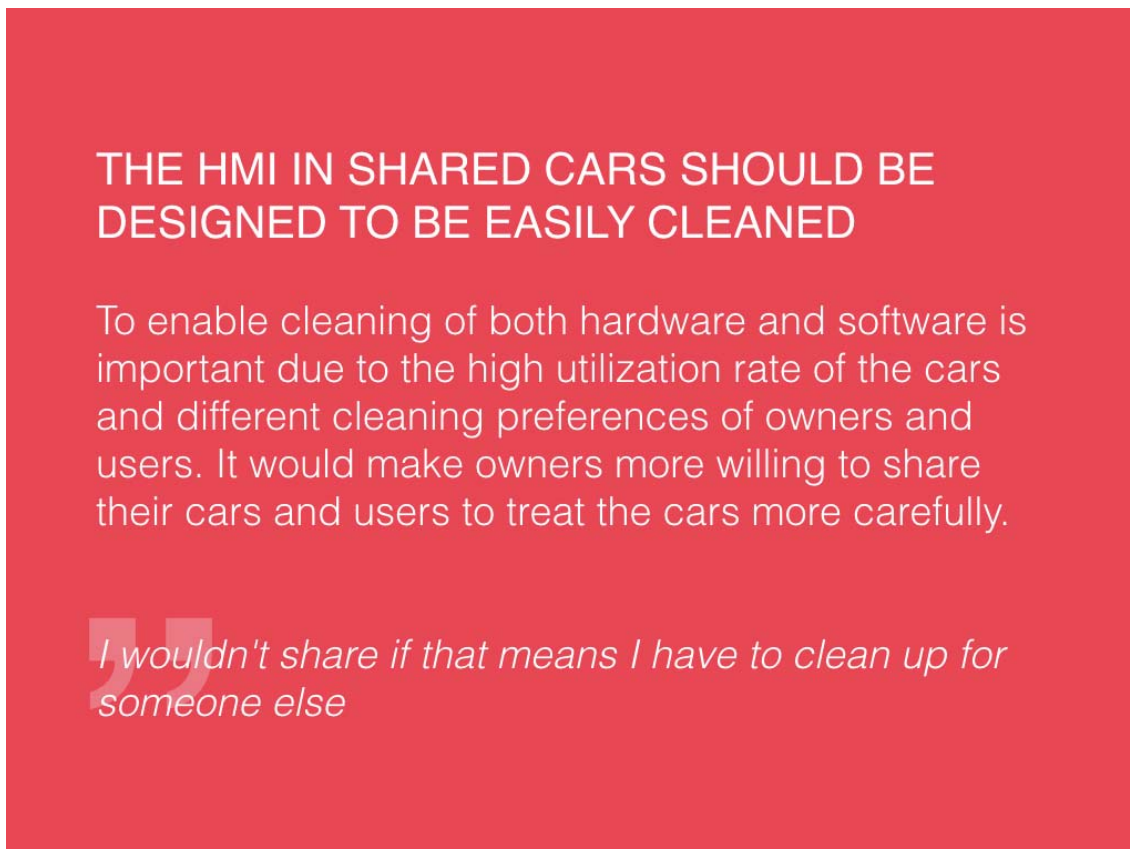


Image 5.6. Example of guideline card



THE UX IN SHARED CARS SHOULD BE DESIGNED TO BE EFFICIENT

The time required for using the sharing service has to be minimized in order to make owners and users feel that the service is worth using.

It isn't an alternative if it requires more time

THE UX IN SHARED CARS SHOULD BE DESIGNED TO BE EFFORTLESS

The effort required for using the sharing service has to be minimized in order to make owners and users feel that the service is worth using.

Is it worth the hassle?!

THE UX IN SHARED CARS SHOULD BE DESIGNED TO APPEAL A WIDE RANGE OF PEOPLE

To appeal a wide range of people is important to ensure that a large number of car owners and users are using the sharing service.

A sharing service is valuable first when it has a large number of users

THE UX IN SHARED CARS SHOULD BE DESIGNED TO FACILITATE FIRST TIME USERS

To facilitate for first time users is important to give a good first impression of the sharing service and to ensure a large number of future users.

If the service is too complicated to get started with, I loose interest immediately

THE UX IN SHARED CARS SHOULD BE DESIGNED TO ENABLE RECOGNITION

To enable recognition is important to make users comfortable using different cars each time when using the sharing service.

Due to the similarities in the design I can create my own routines

THE UX IN SHARED CARS SHOULD BE DESIGNED TO BE EASILY CUSTOMIZED

To enable customization is important to meet owners and users with different ergonomic needs and preferences. To enable it in an easy way is important to make owners and users feel the service is worth using.

I still have to be able to set personal settings, and that in an easy way!

THE UX IN SHARED CARS SHOULD BE DESIGNED TO ENCOURAGE CAR OWNERS TO SHARE

To encourage car owners to share is important since sharing your car with others can be regarded as unusual and strange.

I see the point of sharing, it just feels strange!

THE UX IN SHARED CARS SHOULD BE DESIGNED TO MAKE OWNERS FEEL IN CONTROL

To make owners feel in control would make them more willing to share their cars with others.

There is a fear of getting tricked!

THE UX IN SHARED CARS SHOULD BE DESIGNED TO MAKE USERS PERCEIVE A SENSE OF OWNERSHIP

To make users feel a perceived sense of ownership would make them feel more comfortable using someone else's car and make them treat the car more carefully.

It's clear that I treat things I own more carefully than things I have no personal connection to

THE UX IN SHARED CARS SHOULD BE DESIGNED TO CLARIFY RESPONSIBILITIES BETWEEN OWNERS AND USERS

To clarify the responsibilities between owners and users would make them more comfortable using the sharing service and make users treat the cars more carefully.

If the responsibilities are prearranged in advance I would feel more confident using a sharing service

THE UX IN SHARED CARS SHOULD BE DESIGNED TO CREATE EMPATHY BETWEEN OWNERS AND USERS

To create empathy between owners and users would make them understand each other better and make users treat the cars more carefully.

Since I meet her and she showed that she trusted me, I made sure I returned the product in the same state as I got it

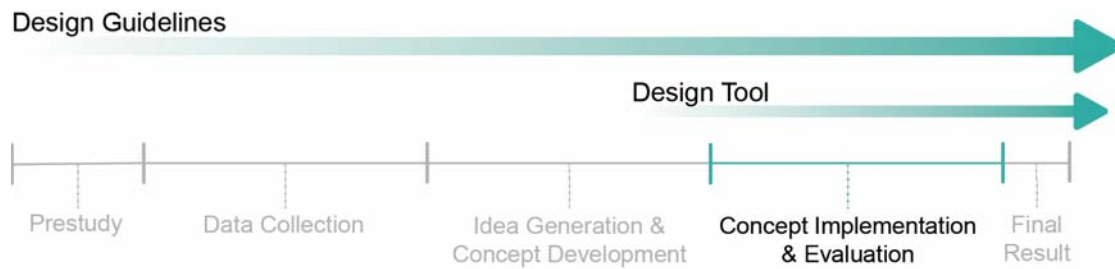
THE UX IN SHARED CARS SHOULD BE DESIGNED TO ENABLE COMMUNICATION CHANNELS

To enable communication channels between owners, users and the customer service would make owners and users more comfortable using the sharing service in case of unpredictable situations.

Since there was a shortcut to contact the customer service the problem could be solved without bothering anyone else

6. Concept Implementation and Evaluation

This phase of the project implemented and evaluated the design guidelines for HMI and UX in shared cars and the design tool developed in the previous phase. The guidelines and the tool were implemented and evaluated by three workshops with the Scrum Teams at the UX department of CEVT. The evaluation focussed on both the content of the guidelines and the format of the design tool. The result of the implementation and evaluation of the guidelines and cards is presented in this chapter.



6.1. Method and Implementation

Three workshops were performed to implement and evaluate the design guidelines for HMI and UX in shared cars and the design tool consisting of 15 guideline cards. One workshop was performed with each Scrum Team. The reasons for having separate workshops with each team were several. The teams usually work independently and are in different stages of the design process, which make them approach and consider Design for Sharing differently. To have separate workshops was also beneficial due to the size of the teams. Further, it gave the opportunity to compare the outcomes of the different workshops.

The three workshops were set to be one and a half hour and started with a short introduction to sharing. The aim of the introduction was to establish a minimum knowledge of sharing among the participants. For example, the sharing scenarios of how cars could be shared and aspects to consider when creating a good sharing experience were presented. The design guidelines and the design tool were then introduced and the layout of the guideline cards explained. The colour coding of the cards was not explained to the participants.

After the introduction a 30 minutes brainstorming session was performed followed by 30 minutes of presentation and discussion. The brainstorming session started with the participants being divided into two groups and the 15 guideline cards were split between the groups. The intention to divide the team members and split the guideline cards was to make the brainstorming session less comprehensive and shorter.

The groups were advised to use the cards for support and inspiration when brainstorming but were told to work as they prefer. By not restricting the participants it was possible to observe how the groups chose to work with the cards. Colour pens, Post-it and A3 sheets were available during the brainstorming session.

After 30 minutes of brainstorming the groups were instructed to present the outcome of the brainstorming to all workshop participants (see Image 6.1). To make sure all participants have heard of each guideline and to create a discussion around the sharing ideas.



Image 6.1. Presentation of sharing ideas



Image 6.2. Ranking of the cards

Lastly, to evaluate the content of the guidelines and the format of design tool the workshop participants were instructed to do two evaluation activities. First the content of the guidelines was evaluated by letting the participants rank the guideline cards (see Image 6.2). They were told to rank the cards based on how interesting they were to work with. Interesting was explained as how novel, inspiring or relevant the guidelines were experienced. The discussion within the teams during the ranking activity was recorded in order to collect complementing comments regarding the content of the guidelines.

The second evaluation activity was to individually fill in a questionnaire. The questionnaire consisted of two questions (Appendix VIII) aimed at evaluating the format of the design tool. The participants were asked to estimate to which extend the cards supported the participants to think and act. They were also asked if and when the ideas generated with the help of the cards during the brainstorming session could or would be implemented.

The results from the workshops were analysed in several ways. How the teams chose to work with the cards, the outcome of the brainstorming sessions and the card ranking were analysed by comparing the results between the different

workshops. Additionally, the result from the questionnaires was compiled and visualized in charts.

6.2. Result

6.2.1. *Description of Workshops*

The three workshops were appreciated and the Scrum Teams generated a lot of ideas during the brainstorming sessions working with the cards. Similar ideas were generated in the three brainstorming sessions even if the teams had slightly different approaches. During the presentation and the first evaluation activity of card ranking similar discussions occurred regarding the content and how to interpret the guidelines.

The first workshop was held with a team that is in an early stage of the design process. The team members listened concentrated to the introduction but did not pose any questions. The brainstorming session was carried out in a methodical way and a number of sharing ideas were generated. The ideas generated did not only concern the HMI and UX in shared cars but also the design of the sharing model. During the presentation of the their ideas the team members shared their own experiences of sharing services.

The second workshop was held with a team that is in a very early stage of the design process. Currently the team works with research and have sharing as one of their research area. The team members were active during the introduction and asked a lot of questions regarding the content of the introduction. The team was eager to start the brainstorming session and to start working with the cards. A lot of sharing ideas were generated during the brainstorming session. The ideas did not only concern the HMI and UX in shared cars but also the design of the sharing model. When presenting the their ideas additional thoughts about each design guideline were added.

The third workshop was held with a team that is in a late stage of the design process. The team works with the Lynk & Co 01 that will be on the market in September 2017. The team members questioned a lot during the introduction. Used research methods and the content of the introduction were questioned. It became clear that several of the team members were not familiar with the subject of sharing or neither had any personal experiences of sharing services. Still, the team generated several sharing ideas and almost exclusively ideas that concerned the HMI and UX in the car.

6.2.2. *Brainstorming Methods Used*

The three teams chose different methods working with the guideline cards during the brainstorming sessions. One of the teams worked with all cards simultaneously and wrote down ideas randomly on a A3 sheets. Another team chose to work with

each card for three minutes, write ideas on Post-it and place the Post-it on separate A3 sheets (see Image 6.3). Yet another team chose to place the cards on a whiteboard, write ideas on Post-it, place the Post-it underneath the cards and then try to connect the ideas with several cards (see Image 6.3). The most common method used was to write ideas on Post-it that were directly put onto a corresponding card. Notably, all sharing ideas generated were written down and not drawn.

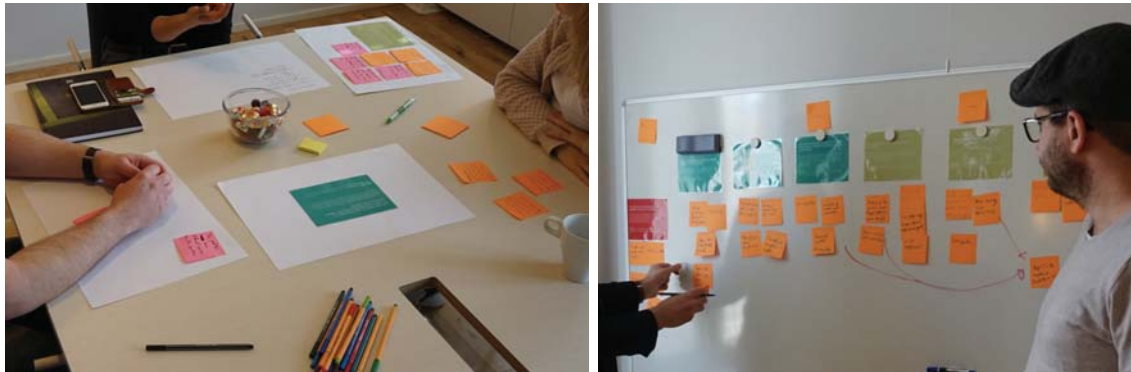


Image 6.3. Different methods working with the cards

6.2.3. Ranking of the Guideline Cards

The three teams ranked the guideline cards differently. The team in the first workshop ranked the green cards highest, followed by the blue and red cards (see Image 6.4). The green cards with guidelines concerning the car, owner and user were seen as the most interesting due to the team's present focus on the interaction between the car and the driver. One of the participants stated "Car sharing comes second to us ... we're building an effortless and efficient platform first". The ranking of the blue cards with guidelines concerning the owner and user showed that the team prioritized the relationship between the owner and user in second place. The red cards with guidelines concerning the car were ranked low since the team experienced that they do not have any say in the physical design of the car. One of the participants stated "We don't get a say in these red things ... we can only recommend things".

The team in the second workshop ranked on average the blue cards higher than the green cards (see Image 6.4). The red cards were sorted out and placed next to the blue and green cards. The team choose a different approach when ranking the cards and ranked the cards based on how relevant the guidelines were for sharing. The team members tagged three cards each with Post-it and the cards were ranked by how many votes they received. The importance of creating a trustful relationship between owners and users when sharing made the team rank the blue cards highest. The green cards were ranked in second place since these guidelines were perceived as self-evident. One of the participants stated "It's not interesting right now to discuss, I would say, because it's kind of like the cars also needs

wheels so we're more like interesting in the actual features of sharing". The red cards were considered to be fundamental and did not elicit any votes.

The team in the third workshop ranked the cards in three levels (see Image 6.4). The three levels included cards of all colours. When ranking the cards the team struggled with not having one specific sharing model to refer to. According to the team the guidelines had different importance depending on the sharing model. One participant stated "So if it's only sharing it's one thing, if you have a sharing option of a private vehicle it's another thing". The team also struggled with which point of view they would take when ranking the cards, the owners' point of view or the users'. One participant stated "It's fun to hear your point of view because I would be a renter and you would be a lender so I care about things you don't". Still, the team agreed that if the responsibilities between owners and users are clarified a lot of other things would be solved. One participant stated, "It is connected to so many other things".



*Image 6.4.
Ranked cards in
workshop 1*



*Image 6.5. Ranked
cards in workshop 2*



Image 6.6. Ranked cards in workshop 3

6.2.5. Result of the Questionnaires

A summary of the questionnaire results is presented below. The graph in Figure 6.1 shows the result of asking if the guideline cards were supportive and made the participants think and act during the brainstorming session. The mean score was 4.5 and the median value 4, which shows that the participants think the the cards were supportive as a design tool. When motivating their answers two participants stated "They provide very good guide to think in a more structured way" and "Short and to the point!".

The graph in Figure 6.2 shows the result of asking the participants if they think the ideas generated during the brainstorming sessions will be implemented or not. The participants were allowed to select multiple response options. The result shows that the participants think the generated ideas are valuable and some of them will be implemented in the future.

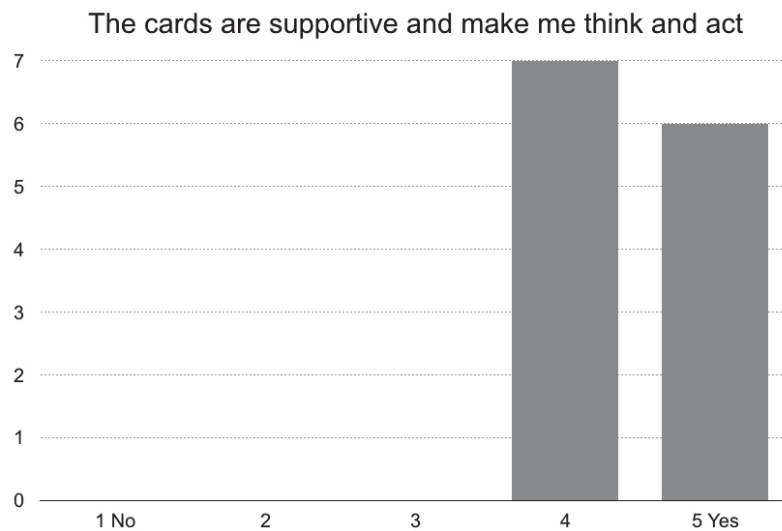


Figure 6.1

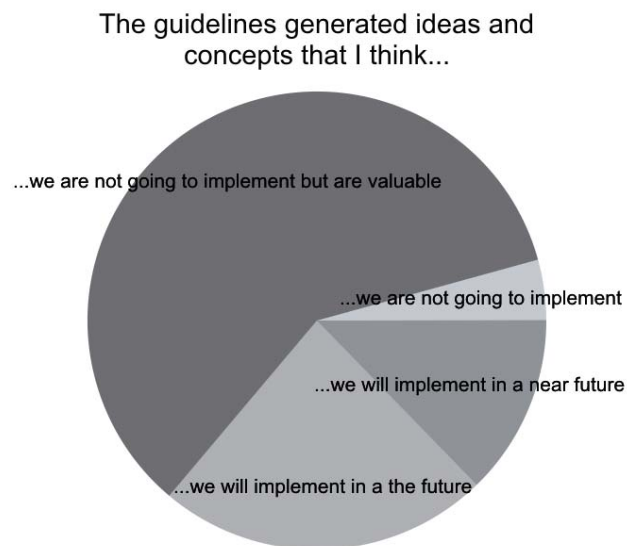


Figure 6.2

6.2.6. Content of the Design Guidelines

Several conclusions regarding the content of the design guidelines can be drawn from the workshops. One conclusion is that the guidelines require previous knowledge and experience of sharing and sharing services. Two other conclusions are that the guidelines are best used in the beginning of the design process and that the guidelines would be easier to use if a specific sharing model was stated.

If you have never thought about sharing or been in contact with sharing services the guidelines could be difficult to understand correctly. The fact that the guidelines are in different levels and some of the guidelines are closely connected to each other also contributes to the difficulties interpreting them. It is therefore preferable to have some knowledge and experience of sharing and sharing services

before starting to work with the guidelines. If that is the case, the guidelines still require the user to engage with them due to the high level of abstraction of the guidelines.

Due to the high abstraction level of the guidelines they are better used in the beginning of the design process. In the beginning of the design process the teams work broadly doing research in different research areas. The guidelines could then be used in a research area concerning sharing when thoughts and initial ideas of sharing are to be discussed. If specific sharing ideas for implementation should be generated with the help of the guidelines a specific sharing model should be stated. By stating the sharing model the importance of the different guidelines could be more easily determined.

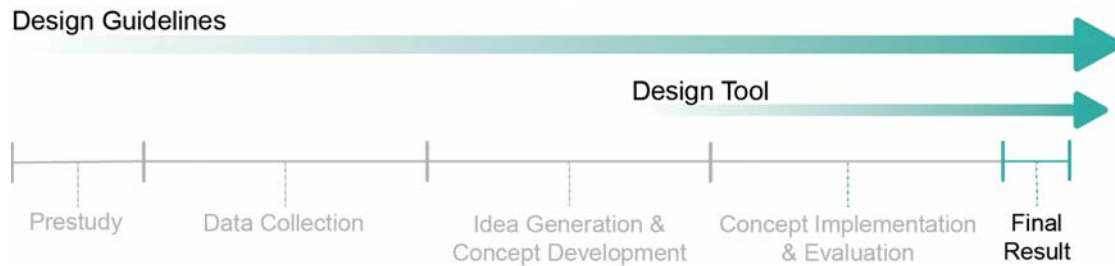
6.2.7. Format of the Design tool

Several conclusions regarding the format of design tool can be drawn from the workshops. For example the guideline cards can be used in several different ways when brainstorming. Further, the cards are preferably and efficiently used within a group and in combination with Post-it.

Another conclusion is that the colour coding of the cards may be limiting but also facilitates the use of the cards. The colour coding can encourage the user of the design tool to sort the cards before starting to work and reflect on their content. If the colour coding is not explained in advance the coding could confuse the user and force the user to approach the cards in an unnatural way. On the other hand, if the colour coding is explained in advance it could facilitate for the user to get started and to approach the cards in a good way.

7. Final Result

In this phase of the project the design tool consisting of 15 guideline cards for HMI and UX in shared cars were refined based on the result from the previous workshops with the Scrum Teams. The final concept of the design tool was presented at the UX department and a set of cards was left to be used in future work. The final concept and how it was presented at the UX department of CEVT is presented in this chapter.



7.1. Method and Implementation

The result from the three previous workshops and improvement proposals for the design tool were discussed and brainstormed within the project group. Finally, the formulations of the design guidelines on the cards were shortened and the font of the individual parts of the guideline formulations was bolded to facilitate the understanding of the guidelines.

Two additional cards were then created. First, a complementing opening card was created to make the guideline cards more independent. There were two things that confused the participants during the workshops. The opening card clarifies the colour coding of the guideline cards and defines “owners” and “users” in the design guideline explanations. Further, information of how the guideline cards can be used was added to the opening card to highlight successful ways of how the design tool could be used. Second, a complementing closing card was created to communicate who have developed the guidelines and the design tool. Contact details were added to enable future users of the design tool to get in touch with the creators if questions would arise.

To finish the project a presentation was held at the UX department of CEVT. At the presentation the main conclusions from the previous workshops were presented. A design tool was handed over and put up on the wall (see Image 7.1) to inspire and facilitate the use of the design tool. Finally, environmental and ethical aspects of carsharing were discussed together with the employees at the UX department.

7.2. Result

7.2.1. Design tool

The final concept is a design tool consisting of 15 guideline cards for HMI and UX in shared cars accompanied by two additional cards (see Image 7.2). The opening

card clarifies the colour coding of the cards, defines owner and users and communicates how the cards can be used (see Image 7.3). The closing card communicates who have created the cards and how to get in touch with the creators (see Image 6.4). The guideline cards contain a stated guideline, an explanation of that guideline and lastly a trigger quote related to the guideline (see Image 7.5). More specifications of the guidelines can be found in Appendix IX.



Image 7.1. The design tool on the wall



Image 7.2. The design tool

Hi, this is a set of cards to use when generating ideas for HMI and UX in shared cars!

The guideline cards are color coded according to their level of abstraction in ascending order **red**, **green** and **blue**.

The owner shares a car

The user takes part of other's cars

Use the cards in combination with Post-it and generate ideas by working with one card or by combining several cards. Take help of the guideline explanations and get triggered by the quotes!

Have fun!

Image 7.3. The opening card

This set of cards was developed by Fina Kuikka and Louisa Swenne doing their master thesis at CEVT in the spring of 2017.

To contact them send an email to finakuikka@gmail.com or louisaswenne@hotmail.com!

Image 7.4. The closing card

THE HMI IN SHARED CARS SHOULD BE EASILY CLEANED

To enable cleaning of both hardware and software is important due to the high utilization rate of the cars and different cleaning preferences of owners and users. It would make owners more willing to share their cars and users to treat the cars more carefully.

I wouldn't share if that means I have to clean up for someone else

Image 7.5. Example of guideline card

THE HMI IN SHARED CARS SHOULD WITHSTAND HIGH WEAR

To withstand a high wear is important due to the high utilization rate of the cars. It would make owners more willing to share their cars and users more comfortable using someone else's car.

The increased wear of the product means I only could share products robust enough

THE HMI IN SHARED CARS SHOULD MINIMIZE THE RISK OF DAMAGE

To minimize the risk of damage is important due to the high utilization rate of the cars. It would make owners more willing to share their cars and users more comfortable using someone else's car.

I'm afraid of breaking someone else's things, so I wouldn't use things that get damaged easily

THE UX IN SHARED CARS SHOULD BE EFFICIENT

The time required for using the sharing service has to be minimized in order to make owners and users feel that the service is worth using.

It's not an option if it takes more time

THE UX IN SHARED CARS SHOULD BE EFFORTLESS

The effort required for using the sharing service has to be minimized in order to make owners and users feel that the service is worth using.

Is it worth the hassle?!

THE UX IN SHARED CARS SHOULD APPEAL A WIDE RANGE OF PEOPLE

To appeal a wide range of people is important to ensure that a large number of car owners and users are using the sharing service.

A sharing service is valuable first when it has a large number of users

THE UX IN SHARED CARS SHOULD FACILITATE FIRST TIME USERS

To facilitate for first time users is important to give a good first impression of the sharing service and to ensure a large number of future users.

If the service is too complicated to get started with, I loose interest immediately

THE UX IN SHARED CARS SHOULD ENABLE RECOGNITION

To enable recognition is important to make users comfortable using different cars each time when using the sharing service.

Due to the similarities in the design I can create my own routines

THE UX IN SHARED CARS SHOULD BE EASY TO CUSTOMIZE

To enable customization is important to meet owners and users with different ergonomic needs and preferences. To enable it in an easy way is important to make owners and users feel the service is worth using.

I still have to be able to set personal settings, and that in an easy way!

THE UX IN SHARED CARS SHOULD ENCOURAGE CAR OWNERS TO SHARE

To encourage car owners to share is important since sharing your car with others can be regarded as unusual and strange.

"I see the point of sharing, it just feels weird!"

THE UX IN SHARED CARS SHOULD MAKE OWNERS FEEL IN CONTROL

To make owners feel in control would make them more willing to share their cars with others.

"There is a fear of getting tricked!"

THE UX IN SHARED CARS SHOULD MAKE USERS PERCEIVE A SENSE OF OWNERSHIP

To make users perceive a sense of ownership would make them feel more comfortable using someone else's car and make them treat the car more carefully.

"I obviously treat my own things more carefully than things I have no personal connection to"

THE UX IN SHARED CARS SHOULD CLARIFY RESPONSIBILITIES BETWEEN OWNERS AND USERS

To clarify the responsibilities between owners and users would make them more comfortable using the sharing service and make users treat the cars more carefully.

"If the responsibilities are prearranged in advance I would feel more confident using a sharing service"

THE UX IN SHARED CARS SHOULD CREATE EMPATHY BETWEEN OWNERS AND USERS

To create empathy between owners and users would make them understand each other better and make users treat the cars more carefully.

"Since she showed that she trusted me, I made sure I returned the product in the same condition"

THE UX IN SHARED CARS SHOULD ENABLE COMMUNICATION CHANNELS

To enable communication channels between owners, users and the customer service would make owners and users more comfortable using the sharing service in case of unpredictable situations.

"Since there was a shortcut to contact the customer service the problem could be solved without bothering anyone else"

8. Discussion

The discussion considers the execution and outcome of the project as well as the environmental and ethical aspects of carsharing. In the end of the discussion possible future work is described and motivated.

8.1 Method, Implementation and Result

In the survey and interviews of the data collection the respondents were only Swedes. The attitudes towards sharing and sharing services probably differ between different cultures. To make the final concept more applicable to the Chinese target group of Lynk & Co additionally interviews could have been held with people in China. Additionally, the survey could have been translated, adapted and spread outside Sweden. However, it could have been challenging to collect comparable data since sharing services are not as common in China as in Sweden.

No changes were done of the concept between the workshops with the Scrum Teams at the UX department of CEVT. Since the teams were not in the same stage of the design process the choice was made to not change the concept between the workshops. Instead, the aim was to evaluate how the different teams used the design guidelines and design tool depending on where in design process they were. The consequence was that the content of the guidelines and the format of the cards were revised only once. If changes in the concept had been done between the three workshops the concept could have been revised three times. On the other hand, conclusions drawn regarding the effect of being in an early or late stage of the design process when using the design guidelines and the design tool would not be as reliable.

The design guidelines have a high level of abstraction. The guidelines were made abstract to be inspiring to work with and to fit to all possible future sharing models of the Lynk & Co cars. However, the level of abstraction made it difficult for the workshop participants to interpret the guidelines fully and use them correctly. It could therefore be beneficial to divide the guidelines into more HMI and UX specific sub guidelines and formulate them as requirements. To make requirements out of the guidelines has not been done since it requires solid knowledge about HMI and UX in cars. To make requirements for HMI and UX is also challenging due to new technologies and trends that will affect the design of future car HMI and UX. Guidelines with a high level of abstraction may therefore be more persistent than specific requirements.

To evaluate something as abstract as design guidelines is difficult. The content of the guidelines was evaluated in the three workshops with the Scrum Teams at the UX department. The teams were asked to rank the guidelines based on how interesting they experienced the guidelines. Additionally, the workshop participants were asked if the ideas generated in the brainstorming session could

or would be implemented. To evaluate the design guidelines actual success the guidelines would need to be used in the real design process and generate solutions tested by real users. The evaluation could then be based on the user experiences of the product rather than on the subjective thoughts of the designers. Since cars are complex products it is not possible to evaluate the guideline outcomes with real users within the framework of this project. If it would have been possible it should have been interesting to see if some of the negative aspects of sharing that the guidelines are partly based on could have been avoided.

The content of the 15 design guidelines was evaluated but never revised. The guidelines were intentionally created to cover all possible future sharing models of the Lynk & Co cars and aspects of sharing that occurred in the data collection. In the workshops with the Scrum Teams at the UX department, the participants ranked the guidelines differently, which showed that all guidelines are relevant. Still, there could be aspects found in the data collection and additionally aspects that are not covered by the guidelines. Guidelines could be added but still the number and the diversity have to be considered. The number of guidelines has to be manageable in order to make the guidelines easy to work with. The diversity of the guidelines has to be clear in order to distinguish the guidelines from each other.

8.2 Future Work

There are several ways to improve the design guidelines and the guideline cards in the future. Firstly, the content of the design guidelines could be complemented to become more applicable in different cultures. Interviews could be held with people overseas and persons within the Chinese target group of Lynk & Co to identify their attitudes towards sharing and sharing services. The results of the interviews could then be compared with the attitudes towards sharing and sharing services that have been identified in this project.

Further, it would be preferable to adapt the guidelines to a specific sharing model when the sharing model of Lynk & Co is set to make the guidelines more relevant and understandable for the employees at the UX department of CEVT. The complemented guidelines, which are adapted to the sharing model of Lynk & Co should then be evaluated. The evaluation would preferably be done by the users of a Lynk & Co car designed with the help of the guidelines.

The guidelines could be adapted to be used throughout the design process. By dividing the guidelines into more HMI and UX specific sub guidelines formulated as requirements the guidelines could be used not only for idea generation but also for evaluation. Formulating the requirements could preferably be done by the Attribute Leaders at the UX department because of their expertise in HMI and UX. Another advantage of them formulating the requirements is their authority to

integrate the requirements with already existing HMI and UX requirements at the UX department.

8.3 Environmental and Ethical Reflection

There are both advantages and disadvantages with carsharing. In literature and media the environmental and social advantages of carsharing are often discussed. No literature and media discuss the disadvantages of carsharing. One frequently mentioned social advantage with carsharing is that carsharing provides cars to people that cannot afford to own a car and to people who would not have chosen to go by car in the first place. Carsharing is said to improve human welfare but no attention is paid to the negative environmental effects that could occur when the use of cars increases. The environmental and social advantages and disadvantages of carsharing have to be identified and weighed against each other. There have to be an ongoing discussion of the advantages and disadvantages of carsharing when developing shared cars and their HMI and UX.

One potential disadvantage of carsharing is that carsharing does not include everyone. The original concept of sharing includes everyone still carsharing is not accessible for all groups in the society. People without driver licenses and people with cognitive and physical disabilities are excluded from carsharing since the service requires a driving license and most of the cars used in existing carsharing services are regular passenger cars, which are not adapted for all needs. An additional group of people that could be excluded from carsharing are those with small children if the cars do not have child seats. A question to ask is - how does it feel to be excluded from something that by its name seems to include everyone? When working with the design of shared cars it is therefore important to consider a wide range of users. Integration of carsharing in the public transport system may be questioned due to its exclusion of several groups in the society.

9. Conclusion

15 design guidelines for HMI and UX in shared cars have been developed to be used as a design tool in the design process. The development of the guidelines were based on people's attitudes and needs regarding the subject of sharing. They are also inspired of sharing related car features that exist on the market today and possible future car features. The guidelines are abstract enough to be applicable on cars in the carsharing models identified and described in six sharing scenarios.

The UX department of CEVT is using a process framework called Scrum and have three Scrum Teams. Every team consists of approximately eight people, working with different car models and are therefore in different stages of the design process. A design tool of 15 guideline cards and two additional cards have been designed to integrate the design guidelines in the work of the teams. The front card clarify the design of the cards and communicate how the design tool can be used to make the set of cards persistent at the UX department.

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Appendices

I. Survey

Hej!

Att dela ägodelar blir mer och mer populärt och under de senaste åren har olika typer av tjänster som underlättar för detta så som Airbnb och Toolpool växt fram.

Vi, Louisa Swenne och Fina Kuikka, läser Teknisk Design på Chalmers och gör exjobb kring delningstjänster. Genom att få en ökad förståelse av användarnas upplevelser är vårt mål är att ta fram riktlinjer för hur man i framtiden ska designa delningstjänster samt produkter som ska delas med andra.

Enjoy!

Kön

- Kvinna
- Man
- Övrigt

Ålder

- <24 år
- 24-34 år
- 35-44 år
- 44 år <

Delningstjänster

1. Vilka av de nedanstående tjänsterna har du använt dig av? Om ingen, gå vidare till fråga 5.

- Car2Go/Sunfleet
- GoMore
- Citybikes/Styr & Ställ
- Airbnb
- Lånegarderoben/Klädoteket
- Fritidsbanken
- Toolpool
- Ingen av de ovanstående tjänsterna

2a. Använde du dig av tjänsterna för att...

- ...dela dina ägodelar
- ...ta del av andras ägodelar

2b. Om du använde dig av tjänsterna för att ta del av andras ägodelar, vilken var den främsta anledningen? För att det var det alternativ som var...

- ...billigast

- ...mest miljövänligt
- ...tillgängligt
- ...smidigast
- Övrigt

3. Vad är din allmänna upplevelse av tjänsterna?

1	2	3	4	5
Dålig				Superbra

4a. Vad upplevde du som positivt med tjänsterna UNDER ANVÄNDNINGEN?

4b. Vad upplevde du som negativt med tjänsterna UNDER ANVÄNDNINGEN?

5. Om du ägde en bostad, bil eller verktyg skulle du kunna tänka dig att genom AirBnb, GoMore eller Toolpool dela dem med andra?

- Ja, min bil via GoMore
- Ja, min lägenhet via AirBnb
- Ja, mina verktyg via Toolpool
- Nej

6a. Vilka andra ägodelar skulle du kunna tänka dig att dela med andra?

- Skrivare
- Strykjärn
- Matberedare
- Symaskin
- Stavmixer
- Cykel
- Regnjacka
- Övrigt

6b. Motivera gärna!

7a. Vad motiverar/skulle motivera dig till ATT DELA dina ägodelar?

- Möjligheten till att tjäna pengar
- Den ökade användningsgraden
- De sociala mötet
- Det minskade dåliga samvetet
- Det alternativa förvaringssättet
- Övrigt

7b. Vad motiverar dig till ATT INTE DELA dina ägodelar?

- Det ökade slitaget
- Det praktiska åtagandet
- Den minskade tillgången
- Övrigt

8a. Vilka skulle du kunna tänka dig att dela dina ägodelar med?

- Familj
- Vänner

- Facebookvänner
- Vem som helst
- Övrigt

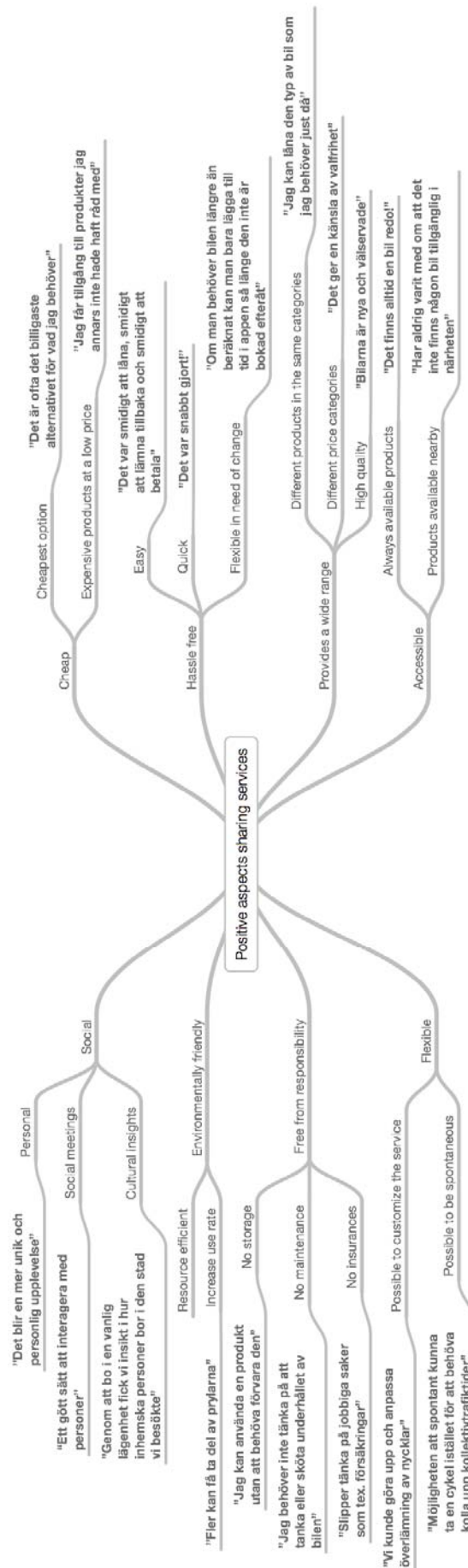
8b. Motivera gärna!

Tack!

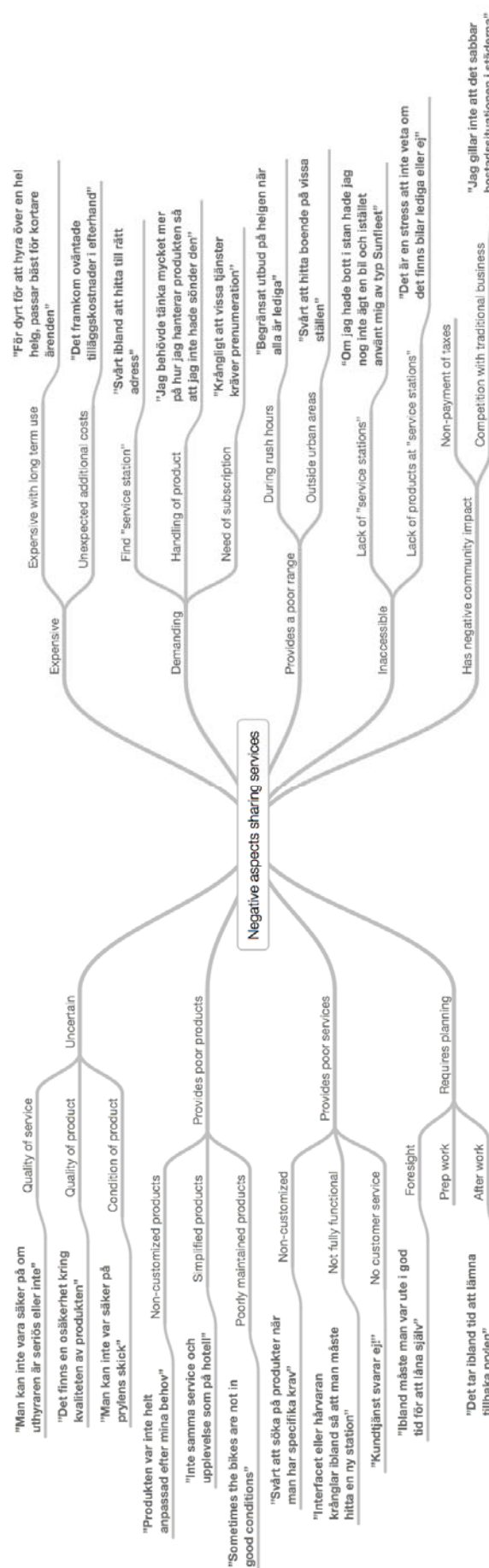
Om du kan tänka dig att svara på ytterligare frågor rörande delat ägandeskap lämna gärna din mejladress nedan så kontaktar vi dig.

Om du är intresserad av att veta mer om vårt arbete kan du kontakta oss på louisaswenne@hotmail.com eller finakuikka@gmail.com!

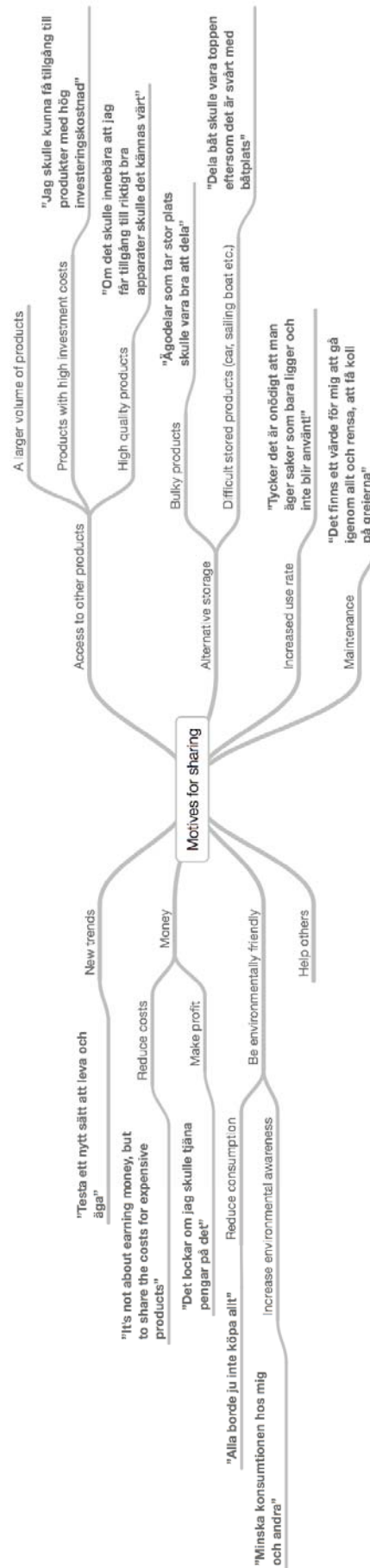
II. Positive aspects of sharing services



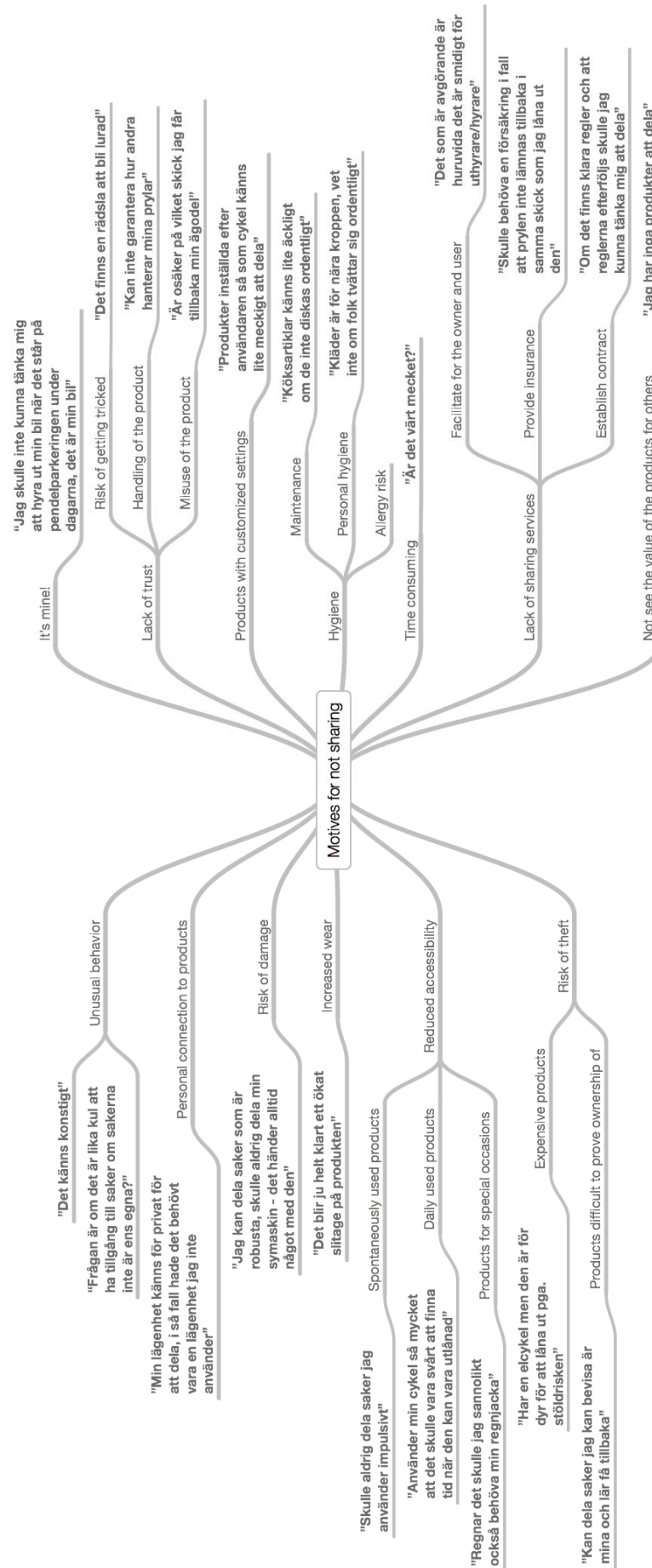
III. Negative aspects of sharing services



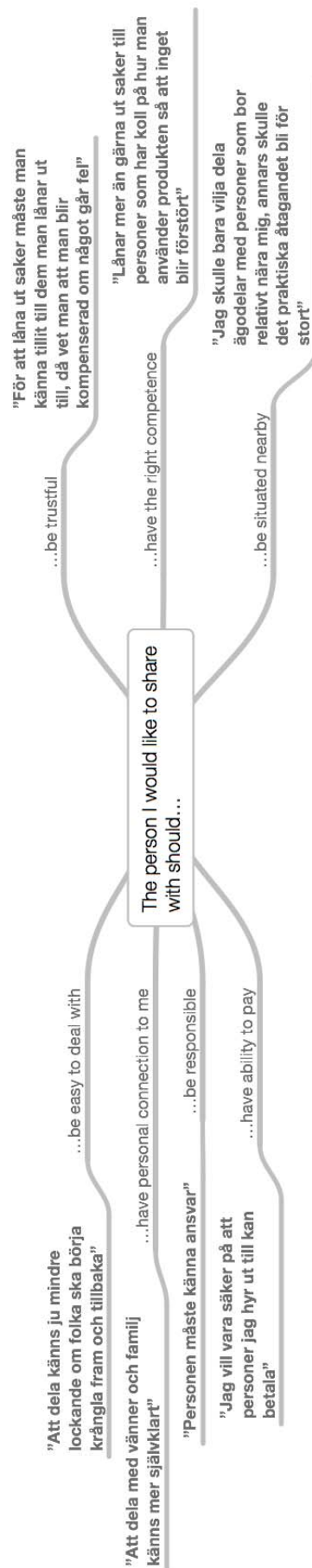
IV. Motives for sharing



V. Motives for not sharing



VI. The person I would like to share with should...



VII. Design guidelines for HMI and UX in shared cars 1

Categorization	Number	Guideline	Explanation	Trigger quote	Idea examples	Based on
Level 1 Car	1.1	The HMI should be designed to be easily cleaned	To enable cleaning of both hardware and software is important due to the high utilization rate of the cars and different cleaning preferences of owners and users. It would make owners more willing to share their cars and users to treat the cars more carefully.	I wouldn't share if that means I have to clean up for someone else	- Displays and controls with few details that do not gather dust and dirt - A HMI share mode that locks out the user from certain functions - Icon reminding the user to clean	- Survey - Interviews
	1.2	The HMI should be designed to withstand a high wear	To withstand a high wear is important due to the high utilization rate of the cars. It would make owners more willing to share their cars and users more comfortable using someone else's car.	The increased wear of the product means I only could share products robust enough	- Reinforced displays and controls, software as hardware	- Benchmarking Autolib - Workshop
	1.3	The HMI should be designed to minimize the risk of damage	To minimize the risk of damage is important due to the high utilization rate of the cars. It would make owners more willing to share their cars and users more comfortable using someone else's car.	I'm afraid of breaking someone else's things, so I wouldn't use things that get damaged that easily	- A small numbers of controls - Reinforced displays and controls, software as hardware - A HMI share mode that locks out the user from certain functions	- Benchmarking Autolib
Level 2 Car, owner and user	2.1	The UX should be designed to be efficient	The time required for using the sharing service has to be minimized in order to make owners and users feel that the service is worth using.	It isn't an alternative if it requires more time	- Highlight frequently used functions - A simplified HMI share mode that only contains the most necessary functions - Proactive design	- Survey - Interviews
	2.2	The UX should be designed to be effortless	The effort required for using the sharing service has to be minimized in order to make owners and users feel that the service is worth using.	Is it worth the hassle?!	- A simplified HMI share mode that only contains the most necessary functions - Gamification to make it fun en worth the effort - Reminder on sms or/and direct synchronization with calendar	- Survey - Interviews
	2.3	The UX should be designed to appeal a wide range of people	To appeal a wide range of people is important to ensure that a large number of car owners and users are using the sharing service.	A sharing service is valuable first when it has a large number of users	- Simple and stylistic design - Use of universal icons - Designed for diversified physical and cognitive abilities	- Benchmarking Autolib
Level 3 Owner and user	2.4	The UX should be designed to facilitate first time users	To facilitate for first time users is important to give a good first impression of the sharing service and to ensure a large number of future users.	If the service is too complicated to get started with, I loose interest immediately	- Animated HMI intro - A simplified HMI share mode that only contains the most necessary functions	- Workshop with Chairmers students
	2.5	The UX should be designed to enable recognition	To enable recognition is important to make users comfortable using different cars each time using the sharing service.	Due to the similarities in the design I can create my own routines	- Similarities in the HMI of the different models - Use of universal icons	- Benchmarking Autolib
	2.6	The UX should be designed to easily be customized	To enable customization is important to meet owners and users with different ergonomic needs and preferences. To enable it in an easy way is important to make owners and users feel the service is worth using.	I still have to be able to set personal settings, and that in an easy way!	- Possibility to change screen layouts and font size - Remember customized settings as gps coordinates and playlists	- Survey - Interviews - Benchmarking Autolib - Benchmarking Tesla
Level 3 Owner and user	3.1	The UX should be designed to encourage car owners to share	To encourage car owners to share is important since sharing your car with others can be regarded as unusual and strange.	I see the point of sharing, it just feel strange!	- Display shared miles - Gamification	- Interviews
	3.2	The UX should be designed to make owners feel in control	To make owner's feel in control would make them more willing to share their cars with others.	There is a fear of getting tricked!	- A HMI share mode that locks out the user from certain functions - Geofencing	- Survey - Interviews
	3.3	The UX should be designed to make users perceive a sense of ownership	To make users perceive a sense of ownership would make them feel more comfortable using someone else's car and make them treat the car more carefully.	It's clear that I treat things I own more carefully than things I have no personal connection to	- Animated personal welcome and goodbye - Personal desktop background - Possibility move and categorize icons on your home screen	- Benchmarking Autolib - Interviews
	3.4	The UX should be designed to clarify responsibilities between owners and users	To clarify the responsibilities between owners and users would make them more comfortable using the sharing service and make users treat the cars more carefully.	If the responsibilities are prearranged in advanced I would feel more confident using a sharing service	- Easy accessed information - Tick list of what is needed to be done when entering and/or leaving the car - Digital damage log	- Benchmarking Autolib
	3.5	The UX should be designed to create empathy between owners and users	To create empathy between owners and users would make them understand each other better and make users treat the cars more carefully.	Since I meet her and she showed that she trusted me, I made sure I returned the product in the same state as I got it	- Short video greeting by the owner to the user	- Workshop with Chairmers students
	3.6	The UX should be designed to enable communication channels	To enable communication channels between owners, users and the customer service would make owners and users more comfortable using the sharing service in case of unpredictable situations.	Since there was a shortcut to contact the customer service the problem could be solved without bothering anyone else	- Call or chat feature in the HMI that do not require private contact details to establish contact	- Benchmarking Autolib - Interviews

VIII. Evaluation form

EVALUTAION

The cards are supportive and makes me think and act

1	2	3	4	5	6
No					Yes

Motivate:

The guidelines generated ideas and concepts that I think...

- ☐ ...we will implement in a near future
- ☐ ...we will implement in the future
- ☐ ...we are not going to implement but are valuable
- ☐ ...we are not going to implement

IX. Design guidelines for HMI and UX in shared cars 2

Categorization	Number	Guideline	Explanation	Trigger quote	Idea examples	Based on
Level 1 Car	1.1	The HMI should be easily cleaned	To enable cleaning of both hardware and software is important due to the high utilization rate of the cars and different cleaning preferences of owners and users. It would make owners more willing to share their cars and users to treat the cars more carefully.	I wouldn't share if that means I have to clean up for someone else	- Displays and controls with few details that do not gather dust and dirt - A HMI share mode that locks out the user from certain functions - Icon reminding the user to clean	- Survey - Interviews
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	1.3	The HMI should minimize the risk of damage	To minimize the risk of damage is important due to the high utilization rate of the cars. It would make owners more willing to share their cars and users more comfortable using someone else's car.	I'm afraid of breaking someone else's things, so I wouldn't use things that get damaged easily	- A small numbers of controls - Reinforced displays and controls, software as hardware - A HMI share mode that locks out the user from certain functions	- Benchmarking Autolib
Level 2 Car, owner and user	2.1	The UX should be efficient	The time required for using the sharing service has to be minimized in order to make owners and users feel that the service is worth using.	It's not an option if it takes more time	- Highlight frequently used functions - A simplified HMI share mode that only contains the most necessary functions - Proactive design	- Survey - Interviews
	2.2	The UX should be effortless	The effort required for using the sharing service has to be minimized in order to make owners and users feel that the service is worth using.	Is it worth the hassle?!	- A simplified HMI share mode that only contains the most necessary functions - Gamification to make it fun on worth the effort - Reminder on sms or and direct synchronization with calendar	- Survey - Interviews
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Level 3 Owner and user	3.1	The UX should encourage car owners to share	To encourage car owners to share is important since sharing your car with others can be regarded as unusual and strange.	I see the point of sharing, it just feels weird!	- Display shared miles - Gamification	- Interviews
	3.2	The UX should make owners feel in control	To make owners feel in control would make them more willing to share their cars with others.	There is a fear of getting tricked!	- A HMI share mode that locks out the user from certain functions - Geofencing	- Survey - Interviews
	3.3	The UX should make users perceive a sense of ownership	To make users feel a perceived sense of ownership would make them feel more comfortable using someone else's car and make them treat the car more carefully.	I obviously treat my own things more carefully than things I have no personal connection to	- Animated personal welcome and goodbye - Personal desktop background - Possibility move and categorize icons on your home screen	- Benchmarking Autolib - Interviews
	3.4	The UX should clarify responsibilities between owners and users	To clarify the responsibilities between owners and users would make them more comfortable using the sharing service and make users treat the cars more carefully.	If the responsibilities are prearranged in advanced I would feel more confident using a sharing service	- Easy accessed information - Tick list of what is needed to be done when entering and/or leaving the car - Digital damage log	- Benchmarking Autolib
	3.5	The UX should create empathy between owners and users	To create empathy between owners and users would make them understand each other better and make users treat the cars more carefully.	Since she showed that she trusted me, I made sure I returned the product in the same condition	- Short video greeting by the owner to the user	- Workshop with Chalmers students
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