Behind the Wheel

Exploring the influence of cognitive ergonomics in peer-to-peer car-sharing interactions

Colophon

List of Definitions

01
The name of the car model of Lynk & Co.

AVN screen
The screen that contains features such as audio, video and navigation (AVN). Often located in the middle of the dashboard.

Borrower
Someone who borrows a car via a sharing platform.

Business-to-businuess (B2B)
Form of car sharing in which only members of a specific company can take part, such as pool cars.

Business-to-consumer car sharing (B2C)
Another form of car sharing is where the user can rent a car via the sharing platform hosted by a company. This company is also the owner of the to-be-borrowed car.

Car Culture
The car culture is a culture in which society is built around cars. It is combined with the politics of the car industry, the car infrastructure, the land use for cars and the neglect of public transport.

Car owner
A car owner is someone who subscribed to or bought the Lynk & Co 01.

Car-sharing
A service by which members get access to a fleet of vehicles and share the usage of this on a per-trip basis.

Cognitive ergonomics
Is about mental processes, such as perception, memory, reasoning, and motor response, as they affect interactions among humans and other elements of a system.

Consumer-to-Consumer (C2C)
This is the same form of car sharing as peer-to-peer car sharing.

Digital key
The digital key is a way to open, start and close cars. This type of key is available with some services on the phone.

DIM/Cluster/Drivers display
The driver's display is the interface in front of the driver that shows relevant information.

Free-floating
Free-floating is when cars can be parked in a certain area and do not have a specific parking spot. It also relates to 'service areas', which are small free-floating sections.

Haptics
Haptics falls under the field of kinaesthetic communication, which focuses on tactile contact as a form of communication.

Human Machine Interface (HMI)
The HMI are features and components of car hardware and software applications that allow drivers and passengers to engage with the vehicle, as well as the outside world.

Infotainment system
Is a collection of hardware and software in automobiles that provides audio or video entertainment.

Lender
Someone who owns a car and lends it to borrowers to use it.

Modality
Mode of transport, such as the train, tram, car, bike or bus.

One-way
With one-way the car can be returned somewhere different from the pickup location.

Peer providers
People who offer their private car for car-sharing.

Peer-to-peer car sharing (P2P)
In the peer-to-peer version of car-sharing, individuals offer their car for rental to other individuals, via an online platform, provided by an external party.

Sharing economy
An economy in which consumers grant each other temporary access to under-utilized physical assets, possibly for money.

Two-way
This indicates the type of sharing. Here the car must be returned to the same location as where it is picked up.

Executive Summary

This graduation project, conducted in collaboration with Lynk & Co, delves into the examination of their current car-sharing service. Lynk & Co, an automotive brand featuring the 01 model, provides a comprehensive sharing platform allowing owners to share their vehicles, even with strangers. However, concerns arise when sharing with strangers regarding the ability to trust the borrower and their driving behaviour. Consequently, owners often reject booking requests from unfamiliar individuals, resulting in a low acceptance rate.

A thorough literature review and a questionnaire revealed five primary motivations for owners' reluctance to engage in sharing: emotional attachment to the car, car availability, financial risks, trust in the user and system, and user behaviour. Furthermore, a journey map identified critical points in the car-sharing service, stimulating owners to offer their idle cars, providing a means to assess borrowers, and ensuring a sense of control during bookings. These insights collectively highlighted a predominant theme—the lack of control and trust in users.
However, amidst the identified challenges, an opportunity gap emerged: the car's interior, a shared space between lender and borrower, with the potential to influence users through cognitive ergonomics. The proposed concept, named Stimulus, capitalizes on this opportunity by utilizing Lynk & Co's distinctive car features and existing sensors to collect driving data. This data creates a profile of the borrower's driving behaviour, addressing owners' concerns about control during bookings.

The designed concept employs existing sensors to enhance the car-sharing experience by providing borrowers with real-time feedback on their driving style. This feedback is delivered through haptics in the steering wheel and visualizations on the car's infotainment screens. Prototyping, both physical and digital, demonstrated the efficacy of this feedback system. Testing with 41 participants affirmed that haptic feedback effectively notifies users, and visualizations encourage careful driving. Moreover, borrowers expressed willingness to share this driving data, recognizing its benefits.
The culmination of driving behaviour data is made into a trip score. In addition to in-car modifications, the mobile app is redesigned to emphasize borrower trust. Parts that are added are a different review system, detailed user profiles and a market for placing requests. In essence, Stimulus aims to empower lenders by enhancing their ability to assess potential borrowers themself and from the system, thereby increasing trust and control, ultimately leading to a higher acceptance rate.

Stimulus addresses the challenges in Lynk & Co's car-sharing service by leveraging cognitive ergonomics in the shared interior space, utilizing existing sensors for driving behaviour analysis and enhancing user trust through real-time feedback. The findings from the project present a holistic solution that contributes to more trust in and over borrowers, leading to a more beneficial car-sharing experience for the lender.

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Chapter 01

The Project

1.1   Project Context
1.2   Project Approach

This chapter introduces the project and shows how it is approached. It explains the method used and shows what type of research and design activities were performed during this project.

1.1 Project Context

Throughout Europe, the car is the most widely used means of transport. In the Netherlands, it even accounts for 62.2% of all trips (European Commission, 2022). Owning a car means it is always available, creating the freedom to go anywhere. It can be adapted to the user's needs and thus is a comfortable way of travelling. Besides the benefits of the car itself, the infrastructure is built with the car in mind, often making it the fastest travel option.

Intercity travel can be done without having to transfer between transport modalities during the journey. However, this fast way of travelling comes with a price. According to the European Commission (2023), public transport in the Netherlands is one of the most expensive for the user. Besides the price issue, there are other concerns: such as hygiene, delays, crowdedness and safety in the public transport.
Travelling from urban to rural areas with public transport is an even bigger hassle. There is not enough investment in the infrastructure of public transport, vehicle capacity is low and connections between different transport modes are inadequate (Jorritsma et al., 2023). Being completely dependent on public transport is therefore not always possible. By looking at this information, the demand for a car will stay high in the coming years. Whether this is how we know the car now remains to be seen.

The 'car' concept is already changing. It looks like the image and the usage of it are different compared to the past. In the past, the car was mostly seen as something to express yourself. However, it looks like people are now starting to see the car more as a means to get from A to B. Therefore, referring to a car is often done with 'mobility' and the car is not a stand-alone product anymore but part of a connected service.

Not only do users have a changing attitude towards cars, but governments also do. To improve the quality of life in cities and to combat climate change, they are getting rid of cars inside the city centres. By removing public parking spaces, moving cars towards garages and hubs outside the city, and introducing environmental zones, car-free streets and future neighbourhoods are built without places for cars to drive (Gemeente Rotterdam et al., 2017).
However, cities are increasingly committed to shared vehicles. They are creating 'Mobility Hubs', commonly seen as physical places that connect a variety of transport modes, such as cars, mopeds and bicycles (Arup & RISE, 2020). Instead of banning the car altogether, people are already looking at how the car still fits into the city and can be part of a connected service for the user. To make better use of the already existing cars.

This relatively new approach to sharing cars brings opportunities for organizations and people to share their cars, also for Lynk & Co.

1.1.1 Initial assignment

This project is done in collaboration with Lynk & Co, a relatively new company in Europe. The automotive brand was introduced in Europe in 2020 (Lynk & Co, 2023). It is not a regular car brand, but one that tries, and has proven to disrupt the conventional automotive industry. They offer their car, the model called the 01, in multiple ways. It can be bought, leased and acquired via a Netflix-like way: a monthly subscription. However, this is not the only thing that makes them unique, they also provide a sharing platform on which owners of a 01 can provide their private car to be shared with others, for a self-determined time and price. When the 01 is acquired via lease of monthly subscription it means that the owner must pay a monthly all-included price for the car and services, which comes with a limited amount of mileage. However, when sharing the car this does not add up to the mileage.

This idea of sharing vehicles came from the fact that cars are parked 96% of the time (Lynk & Co, 2022), so Lynk & Co's idea is to share these cars during the time the owner does not need them. This way, fewer people need to buy a new car, which reduces the use of resources and thus reduces the environmental impact. Anyone who has the Lynk & Co app on a mobile device can borrow the 01. Currently, in 2023, around 20% of all 01 owners in the Netherlands provide their car via this platform (Lynk & Co, 2023). This number is based on making the car available once and thus not on a regular basis.

Lynk & Co is going to shift its focus in the future. By not only actively promoting flexibility but also car-sharing. From a business point of view, this has two reasons. Through car sharing, the cars are more on the street which creates brand awareness and loyalty. In addition, for every sharing booking, there is a service fee that goes to Lynk & Co, which creates additional revenue.

Currently, the amount of people providing their car is too low, around 20% of all owners (Lynk & Co, 2023c). To make car-sharing in the near future a sustainable part of the business more people must provide their 01 on a regular base. Therefore, the project started with the following initial problem statement:

> " Not enough people provide their car on the sharing platform. "

Initial problem statement.

1.2 Project Approach

The project started via a 'User-Oriented' and 'Strategic Design' approach. A User-Oriented design approach is one that focuses on the user perspective to create valuable and usable products, interfaces, services or systems (Van Boeijen et al., 2020). This approach was chosen because the main focus lies on the needs and desires of the users of the car-sharing service and the users were involved in testing the designed product.
The Strategic Design approach is to bridge business and design to innovate within organizations (The Fountain Institute, 2023) and is used to make car sharing sustainable in the future.

To investigate the initial problem statement, this report uses the Double Diamond Method (British Design Council, 2005). This method consists of four phases: discover, define, develop and deliver. These phases are used as a guideline for this project. In which the problem is first explored in a divergent way, to gather as much information and insights as possible. After that, convergent thinking is used to define the direction in which will be designed. When the middle of the diamonds is reached, again divergent thinking is used to explore the possible solutions, which are then worked out, tested and detailed in a convergent way.

Discover phase
The first phase is the discover phase, in which the focus lies on discovering what aspects are related to car-sharing.

In Chapter 2: Theme, the domain of car-sharing is broadened to explore everything related to the initial problem. First, literature research was done by looking at already existing studies by Lynk & Co. These studies are supplemented with relevant literature about car-sharing in general, more specifically peer-to-peer car sharing, the motives from (potential) users to participate in car-sharing. Field research was then conducted, in the form of a questionnaire with people who travel, owners of the 01 and people who used car-sharing before. This was done as a starting point, to see what the main concerns are. Again, the results were supplemented with pre-existing literature after which a link could be made to ergonomics, in-car but also other points during travel.

Chapter 3: Context, a business and strategic view of the problem is shown. Lynk & Co itself and external factors affecting its car-sharing service are discussed. It consists of a business, market and stakeholder analysis. Next to that, benchmarking was done with other peer-to-peer (car) sharing services and products that exploit cognitive ergonomics.

In Chapter 4: Interaction, a deeper understanding of the current interaction for both borrower and lender is shown.

Define phase
In this phase, the insights of the previous phase are connected to draw conclusions and arrive at a more detailed problem statement, an opportunity space and a vision.

Chapter 5: Journey, shows a final journey map for the lender. In this map, the critical points within the journey are highlighted. Together with a persona, which represents the most common user of the Lynk & Co sharing service and will be used during the design process.

In Chapter 6: Design Brief, the new problem definition is stated. Next to this, a scope is created with the time and area in which will be designed. At last, a vision for this domain is created, which is used to start generating ideas.

Develop phase
This phase starts with ideation and ends with a chosen concept direction together with the parts that will be developed.

Chapter 7: Exploration, elaborates on the ideation phase and showcases which methods from the Delft Design Guide were used to actively generate ideas. The ideas were later developed into concept directions, these concepts were tested against the needs and requirements. Eventually, there is the chosen concept direction with reasons why this was chosen.

In Chapter 8: Conceptualising, the two different parts of the concept were worked out and explained. Prototyping, user testing and the related insights are shown.

Deliver phase
The deliver phase consists of two chapters, in which the final design is shown and explained.

Chapter 9: Showcase, highlights the final design. The complete service is shown, how different parts are related and how they interact with the user.

At last, there is Chapter 10: Conclusion. In this chapter, the whole project is reflected on. Next to that, there are recommendations towards the company and there is a personal and project reflection.
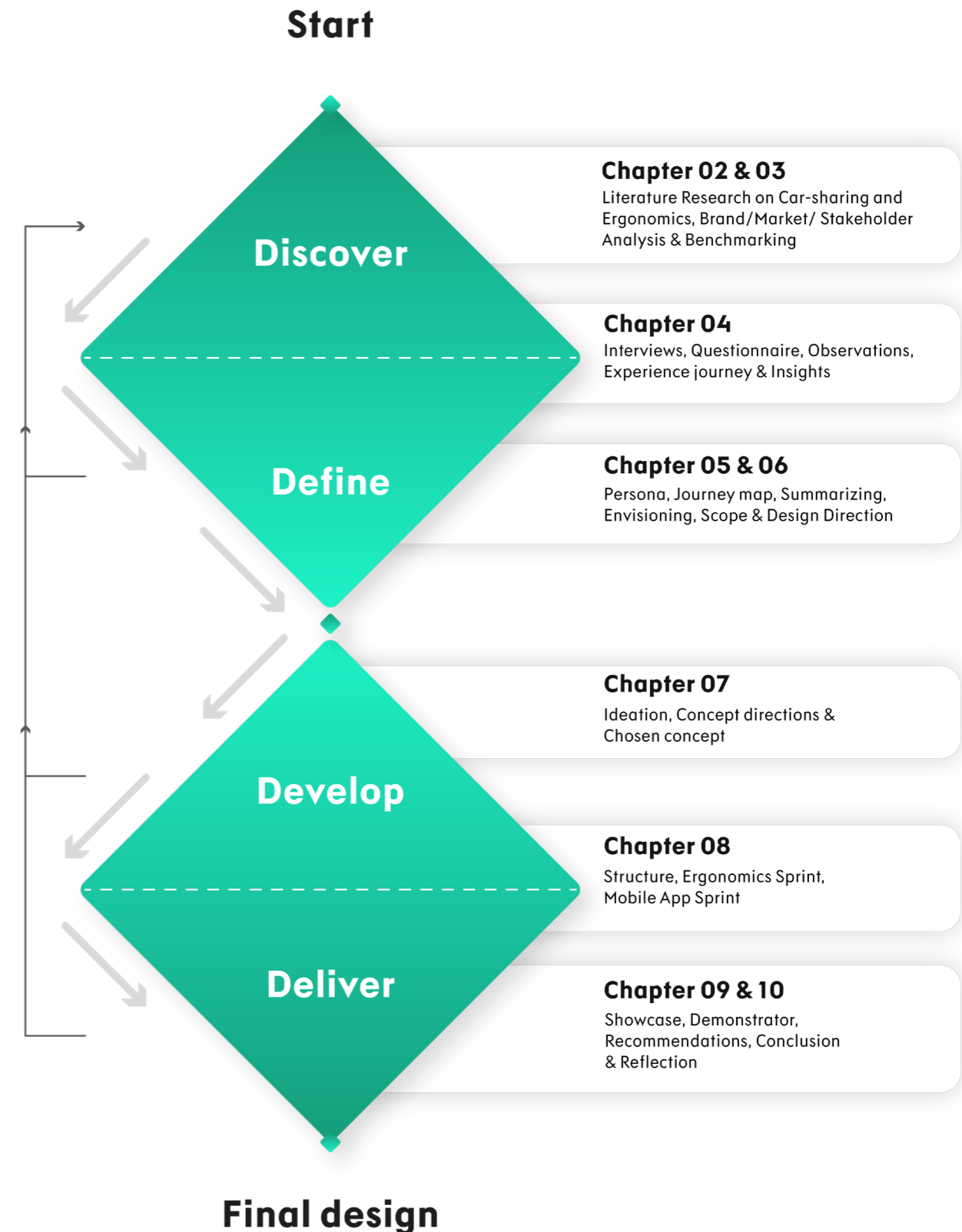
Start

Discover

Chapter 02 & 03
Literature Research on Car-sharing and Ergonomics, Brand/Market/ Stakeholder Analysis & Benchmarking

Chapter 04
Interviews, Questionnaire, Observations, Experience journey & Insights

Define

Chapter 05 & 06
Persona, Journey map, Summarizing, Envisioning, Scope & Design Direction

Chapter 07
Ideation, Concept directions & Chosen concept

Develop

Chapter 08
Structure, Ergonomics Sprint, Mobile App Sprint

Deliver

Chapter 09 & 10
Showcase, Demonstrator, Recommendations, Conclusion & Reflection

Final design

Figure 1: The double diamond method, supplemented with project activities.

Chapter 02
Theme

This chapter explores the theme and explains topics related to peer-to-peer car-sharing. First, the sharing economy is explained, and how it relates to car sharing. The different car-sharing types are shown and literature research is used to supplement the conducted questionnaire, explaining why people use or do not use car-sharing. At last, car-sharing is linked to ergonomics and the relevant domains are explained.

2.1 Sharing Services

The term sharing economy is used for a lot of products and services. In order to design a car-sharing service it is needed to know what a sharing economy is and more importantly how and why it differs from other closely related services.

2.1.1 What is the sharing economy?

'Sharing economy' is described by Frenken and Schor (2017) as:

> " Consumers granting each other temporary access to under-utilized physical assets ("idle capacity"), possibly for money. "

The first important aspect of this definition is 'temporary access'. This term makes sharing different from the second-hand economy, a closely linked economy. Where consumers sell each other goods and thus grant each other permanent rather than temporary access to their goods.

Another important characteristic of the sharing economy is that participants offer their 'under-utilized goods (idle capacity)'. These goods, called shareable goods, can be products and services. In essence, they are goods that by nature provide owners with excess capacity. Excess capacity of a consumer good is present when the owner does not consume the product all the time, such as cars. In order to be 'sharing', it does not always have to include goods. It can also be members of a community that share the costs of an investment, and then following its implementation they also enjoy the benefits accruing from the project, this is also called 'Collaborative consumption' (Botsman and Rogers, 2010; Meelen and Frenken, 2015).

The notion of 'idle capacity', combined with the purpose of why someone bought a good, is also key to describing the difference between 'sharing' and 'renting'. Renting goods from a company rather than from another consumer is seen as the product-service economy. The service provided by the company consists of giving the consumer access to a product while the company retains ownership of it. Once the product has been used and returned, it becomes available again for another renter. However, currently getting a car from a company or organisation for a short time is also considered as sharing. So, time also plays a role in whether something is 'sharing' or 'renting'. Companies call it sharing when it is actually renting because of strategic purposes, it is a growing business that is seen as new and sustainable and therefore trendy.

At last, there is a difference between sharing goods and on-demand services. The notion of sharing 'idle capacity' distinguishes this. With the on-demand economy, a consumer creates new capacity by ordering something on demand, Uber is an example of this. By contrast, with the sharing economy, the consumer uses something that is there, that would otherwise not have been used at all (Benkler, 2004).

As summarized in Figure 2, the sharing economy can thus be distinguished from three other types of platforms: the second-hand economy, the product-service economy and the on-demand economy. The main features of the sharing economy are temporary access, idle capacity, shareable goods (excess capacity), the amount of time, peer-to-peer and the sustainability drive. However, some of these features of the sharing economy create some overlap with other economies.
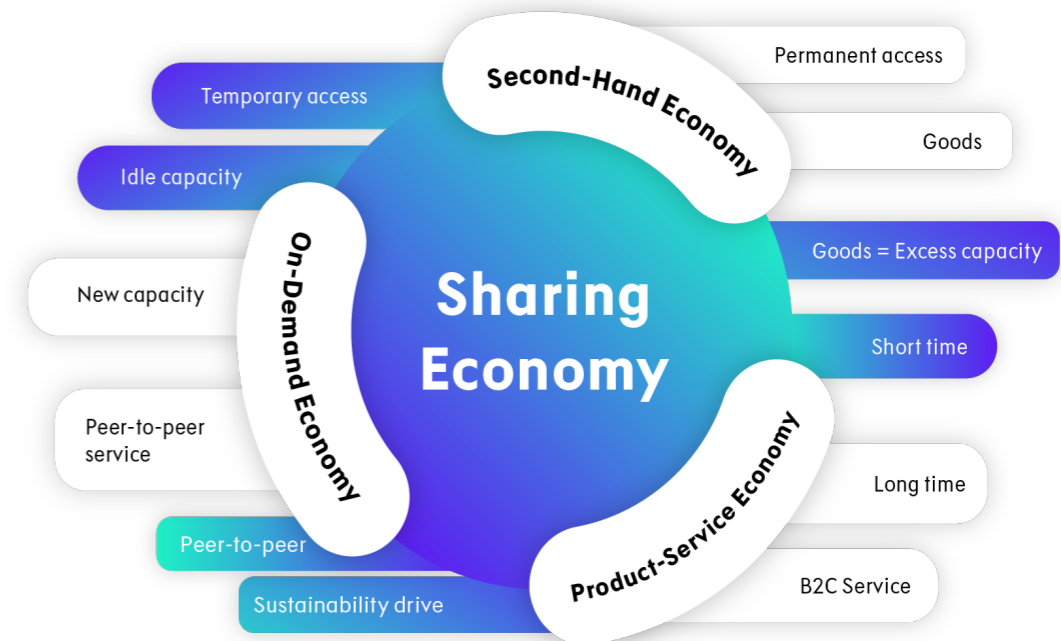
Figure 2: The sharing economy in relation to related economies and their main features.

2.1.2 Definition of car-sharing

Car-sharing represents a promising solution for sustainable transportation. Considering that there are already many cars that are not used to their full capacity. Car sharing can be done in different ways but can be captured in one definition. It is defined by Nobis (2006) and Katzev (2003) as:

" A service by which members of shared-use vehicle organizations get access to a fleet of vehicles. "

The emphasis here is very much on getting access through a service to a fleet of vehicles. But car-sharing goes beyond that. According to Ferrero et al. (2018), this fleet of vehicles is used for making trips on a per-trip basis:

" Share the usage of a vehicle fleet by members for trip making on a per trip basis. "

This report therefore uses a combination of the two definitions for the term 'car-sharing'. The definition is as follows:

" Car sharing is a service by which members get access to a fleet of vehicles and share the usage of this on a per-trip basis. "

2.1.3 Differences in car-sharing

Although car-sharing can be defined in one definition, the service can be offered in different ways and between different actors. In total, there are nine types, based on the classification by CROW/KpVV (2015), Ferrero et al. (2018) and Münzel et al. (2019). At first, there are differences in the trip and locations, also visualised in Figure 3.

Two-way (station-based)/Traditional/Round trip
In the Two-way (Nourinejad & Roorda, 2015) mode the available cars are parked in pick-up stations, which are predefined parking lots by the service provider or local administration. The journey must start and finish in this same space and this operational model does not consider the intermediate parking, which are the stops that the customer may plan for personal needs. Dutch examples of this service are Greenwheels or MyWheels.

One-way (station-based)
The One-way (Nourinejad & Roorda, 2015) mode is similar to the previous one, but with One-way the parking lot in which the journey finishes can be different from the parking lot in which it started. The set of parking lots is predefined. Sixt but also MyWheels use this type of sharing.

Free-floating
The Free-floating (Firnkorn & Müller, 2011) mode is the last one to come to the market. The cars are freely parked in public spaces within the service area (i.e., the area served by the car-sharing company), and the journey can start and finish at any point in this area. Sixt is also an example of this type of service.
This type of sharing can also be used with virtual fences, which are called **home areas**. Here individuals have the freedom to park their car anywhere in permitted parking locations.

Besides these differences in the type of trip and the parking. There are also differences in the organisation of car sharing. They can be divided into private car-sharing, peer-to-peer car-sharing (P2P), business-to-consumer (B2C) car-sharing and business-to-business (B2B) car-sharing (Figure 4).

Private car-sharing
The oldest type of car-sharing is between private individuals, such as friends, acquaintances and neighbours. This type of sharing can also be identified as 'community-based car sharing'. External parties have no part to play and there is no profit motive involved.

Peer-to-peer car-sharing
In the peer-to-peer version of car-sharing, external parties do play a role. Individuals offer their cars to borrow via an online platform (for example SnappCar). The online platform operator takes care of the legal and administrative aspects. There is a difference in the key transfer, this can happen physically, but it is also possible via a 'digital key'. The user can unlock the car via a connected app.

Business-to-consumer car-sharing
This is a situation where a business rents products or services directly to end consumers. It is the most common way of how car-sharing is provided. Companies provide a platform from which people can borrow a car. The company retains ownership of the cars. When it is for a longer time, more than one day, it is called renting. Whereas a short-time rental is called sharing (examples are Avis, Hertz and Sixt).

Business-to-business car-sharing
The solution is not open to anyone who registers, but only to members of a specific company or community. An example is pool cars, they are usually part of a comprehensive 'mobility package' for employees. With this package, employees can share a number of cars in the fleet.

In this report, the focus lies on the type of car-sharing from Lynk & Co. They use the peer-to-peer car-sharing service, combined with station-based Two-way sharing. An individual is the owner of the car, which is lent out by this individual to another individual on a platform and has to be returned to the same place where it was picked up.
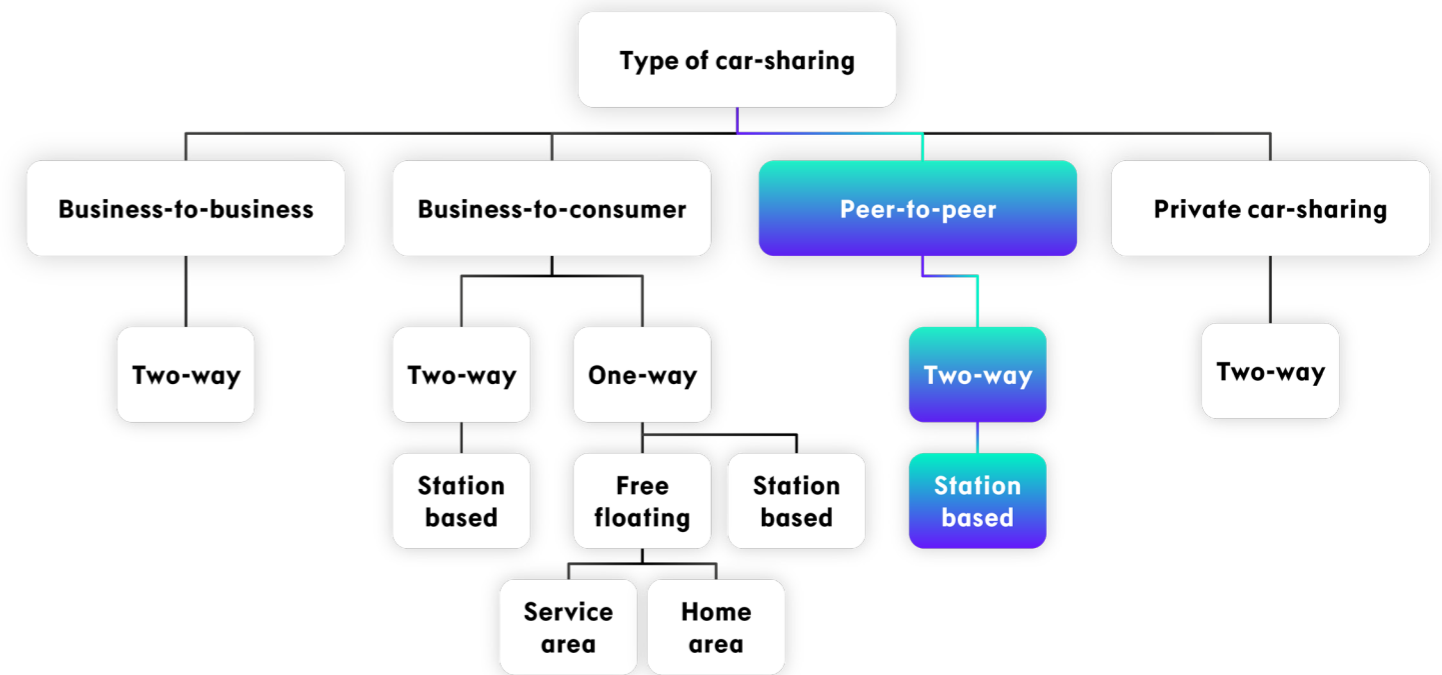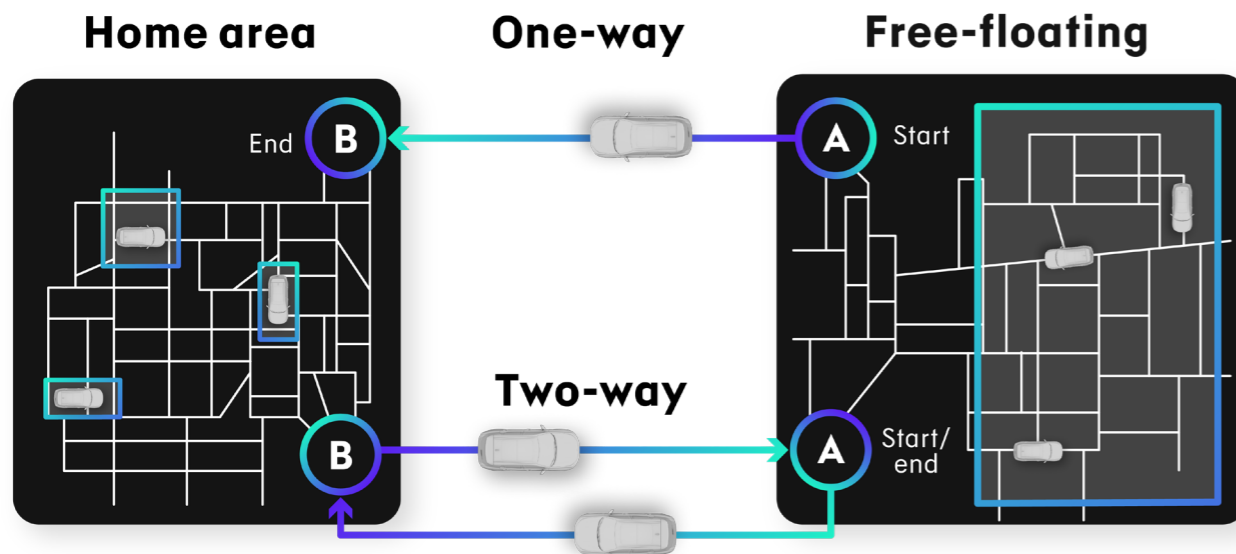

Figure 3: Visual overview on different trip types of car-sharing.

Figure 4: Different types of car-sharing.

2.2 Car-sharing Motivations

Peer-to-peer car-sharing happens via an interaction between two people: borrower and lender. The focus of this report is on the lender, as the initial problem statement is about how to let more people provide their cars on the sharing platform.

However, as this is a two-way interaction the motives of the borrower are also researched. The reasons why borrowers do use or not use car-sharing are shown in Appendix A.

2.2.1 Owners that provide their car

In this chapter, the motivations to provide or not provide the private car are shown. Insights were gathered via a questionnaire, which can be found in Appendix B. Next to that, literature is used to substantiate the motives.

People who provide their car on the sharing platform have personal reasons for doing so. Which can be classified into main reasons. Wilhelms et al. (2017), conducted a study in which participation motives from peer providers in the peer-to-peer sharing economy are researched. In this study, it is shown how these motives are constructed, via attributes, consequences and values. The study showed different values that are built up via different cognitive reasons: quality of life, economic interest, helping others, sustainability and belonging. The findings of this study are in line with the results from Lynk & Co (2023a) and therefore used to supplement these results.

Quality of life

The value relates to the fact that participants of peer-to-peer sharing, use the earned money from providing their car, for other purposes. And thus enhance their overall quality of life.

In the results that emerged from the questionnaire, there is no clear indication of people using money to enhance their own quality of life. However, the majority of the participants did mention that they shared their car 'To lower my costs for having a car'. This is in line with the literature because according to Wilhelms et al. (2017), this is a consequence that is present with this 'quality of life' value.

Next to that, some of the lenders that participated in the questionnaire mentioned that they shared their car 'To increase the use of my car', which relates to one of the attributes of the study, called 'low utilization', which is also present with the 'quality of life' value.

This attribute combined with the attribute of 'rental income' enables providers to perceive the functional consequence of 'reduction of fixed costs', resulting in the psychosocial consequence of having money for other purposes and thus enhancing the quality of life (Wilhelms et al., 2017).

The 'quality of life' value is interesting because it focuses on the individual, whereas the sharing economy in general focuses on collaborative consumption (Botsman & Rogers, 2010). This value is also driven by the generation of extra income, which differs from a mere cost reduction focus, as is the case in the next motive: 'economic interest'.

Economic Interest

This value relates to two consequences: 'reducing fixed costs' and 'the car is moved when it is rented out'.

The first consequence of reducing fixed costs is again in line with the answers from the questionnaire respondents: 'To lower my cost for having a car' (Lynk & Co, 2023a). The consequence of the car being moved when rented out comes from the attribute of 'low utilization'. This differs per use case, some people do not use the car for a longer time, and the car stands still for too long which is not good for some mechanic parts. So, being driven by someone else reduces the maintenance costs. Other people do not like the hassle of charging the battery, so renting it out takes this problem away because someone else does this. Next to that, when a car is parked in the city centre someone has to pay money for this, so when it is shared, no parking fee has to be paid.

The value of economic interest shows that temporary disposition is influenced by a desire for savings related to the product to be rented out (Wilhelms et al., 2017).
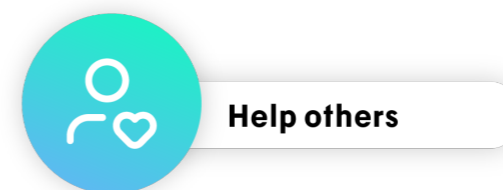
Help others

From the conducted questionnaire it was also made clear that peer providers participate because 'To share my car with a wider audience', especially with people they know. The study findings of Wilhelms et al. (2017) elaborate on these findings. This 'helping of others', makes people feel better. It generates a positive feeling that is driven by the consequence that 'the car is being moved', which relates to the attribute of 'low utilization'. When the car is used more often, the purchase becomes more sensible (Wilhelms et al., 2017). Another element is that people like to see others enjoy their car. Peer providers like to be part of the experiences of others, they get gratification when providing others with access to their good (Philip et al., 2015). This feeling is a consequence of the attribute 'interest in sharing', which leads to the value of 'helping others'.

This attribute is often indicated by people who not only share their car but also participate in the whole sharing economy. Which also indicates there is some level of environmental awareness.
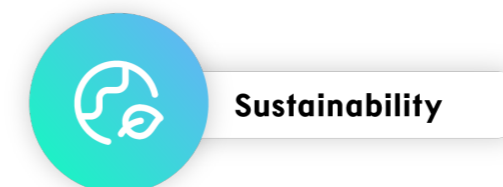
Contributing to sustainability

Most people relate sharing economies with environmental awareness and being sustainable. The same goes for peer providers in the car-sharing sector. Sustainability is linked with the consequence of an 'overall decrease in the need for vehicles', which is driven by the attribute of 'low utilization'.

This decrease of unused vehicles is a desire from owners, that will allow some people to live without a car. However, according to Wilhelms et al. (2017), environmental concerns are not part of the participation decision, environmental benefits are rather perceived as a by-product. Participants of the questionnaire indicated that they share their car 'To contribute to sustainable mobility', as the second main reason.
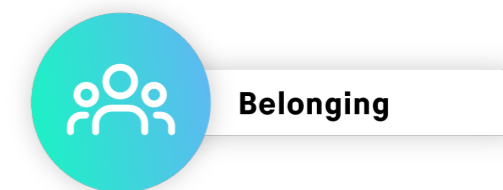
Belonging

The sense of community is also one of the aspects of why people want to share their car (Bardhi & Eckhardt, 2012). This feeling of belonging can be split up into two parts: being part of the community that shares their car and being part of the community someone lives in. The first one also relates to a sustainable lifestyle and this reason to provide a private car. Being part of the community in which someone lives, a neighbourhood, is also a reason to provide a car this way people can interact with each other. Both are achieved through collaborative lifestyles, in which people with similar interests are banding together (Botsman & Rogers, 2010).

All motivations are summarized and mapped in chapter 2.2.3.

2.2.2 Owners that do not provide their car

The previous chapter, 2.2.1, gave insight into the reasons why peer providers tend to share. However, the main problem is that other car owners prefer not to share. In this part, the reasons for people to decide not to share their car are shown (potential peer providers).

Especially with Lynk & Co, this is interesting. Because people acquire a car that can be shared but do not use it. So, what is the reason for people to get such a car? The reasons that the owners mentioned were the flexibility of the monthly subscription, the fast delivery, the price and that the car is very well equipped.

A study by Havas Worldwide (2014) showed that 42% of the average consumer is willing to share tools, but when it comes to more personal things, like cars, this proportion drops to 15%. Zooming in on specifically Lynk & Co 01 owners, the amount willing to share is roughly the same, around 20% (Lynk & Co, 2023c). In order to study why this number is relatively low, again the questionnaire from Appendix B is used and supplemented with relevant literature.
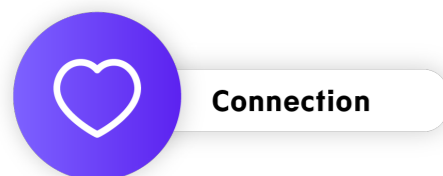
Connection

Emotional connection
We live in a 'car culture'. A culture in which people see the car as not only a means to get from A to B but as an expression of one's personality, a symbol of freedom and an experience in itself. The car elicits a wide range of feelings and people tend to create a connection with it (Sheller, 2004).
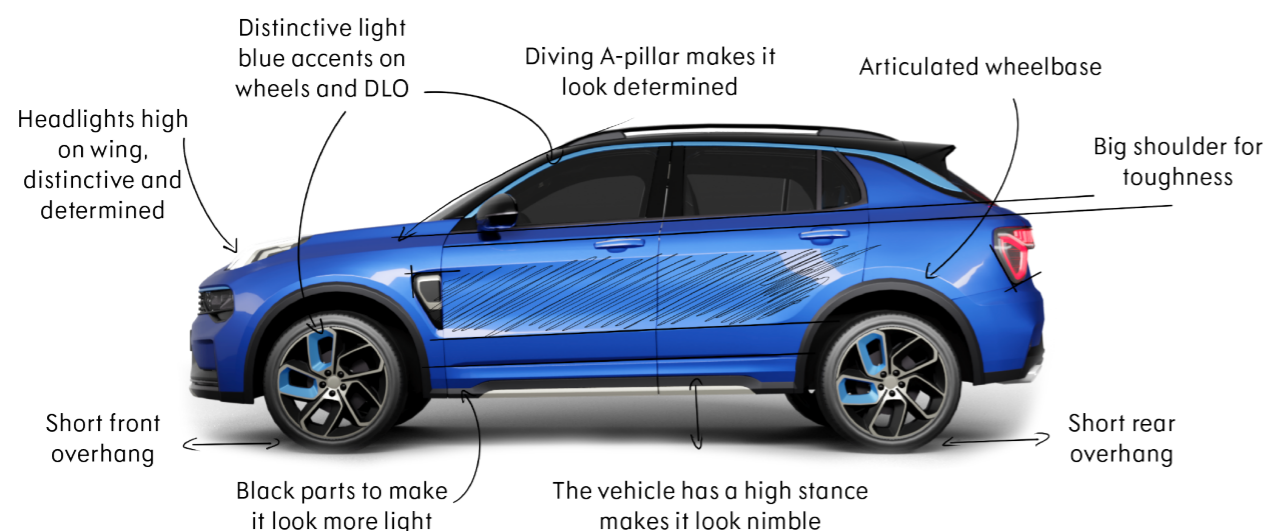
This emotional connection is one of the reasons why people do not want to share their car. Something that someone has an emotional connection with is not simply shared with someone else, and certainly not with strangers.

This connection can be explained by the fact that people refer to them as humans, which is called anthropomorphism. Anthropomorphizing influences people's psychological and emotional bond with objects. It imbues non-human objects with human-like characteristics, which alters people's relationship with these objects, and therefore shifts people's emotional and cognitive responses towards them (Esmeralda et al., 2015). This anthropomorphism creates object attachment. It allows for to strengthening of the individual and relational self, which happens especially with cars (Wan & Chen, 2021).

A car reflects who you are and what you stand for, it is an expression of your self-identity and an extension of your personality (Belk, 1988). This connection seems only relevant for car people but is also relevant for non-car people, humans who say they do not really care about cars. The underlying connection with cars is still present because unfamiliar non-human objects are anthropomorphized. Which enhances the fluency of comprehending the objects and prompts people to experience the objects in a more emotional way (Delbaere et al., 2011).

The reference to humans is not entirely coincidental. Car designers give character to a car. They do this on purpose, not only to be consistent with the brand identity but also for people to bond with it. The overall design subconsciously evokes character, as an example the determined and friendly-looking Lynk & Co 01 is analysed in Figure 5.

This exhibiting of human touches, facial features and characteristics makes owners of their car feel connected to them (Schroll et al., 2018); (Sano, 2010). People can feel a strong sense of connection with a product that exhibits a human touch. This implies that a product can serve as a replacement for a human relationship (Wan & Chen, 2021). Indeed, a car can show this human touch or human characteristics via the design. For example, the headlights that blink when you approach your vehicle, like a human saying 'hi'. But a car can even show a human touch via the flaws it has. Such as not driving that well in the morning, makes people relate to it as someone who is not a morning person. These flaws are seen as human traits.

This human touch is very evident in the front of a car (Figure 6). People compare the front to the human or animal face. For this reason, car designers attempt to leverage facial feature comparisons in order to create an emotional attachment to their automobiles. The headlights as "eyes" and the grille is a "mouth" (Toshinobu & Norihiko, n.d.).

Figure 6: Different car facial expressions. The Lynk & Co 01 on the left and the Lotus Eletre on the right.

Lastly, cars provide experiences. People create memories with cars, the car makes it able to be physically present in special moments. It is there after a long day of work, but also with major milestones, such as a graduation or a wedding (AutoTrader, 2013).

In conclusion, this emotional connection between the owner and their car makes them hesitant about lending it, especially to strangers. This makes it one of the reasons, if not the strongest one, why potential peer providers do not want to participate in car-sharing.

Acknowledging the fact that a car is more than just a means of transport, is important. In current strategies to influence car driving decisions, this is often not taken into account. Especially when these decisions relate to asking owners of a private car to share it with others. This person acquired this car and consciously or unconsciously chose that one because it is an extension of themselves, and it reflects them which creates an emotional connection with it. Not everyone has this high-level emotional connection with a car. But even these people do refer to cars as humans due to anthropomorphism. Which suggests that they also feel some sort of emotional connection.

Availability

Availability
This car culture also reflects on the dependency of this type of transport. Another concern is that their car is not always available when provided for car-sharing. Research shows that owners of private products are unwilling to let them because they want to use them themselves. Letting it go, makes it less available for your own use (Bieger et al., 2007).
In a study among peer-to-peer car-sharing providers by Shaheen et al. (2018), hosts mentioned that they found themselves in (emergency) situations in which they needed the car. This idea of them being less mobile and flexible keeps them from lending their car.

Financial risk

Financial risk
The questionnaire showed that most people who own a 01, are afraid that the car interior or exterior will be damaged when shared. This concern is in line with research from Shaheen et al. (2018), in which peer providers expressed their concerns about possible damages.
Tangible goods can be damaged by those who use them, which leads to the risk of substantial financial loss, this makes owners insecure, making them less likely to share their car (Bossauer et al., 2020); (Ballús-Armet et al., 2014). It remains a risk for owners to find out who made a certain scratch or dent, recover the costs from that person and then also get their reimbursement. This is especially the case with small damages, these are often only noticed after a long time. This concern is less evident with providers who share their cars with friends and family.

Distinctive light blue accents on wheels and DLO

Diving A-pillar makes it look determined

Articulated wheelbase

Headlights high on wing, distinctive and determined

Big shoulder for toughness

Short front overhang

Short rear overhang

Black parts to make it look more light

The vehicle has a high stance makes it look nimble

Figure 5: The character of the Lynk & Co 01 explained.

Trust

Trust

63% of the questionnaire respondents indicated that they do not want to share their 01, because they do not know who is going to drive it. They are more willing to lend their car to people they know, friends and family. Even people who did provide their car via the sharing platform indicated that it is a major drawback to not be sure who is going to borrow their car. But, after several times of lending their car, they gained trust and were more open to share their car. The trust issue that occurs when sharing with strangers holds back people from providing their car, a motive in line with findings from KiM (2015) where this was found as one of the main reasons. The trust issue also relates to the fact that car interiors are seen as second homes. People live in them and keep personal things in them.

In a study conducted by Stanford, in collaboration with Airbnb, they researched the willingness to trust someone, based on how similar they are. It proved that we trust people who are the same more and that people are not that willing to share with people they do not know or are different (TED, 2016).

Usage behaviour

Usage behaviour

The trust concern relates to user and usage behaviour. People act aggressively and impolite in traffic. Seeing this current user behaviour on the streets logically holds back people from sharing. Why would you share something expensive with people who do not care about that?

How people treat products that they do not own is different from products they do own. Bardhi & Eckhardt (2012) studied how people treat their shared car and showed that people have the sense of "It is not mine". They treat products that do not belong to them differently from products that belong to them, often in a negative way. The same can be concluded via observations. How people use another sharing service, such as moped sharing, shows the bad treatment.

This also relates to how people behave in traffic: speeding, double parking and running red lights. This was also one of the aspects that held back owners because they did not know how people behave in their cars and in traffic. Speeding, fast accelerating and thus driving fast also relates to the financial risk, because having a 'sporty' driving style influences the wear and tear of the car more than driving less sporty (Renault Group, 2019).

Hygiene

Hygiene

Another concern among car owners with joining the sharing platform is the cleanliness of their car Shaheen et al. (2018). Something that was also found via the questionnaire, participants do not want their cars to get dirty. Especially the parts of the interior that someone touches: seats and screens. This refers to contagion, the disgust that people feel when they are aware that an object has been physically touched by someone else (Argo, Dahl, and Morales 2006; Rozin and Fallon 1987).

Other cleanliness concerns were about the smell and littering inside the car, such as smoking. Some hosts even cleaned the car more frequently and as a result, became more familiar with the vehicle. Owners also cleaned the cars more, to know all the details of the car in the event of damages (Shaheen et al., 2018).

IT & Design

IT & Design

Another reason why car owners do not provide their cars for sharing is the fact that the technology behind the platform does not always work (App Store, 2023).

In the conducted questionnaire there were no questions about the IT platform because it is already a known issue. Peer-to-peer sharing platforms are highly reliable on the connectivity, when they do not work as intended it causes frustrations to the users and can result in not using these platforms at all.

2.2.3 Insights

In conclusion, there are several connected drivers and concerns about sharing a private car. These are summarised in Figure 7.

On the right side, coloured in blue. There are different intertwined reasons why people want to provide their car on the car-sharing platform: to enhance their own quality of life by having more money to spend on other things, to reduce the costs of having a car, to help others, to feel a sense of community and to contribute to a sustainable lifestyle.

However, these reasons do not outweigh the reasons for not providing the 01. These reasons are shown on the left, coloured in purple. Because most of these reasons are deeply rooted in users' behaviour and their attitudes.

There is a bond with cars due to the emotional connection and the financial investment of it. Besides that, people are highly dependable on the car and expect it to be always available. However, the biggest concerns can be generalised in trust. Trust in other people's behaviour in driving the car, the hygiene and trust in the system. Trust is one of the most, if not the most, important drivers for the success of sharing platforms in general, but especially peer-to-peer car sharing (Botsman, 2013); (Gebbia, 2016); (Hawlitschek et al., 2016). Trusting other users is intertwined and influenced by the trust in the system and the feeling of control over the owned property. How people interact with these systems in the machines, such as cars, is related to ergonomics. Specifically cognitive ergonomics.

Figure 7: Reasons of (potential) lenders to participate in car-sharing or not.

2.3 Ergonomics in Car-sharing

2.3.1 Ergonomics definition

As discussed, car-sharing services are provided via digital systems, and how the user interacts with these systems is related to cognitive ergonomics. First, it is important to know all ergonomic domains. According to the International Ergonomics Association (IEA, n.d.), ergonomics is the understanding of interactions among humans and other elements of a system. It can be divided into 5 domains: physical, behavioural, organisational, sensorial and cognitive ergonomics (IDE TU Delft, 2021). Together with a brief explanation, these are shown in Figure 8.

In this report, the focus lies on the last two: cognitive and sensorial ergonomics.

Physical
It studies the shapes, dimensions, motions and strengths of the human body and how these relate to the environment.

Behavioural
Focuses on the way people are motivated towards certain behaviour, investigates how the environment can influence this.

Organisational
Focuses on the interaction between people in a business. Studies the effect on corporate outcomes and human wellbeing.

Sensorial
This area focuses on the capacities and limitations of the human senses and studies how people sense their surroundings.

Cognitive
Focuses on the capacities and limitations of mental information processing, studies how people perceive and process information.

Figure 8: The five different ergonomics domains (IDE TU Delft, 2021).

2.3.2 Ergonomics and touchpoints

The peer-to-peer car-sharing service of Lynk & Co can be accessed via various (digital) touchpoints. Touchpoints are points in the journey, in which the user encounters the brand and their service. Besides this definition, a touchpoint is a stimulus fulfilling a specific role within the customer journey (Barann et al., 2022).

Construction of touchpoints

The same study also set up a framework, on how a touchpoint is constructed, it identifies three parts: 'Stimulus', 'Interface' and the 'Encounter'. The framework is used as a tool to show how touchpoints influence the journey and what can be used for designing. A visual representation can be seen in Figure 9 on the next page.

The stimulus can be considered as a sensible element designed to guide the interaction between the user and the service provider (Kronqvist & Leinonen, 2019). Thus, it can be described as a potential interaction element (Heuchert et al., 2018; Richardson, 2010; Stein and Ramaseshan, 2016). It describes the planned encounter by the organisation and therefore, the controlled stimuli are the enduring parts that can be designed and managed. An example related to car sharing is the mobile app for sharing. There are also out-of-control stimuli, such as customer reviews.

The interface simply conveys the stimuli and therefore facilitates the encounters. An example is the infotainment screen inside the car on which the sharing app is displayed.

At last, there is the encounter, which is the actual moment of contact of a user with a touchpoint at a point in time. It is therefore characterized by a transient point of view. When a user of the car enters it and the infotainment screen starts, this is when the encounter happens. The encounters can be monitored, to apply improvements and adaptations.

Touchpoints in relation to car-sharing

Access to car-sharing for both the lender and borrower is through these digital touchpoints. They indirectly interact with each other through these machines and the associated sensors. Examples include: a mobile app, the infotainment screen but also the charging station can be influential.

The question that arises is, can cars that are not built for car-sharing only, which is the case with the Lynk & Co 01, influence both lender and borrower via the digital touchpoints? The interfaces in a car are relatively easy to change and connect with other actuators and sensors in the car.

Ergonomics in cars

Cars are one of the, if not, the most complex products that exist. How they are built but also in relation to the user due to the number of touchpoints and the enormous number of reactions that happen when someone interacts with it. Nowadays, most of these are digital and thus include interfaces, which are designed with cognitive ergonomics in mind.

An important part of the sharing experience is the car itself. It is the main product and influences the experience for the borrower. But the car is also the main product of peer-to-peer car-sharing that keeps potential lenders from sharing their cars.

The 01 already has some features that were designed with car-sharing in mind, but they are not optimally used. There is a 'car-sharing' application in the car, from which the owner can turn sharing on or off and set some settings. Other digital touchpoints that provide information and can control the user in the car are the interfaces: the driver's display (DIM) and the infotainment screen (AVN screen).

Touchpoints along the journey

There are other digital touchpoints in the journey in which the lender and borrower interact: the charging station and the mobile app. These are further explained in Chapter 4: Interaction.

The interaction that a person has with these machines forms the complete experience for the user. The user experience (UX) is an extension of the traditional usability approach to human–technology interaction research that includes the user's psychological, sociological, and cultural experiences with technology (Lai-Chong Law, 2011). The interaction and the user experience are connected with each other. Individuals will experience a positive psychological state (flow) as long as the challenge an activity poses is met by the individuals' skills (Novak et al, 2000; Huang, 2003). This implies that the user experience can be influenced by the underlying cognitive ergonomics.
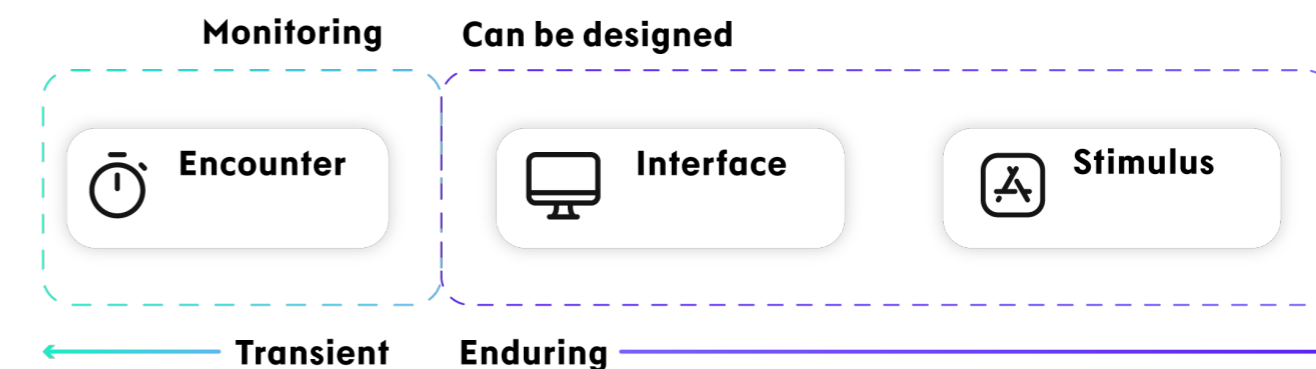

Figure 9: Abstract construction of a touchpoint, based on research from Barann et al. (2022).

2.3.3 Cognitive ergonomics

Cognitive ergonomics is about mental processes, such as perception, memory, reasoning, and motor response, as they affect interactions among humans and other elements of a system (IEA, n.d.). Relevant topics include decision-making, skilled performance and human-computer interaction as these may relate to human-system design. The reasoning of humans in cars has to do with where everything is located on the screen and how the menu is structured in order to reach all functions. But also, when the driver presses a button to perform an action, the haptic or acoustic feedback that emerges from this is also cognitive ergonomics. More pictures of relevant ergonomics and car-sharing features within the interior of the 01 can be found in Appendix C.

Ergonomics and anthropomorphism
Cognitive ergonomics can also be related to anthropomorphism. With interactive technologies, there is substantial evidence that people think of and treat interactive technology as if it is their friend (Nass & Moon, 2000); (Fogg & Nass, 1997). They ascribe a broad range of human attributes including personality to interactive technology (Desmet et al., 2008).
This perception of objects as human beings (anthropomorphism) also relates to psychological processes, such as the human-machine interaction. The attributing of human characteristics to non-human objects increases people's ability to understand the objects, reduces the uncertainty associated with them, and increases confidence in prediction about the objects (Epley et al., 2007).

A touchpoint has an interface (Barann et al., 2022), which can have different forms (physical or digital). This interface grants access to the digital features (mobile apps) and is mediated by a human. This human-machine interaction plays a big role in cars and car-sharing because it gives the user access to all car functions. There is evidence to suggest that the full potential of these already existing interfaces is not (yet) used. Especially when it comes to car-sharing because every user is different but gets to see the same interface. However, as proved by Dong & Liu (2016) the final user experience is influenced by individual cognitive differences.

2.3.4 Sensorial ergonomics

Sensorial ergonomics focuses on the capacities and limitations of the human sensory system and studies how people hear, see, smell and feel their environment (IDE TU Delft, 2021). Sensorial ergonomics can relate to tactile aspects, such as the structure and feel of materials (material on the seats). However, in this project, the focus of sensorial ergonomics is on how the environment can change due to visual and acoustic aspects and how different users adjust their behaviour to this.

Sensorial ergonomics in the interior
The environment, the car interior is the space that both the owner and the borrower make use of and it is a complex environment with a lot of features to offer. Which can be perceived differently according to different users. This means it is the most interesting touchpoint in the journey to design. Can the same space change according to the user and the purpose of the trip? And can the user behaviour be influenced this way?

Lenders indicated that they had concerns about how the interior of their car would look after it had been shared. This space is very wear and tear sensitive, due to the fact that people live in it. Next to that, it is perceived as a private space, and with car sharing it will be shared with others. Besides the concerns, this is also the space in which the borrower can be guided via these sensorial ergonomics.

2.3.5 Multi-sensory design

Multi-sensory design considers not just the shape of things but how things shape us, our behaviour and our emotions (Gibson, 2012). This ability to change human behaviour can have a huge influence on the user experience. Different people can perceive the same space in different ways (Altmann & Chemers, 1984).

This multi-sensory design is closely related to ambient computing. A type of computing in which smart devices use data and human activity to produce a result without the need for a command. It is a 'smart' way of providing a human-machine interaction, that reacts to the cognitive ergonomics as well.

In summary, cognitive ergonomics has to do with human-machine interaction and can influence the way people use products, by the things that are displayed and the sounds and light effects it produces. In potential, the machine can create a direct connection between the lender and borrower. Whereas sensorial ergonomics can interact with the senses of humans and can have a huge influence on how spaces are perceived pee different users.
Both domains are therefore capable of interacting and influencing people which can create trust and control for the owner of the private vehicle. How both types of ergonomics in the 01 are evident, is shown in Figure 10 and illustrated in Figure 11.

Figure 10: Picture of the 01 that shows which of the digital systems and other features are present.
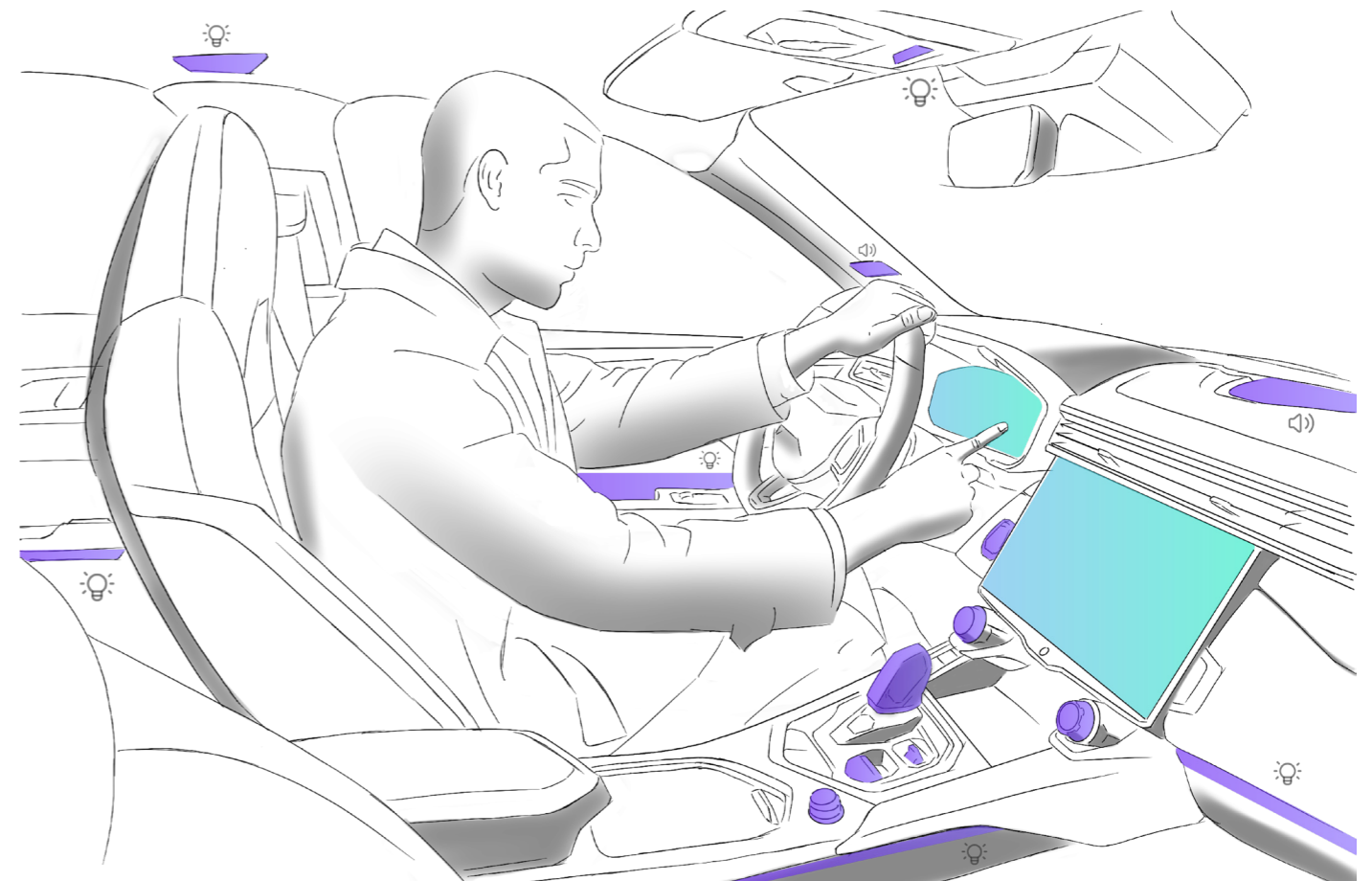

Figure 11: Illustration of difference between cognitive (blue) and sensory (purple) ergonomics in a current car interior.

Context

This chapter is about the context of peer-to-peer car-sharing. It gives an insight into the brand Lynk & Co and it provides a reflection of the company in relation to other car-sharing providers. Besides the business and market aspects, benchmarking with other peer-to-peer sharing services is conducted.

3.1 Brand Analysis

To find out how Lynk & Co differs from other car-sharing organisations, the brand identity is researched and a SWOT analysis is performed. Both are used in the design process to create a unique brand focused solution.

3.1.1 Brand identity

The brand identity is the outward expression of a brand, including its name, trademark, communications, and visual appearance. Assembled by the brand owner, it reflects how the owner wants the consumer to perceive the brand and by extension the branded company, organisation, product or service (van Grondelle, 2022).

The identity of Lynk & Co was found by looking at brand values, the mission statement and objectives, the brand proposition, the portfolio (range of cars), the ads and the location and looks of the dealerships. For this project, Lynk & Co Europe is chosen to research, as this aligns with the car-sharing scope. Lynk & Co is also active in China, with a more diverse portfolio and a different market approach.

The brand identity is summarised in three words: Bold, Different and Simple and is shown in Figure 12. The research that led to these words can be found in Appendix D.

3.1.2 SWOT analysis

In this analysis the internal factors (strengths and weaknesses) are shown next to the external factors (opportunities and threats). The scope of the competitive business environment is limited to car-sharing services in the Netherlands. All points from the SWOT analysis are discussed and visualised concisely in Figure 13 on the next page. A more comprehensive explanation can be found in Appendix E.

Figure 12: Brand identity and associated words of Lynk & Co in Europe.

Strengths
The current strengths of Lynk & Co mainly relate to the car itself, the existing sharing platform and the uniqueness of the brand.
The car itself is possibly the biggest strength, it is a luxurious car and equipped with all the latest features. Besides the car, there is the already existing sharing platform, consisting of the (in-car) app and the backend connectivity. Next to that, there are the clubs, unique styled locations with the car inside the city centres. And at last, the flexibility, which refers to the monthly subscription.

Weaknesses
The weaknesses of the company and especially the car-sharing service can be divided into three parts.
The first one is the fact that although the car can also be acquired via a subscription, the car is still privately owned and people feel responsible if something goes wrong with the car. As discussed in Chapter 2.2.2, this creates concerns about sharing the car. The other one is the fact that Lynk & Co in Europe shares parts and software with Lynk & Co in China. So, not everything is specifically designed and made for the same purpose and user.
Then there is the fact that the car-sharing service and the car itself are highly dependable on connectivity. Connectivity issues can influence the whole experience of the service for both lender and borrower negatively.
At last, the customer service is considered as a weakness (TrustPilot, 2023). This also creates troubles with car-sharing.

Both external parts are connected to the trends and developments research that can be found in Appendix G.

Threats
One of the threats is that the market is very dense, which will be further discussed in Chapter 3.2. Another threat is user behaviour, a threat in general with car-sharing, especially the P2P car-sharing from Lynk & Co. The other threat is diversification, people perceive the same experience differently. It could be challenging to provide a suitable sharing service for every user. The fact that people need to provide information in order to use the service in the best way (e.g. profile picture, full name and living address) creates a threat as well, because not everyone is that open to providing this.

Opportunities
The main opportunities lie within the car itself. Within the car, the 01, there are already a lot of digital features. However, these features are not optimally used, which creates the opportunity to make them more focused on car-sharing.
People in neighbourhoods asked if they could get access to a shared car (Appendix F), they were interested from an economic and sustainable point of view. Lynk & Co can play a role in these highly populated areas by focusing on these people. Besides that, there are emerging technologies that could be used to enhance car-sharing.
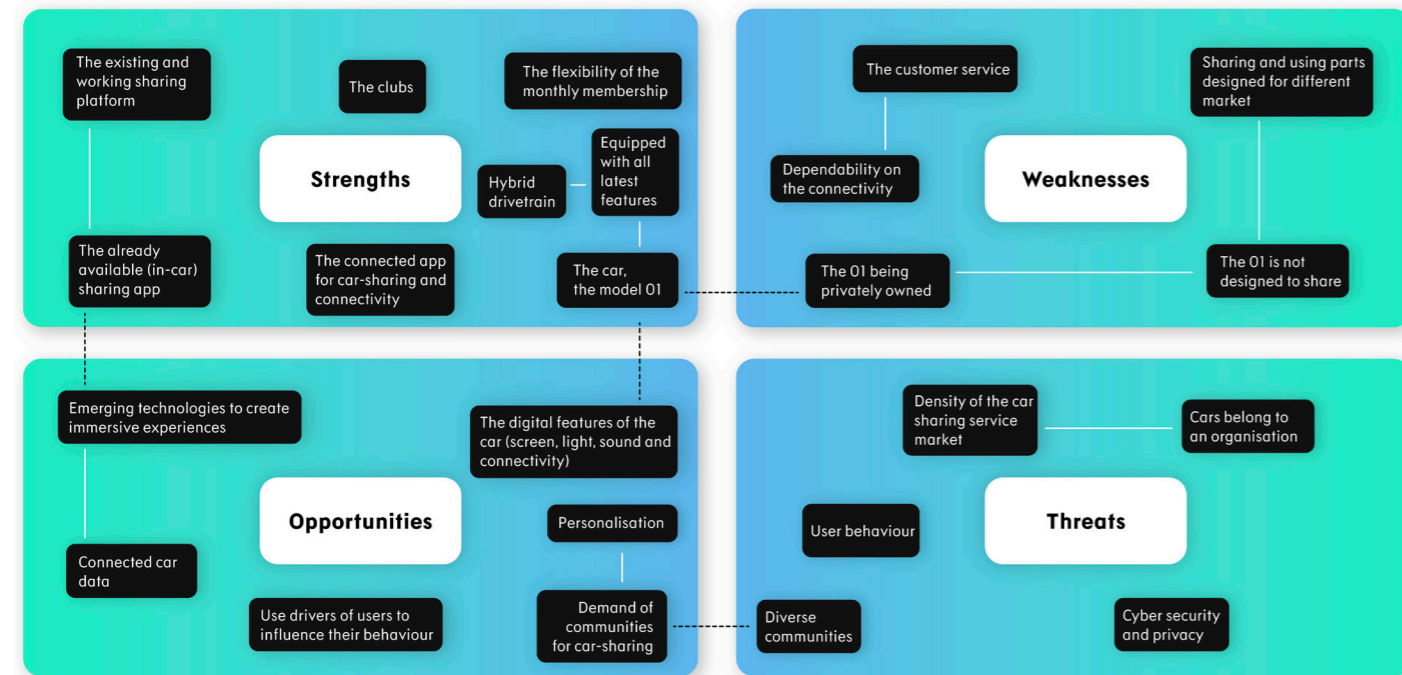
3.2 Market Analysis

To make car-sharing a sustainable business it is important to know what competitors approach the market, therefore a market analysis is performed. Due to the increasing supply of shared cars and therefore different types of shared services, it is difficult to keep track of local and private initiatives. The statistics in this report, are based on data from CROW-KpVV that are provided by suppliers of the sharing services (e.g. Greenwheels). The KpVV programme develops collective knowledge for decentralised authorities in the field of mobility.

3.2.1 Car sharing users (borrowers)

For this analysis, the most recent known amount is used. By 2021, there was a total of 970,000 car-sharing users in the Netherlands, this measurement is based on the number of people who have a membership or subscription to a car-sharing provider. When looking at people who actually use car-sharing, from 2018 to 2021 this is around 200,000 over these past 3 years. This number is built up from users of business-to-consumer (B2C) and peer-to-peer (P2P) services and accounts for 0.02% of the total number of car trips in the Netherlands (Jorritsma et al., 2021).

In a study, amongst 12.500 participants (above 18), by the Ministerie van Infrastructuur en Waterstaat (2023) on travel behaviour in 2022 in the Netherlands, it was found that 19% have used one or all the forms of car sharing (as discussed in section 2.1.3). Of the individual forms of car sharing, borrowing a car is mentioned most often (7%), followed by a commercial shared car, through a rental company or an online platform (3% each). A shared car through the employer and shared ownership were mentioned by 2% each. Thus, only a small proportion mentioned they used multiple forms of car-sharing.
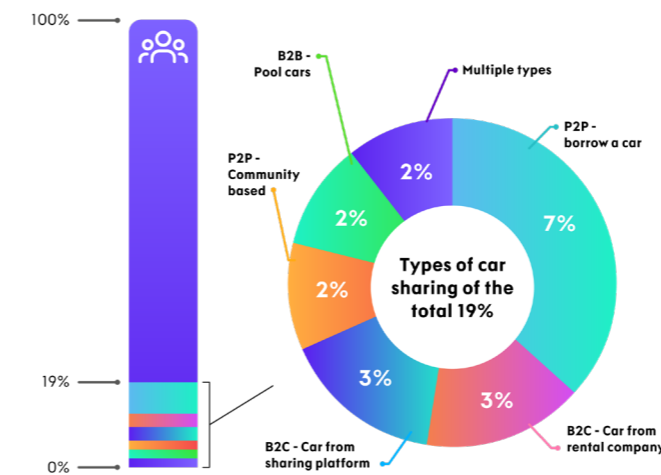
3.2.2 Amount of shared cars

There is a total of 100,000 shared cars (CROW-KpVV, 2023). Interesting is that 75.000 of these 100.000 shared cars being available are P2P car-sharing cars (Figure 15).
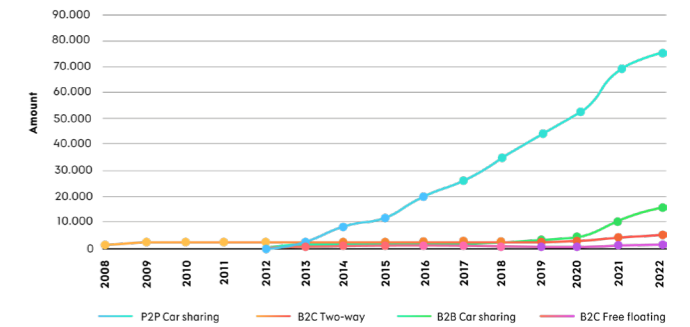

Figure 15: Amount of car sharing vehicles per type of sharing (CROW-KpVV, 2023).

Another interesting division can be made in the type of car offered. If the distribution of car classes is compared with the entire private car fleet in the Netherlands, the mini-class is well represented among shared cars.
This indicates two things, more luxurious and (often) bigger cars are not provided via car-sharing services. And that more people buy relatively bigger cars: C, D and E class cars. This implies that the demand for these cars is bigger.

Of these shared cars, 37.9% are electric (fully electric or plug-in hybrid). When the number is compared to private cars, the amount of electric cars is only 5.3%. Over the years, the number of shared cars being electric has increased: in 2021, the amount of electric shared cars was 13% of all shared cars.
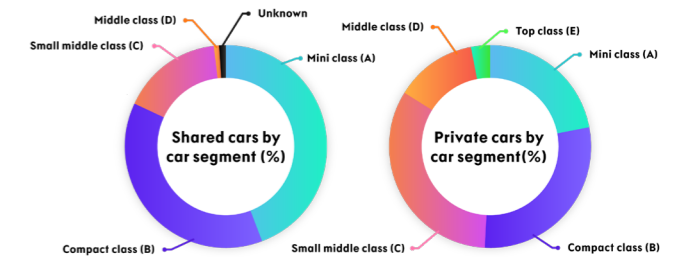

Figure 13: SWOT analysis within the scope: Car-sharing services in the Netherlands.

Figure 14: Percentage of different car sharing users (Ministerie van Infrastructuur en Waterstaat, 2023).

Figure 16: Difference in car segments between shared and private cars (CROW-KpVV, 2023).

3.2.3 Shared cars locations

The shared car supply is concentrated in highly urbanised areas in the Netherlands. That is also where the largest increase is taking place. In general, the stronger the urbanisation, the more shared cars (Figure 17).

The measurement used 24/7 shared cars, which are accessible day and night without the intervention of a person. There are also shared cars that no longer require a key, which starts at the press of an app button (such as Lynk & Co).
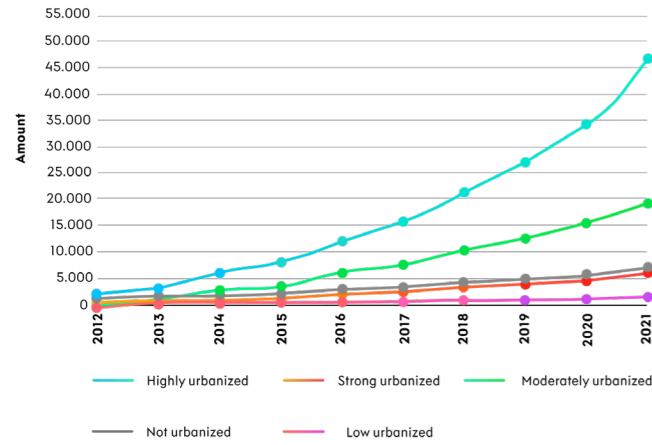

Figure 17: Amount of shared cars to urbanisation rate (CROW-KpVV, 2022).

Large cities also offer the greatest variety of car-sharing services, as shown in Figure 18. This also shows that the peer-to-peer car-sharing type in local communities, is the highest in highly urbanized areas.

Users like the fact that there are various forms of car sharing and providers with their P2P services. This leads to more choices and a suitable solution for different target groups. However, the B2C providers all target a bigger audience, with a on its own working service which creates difficulty for people to choose.
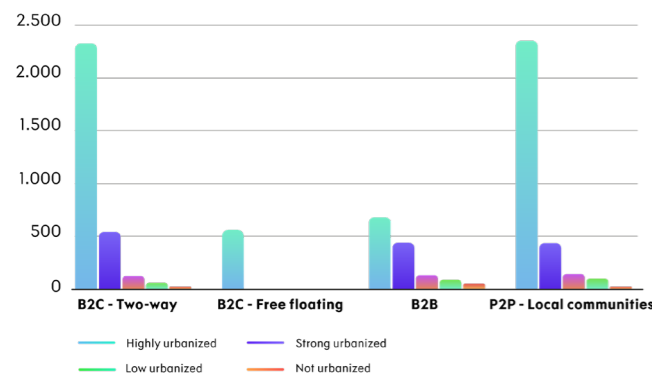
Figure 18: Amount of different types of shared cars to urbanisation rate (CROW-KpVV, 2021).

3.2.4 Car sharing providers

The Netherlands is attractive for car-sharing, because of the developed road infrastructure, relatively many charging stations and the short distances. The amount of shared cars is divided in the Netherlands, among more than 10 relatively large providers. The 5 largest and their share are shown in Figure 19.

In Figure 20, an overview of the car-sharing provider market is shown. This overview includes the company structure (B2C, B2B or P2P), and the type of trips the company offers (Two-way, One-way) combined with how vehicles can be parked (parking spots, home area or free-floating). The type of cars according to the UNECE standard (European Commission, 2013) and the drivetrain (electric, hybrid, gas).
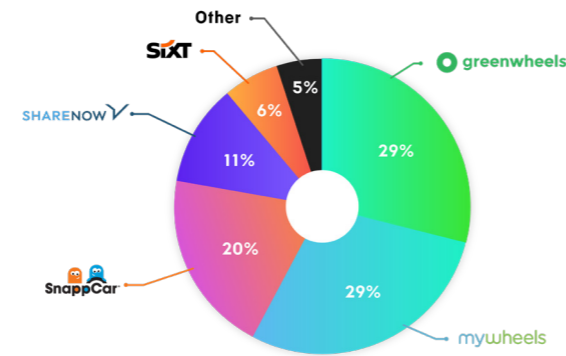
Figure 19: Key players in the car-sharing economy in the Netherlands (Statista 2023).

3.2.5 Insights

From the market analysis, several conclusions can be drawn. First, the car-sharing market is dense, for both B2C and P2P sharing. The B2C organisations target a wider audience. The fact that these services do not target a specific user ensures that they are design-for-all which is also reflected in their cars. The cars from these B2C services are also standard, i.e. basic models with little to no options. Lynk & Co is unique in this area, offering a car with all the latest features.

There is a high P2P car-sharing demand, but there is only 1 provider in the Netherlands, Snappcar. An advantage over Lynk & Co on this provider (and other P2P providers in Europe) is that the car is already able to be shared and there is not something needed to be built into the car. Besides that, private sharing or collectively buying a car already happens in neighbourhoods (Gemeente Rotterdam, 2020). These developments present opportunities for Lynk & Co, since they already have their own platform.

At last, other P2P car-sharing services show interesting approaches. Peer providers of Turo can link cars to an experience to attract similar people. Getaround, lets borrowers book cars without approval. Hiyacar focuses on how the car is returned and especially on hygiene in the interior.

Figure 20: Market analysis of the biggest car-sharing companies in the Netherlands, and biggest peer-to-peer car-sharing companies from the world.

3.3 Stakeholder Analysis

The number of providers makes car-sharing complex for both users and companies. For the user, it is difficult to choose between all the providers. And for the company, it is difficult to create a competitive advantage with their service. But what makes it even more complex are all involved stakeholders. With different actors, such as residents, other road users, local authorities, municipalities and organisations within and even outside the company itself. All these stakeholders have different interests. The stakeholder map on how Lynk & Co is connected to all these players is shown in Figure 21 on the next page.

3.3.1 Business perspective

Geely Holding
The Zhejiang Geely Holding Group (Geely Holding) was founded in 1986 in China, this is the group to which Lynk & Co belongs. This automotive enterprise has a big portfolio containing several brands, such as Lotus, Volvo, Polestar, Smart and Lynk & Co. The cars from these brands share the platforms with each other. This group provides financial assets, and Lynk & Co also has to report to them (Geely, 2023).

Lynk & Co
Lynk & Co is the automotive brand formed as a joint venture between Geely Holding and Volvo Car. They launched in 2016 with their car, the 01, designed and engineered in Sweden and provide them for their users. Currently, other models are only present in China, where they range from the 01 to the 09. Cars can be seen in experience stores, called 'clubs' and they are sold in a digital way (Zhejiang Geely Holding Group, 2023).

CEVT
China Euro Vehicle Technology AB (CEVT) is the provider of product development support within Geely Holding. They provide software for the cars, such as in-car apps, which will be used by the user (Zhejiang Geely Holding Group, 2023a). The software that is used for the app, that connects the user to the car, is developed in-house at Lynk & Co.

3.3.2 Government perspective

The government perspective can be divided into three parts: European Union (EU), the Dutch government (Rijksoverheid) and the municipalities of cities.

European Union
The regulations that are set up by the EU influence the acting of the national government, such as the Dutch government. Regulations about emissions, cybersecurity, privacy and connectivity are most influential to car sharing.

Dutch government
The part of the Dutch government that decides on the infrastructure and that is able to set regulations that influence travel behaviour, is Rijkswaterstaat Ministerie van Infrastructuur & Water. The Dutch government in general sets cooperative strategies for mobility between different parties and they therefore also influence the municipalities.

Municipalities
Municipalities have a big interest and influence in mobility, and also in shared mobility. They decide together with the national government, project developers and people how the cities will look like, where (shared) cars are parked, what people need to pay for this and if there is a difference between shared and conventional cars (Gemeente Rotterdam, 2020; Appendix H).
In this report, the municipality of Rotterdam is chosen to make the scope and therefore relevant stakeholders more tangible and get a better view of their role with the sharing services. Besides that, the TU Delft is partnered with Rotterdam as they are the frontrunner with future mobility in the Netherlands (Rotterdam Partners, 2023).

3.3.3 People perspective

Users of the sharing platform
The users consist of two types: the lender and the borrower. They have a big influence and high interest in car-sharing. During the sharing journey, they use all the touchpoints. Such as the same car, the sharing platform to interact with each other and the mobile app.

Cities (public spaces)
The cities, and public spaces in general, are the spaces in which car-sharing takes place. These spaces are linked to the municipalities and adapt to their regulations. Examples of points from these public spaces that influence the car-sharing of Lynk & Co, are the ability to park, the charging infrastructure and garages. Within these public spaces, the use of these types of cars influences the way people live in their neighbourhoods.

Other road users
Within these neighbourhoods and thus public spaces, car-sharing has an influence on other road users. Such as other vehicles, pedestrians and bicycles are actors that also participate in traffic, just as the users of car sharing. They want to know what the shared cars are up to. The other road users have an interest in car sharing, as it influences the way their street will look.
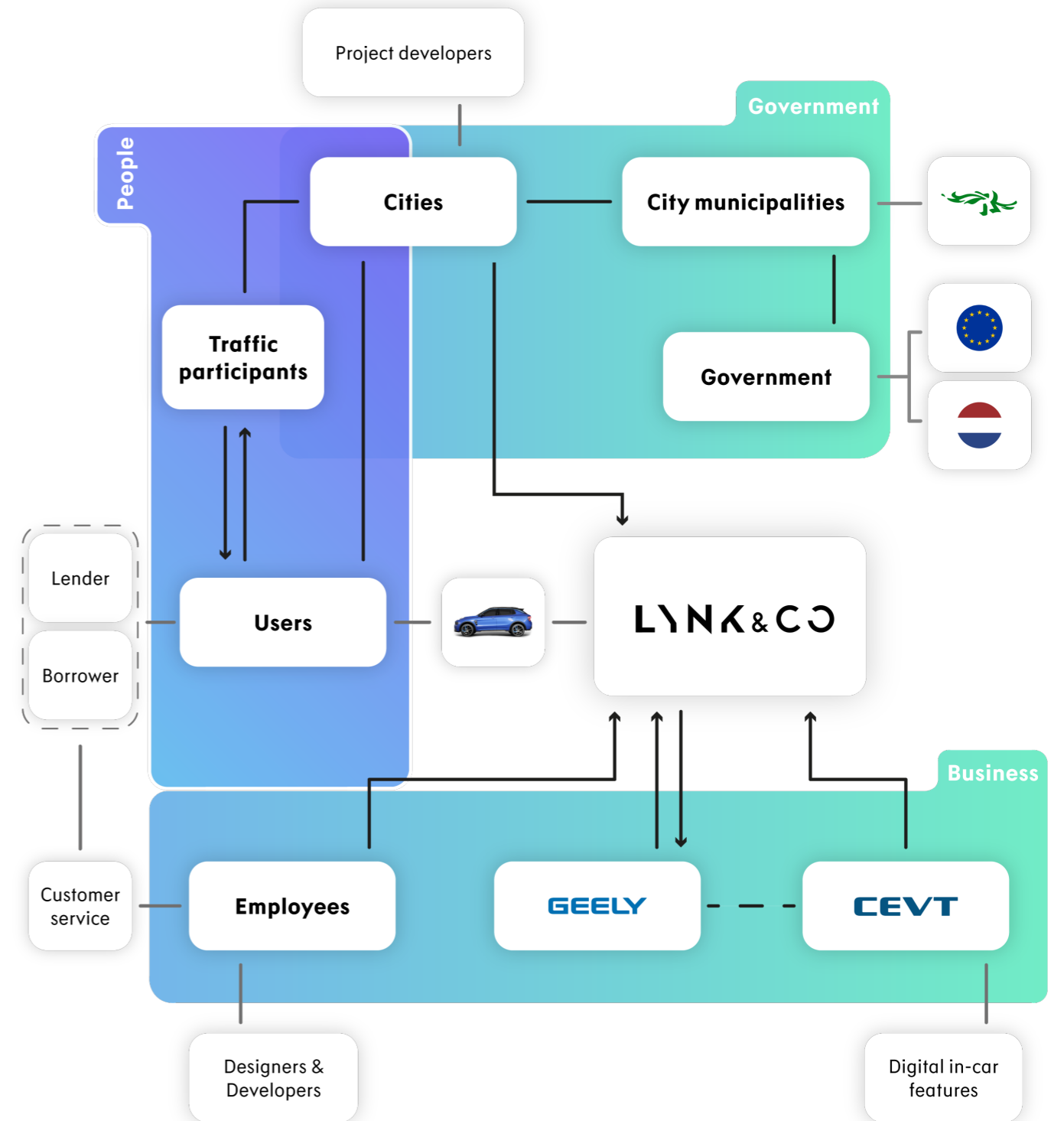

Figure 21: Stakeholder map with relevant players and how they are connected.

3.4 Benchmarking

Benchmarking is done with peer-to-peer sharing services in which trust plays a role and secondly, a benchmark is done with interactive spaces, where cognitive and sensorial ergonomics influence user behaviour. The services that were benchmarked all had some aspects that touch upon the trust and control issue and therefore relate to the topic of P2P car-sharing.

3.4.1 Design for trust

Airbnb is a company that took an interesting approach to sharing highly valuable personal spaces. Airbnb is a platform where people can rent out or share their home or room with someone else. The service can be accessed via digital interfaces: the mobile app or the website, which are fully designed on trust between the host, the one who owns the place and the guest, the one who wants to stay in this place.

An important aspect of this service is the trust and control of the host over the guest. They use different approaches to build trust and tackle the concerns of the owner, the stranger-danger bias. This implies that people trust people they know more (Airbnb, 2023; Auffman, n.d.).

Rating and reviewing
As discussed in Chapter 2.2.2, research was performed on the willingness to trust strangers. This trust issue is approached by Airbnb via a rating and review system. In which the host and the guest have to leave a review after the stay is over. When reviews were added, and people had a high reputation, it became clear that it did not matter if people were different. There is also a difference in the reviews, there are reviews about the person, the staying and how the house is handed over again to the host.

Introduction to increase trust
Before the stay, guests must introduce themselves and explain why they want to book the place. This makes people have more trust and confidence in defining if people are suited to stay. Airbnb uses the design of its digital touchpoints and interfaces to give hints to its users on what to provide and which actions to take.

Personal information
All hosts and guests have a profile in which personal information is stored. The host can state personal information, give interests and provide preferences. It turns the trust issue around, not only hosts can check guests but guests can already see what type the host is and if it will match. It is an interesting approach from another point of view. The host also feels more in control due to the personal information that is provided, as the guests will only try to book when they are more alike or have things in common (Airbnb, 2023; Auffman, n.d.).

Other important aspects when designing for trust are transparency, instructions, reminders, personalisation and grouping. Transparency focuses on the fact that for both host and guest, all the information is shown all the time. Including the price built up and the defined rules for staying. At the end of a booking, there is no doubt and discussion about important things such as costs and regulations.

Personalisation
As a base, there are different types of travel trips: vacation, city trip, beach, adventure or business. Airbnb groups accommodations based on these trips (experiences). The hosts can mention what kind of trips they are open for and will mainly attract these types of guests. Guests can search for specific trips and experiences; this way booking will be more alike and therefore match (Abrahao et al., 2017).

The host can give instructions and provide reminders to the guests. Instructions on what needs to be cleaned and time-related reminders on things they might have forgotten.

All these minor design aspects create a bigger feeling of control along the complete journey. This approach shows that small tweaks can influence the whole experience.

3.4.2 Community

Another comparison is made with Peerby, this is a platform where people can share all kinds of products with others within communities and neighbourhoods.

The interesting part is that the service works in two ways. People can offer their product, a party tent for example. And others can react to this advert if they have a birthday in their garden and want to borrow it for the weekend. However, Peerby also enables people who want to use/rent something to place requests for a certain product at a specific time. They can for example ask in their community, 'I have some shelves to put on the wall, does anybody have a drill that I can borrow?'. This way people actively participate in the sharing and connect more with people in their community (Peerby, 2023).

3.4.3 Interior

An example where the interior is used as a tool to influence the behaviour of different users and is fully connected with sensors and actuators in the interior is the new Mini Cooper Electric in 2025.

Digital interventions
This interior uses the AVN screen together with lights and sounds that are embedded inside the car, to create all kinds of different experiences. These modes can be changed but come with preselected features that are enabled and some of them are disabled and therefore less prominent or not shown, depending on the relevance and need of the task (BMW Group, 2023).

The screen plays a big role for the user of the car, it adapts to the user. Visualises different predefined experiences and shows relevant information. The lights can change colour, but they can also display patterns and shapes to enhance and guide the user even more. Next to that, new sounds are developed that correspond to the driving, the actions that someone takes and the specific experiences. Besides this, a personal assistant is used in the system to guide the user when questions are asked but also out on its own. At last, the phone, just like Lynk & Co, is used as a digital key.

Such an approach to enhancing the in-car experience and influencing the user is interesting to use as a starting point to influence car-sharing users.
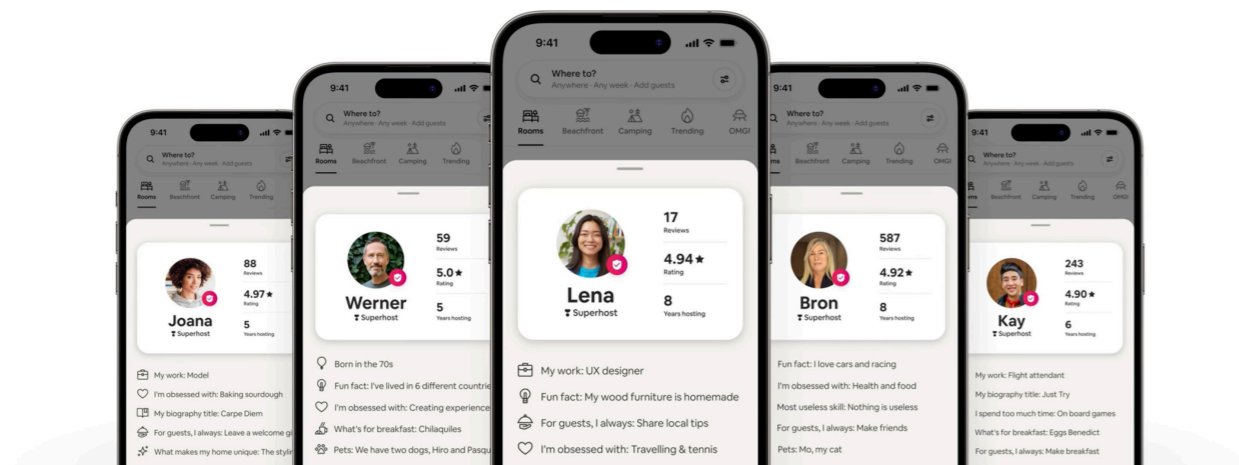

Figure 22: The hostpass to show how Airbnb makes sharing valuable properties and providing trust and control (Airbnb, 2023).

Figure 23: The new Mini Cooper Electric 2025 interior (BMW Group, 2023).

Chapter 04

Interaction

4.1   Construction of Research
4.2   Current Interaction

This chapter is about the interactions the user has with the current car-sharing service. It shows a structured overview of the performed tests. And explains the performed interaction with relevant actions, insights and touchpoints.

4.1 Construction of Research

It is important to fully understand the current experience of the lender and borrower. This way it can be seen where the concerns and pain points are, but also what goes well during the experience.

The research on this experience is split up into a questionnaire, experiencing the car, experiencing the service, and interviews (in this order). Insights about why people want to share or not are also researched via this questionnaire and are shown in Chapter 2.2. This chapter discusses insights related to the journey as a borrower and lender.

4.1.1 Questionnaire

At the start of the project, a questionnaire was done amongst owners of the 01, users of the sharing platform of Lynk & Co and people that never used car-sharing services. This was done to get a first idea of the problems and concerns related to car-sharing.
Questions were based on previous research performed by Lynk & Co (Lynk & Co, 2023a) and first ideas about possible concerns present with car-sharing, based on literature research and initial thoughts.
The survey was distributed through social channels, flyers (Figure 24) and via employees of Lynk & Co who know people who own a 01. The questions and results can be seen in Appendix B.

4.1.2 Borrower experience

After the questionnaire, the service was experienced as a borrower, to mimic the interaction of a real borrower, who was new to the car. The interaction as a borrower of the 01 was performed by two people (including myself), to see which parts of the journey are most relevant and what to ask the owners of a 01 at a later stage during the interviews. First, the journey was tried out by myself. After that, the journey was performed by someone else, to provide the opportunity to make notes, take pictures and gain more insights.

The service scope that was tested went from setting up an account on the Lynk & Co app to receiving the final email with the amount that will be charged to the borrower, so the complete journey for someone who knows that the 01 can be used as a sharing car.
During testing, photos were taken from the interaction and screenshots of the digital touchpoints were used (Figure 25).

4.1.3 Experience the 01

Before testing the experience as a lender, it was important to know all the current features of the car. Just as a real lender, you have to know the car and how everything works. This way it became clear what potential borrowers could touch, access and change.

4.1.4 Lender experience

After getting to know the car. The service from a lender's point of view was performed. Again, with two persons, this way one could perform actions and the other could take photos and take notes. Next to that, this experience is tested in two environments. One outside at a charging station and one inside a parking garage. This was done to not only identify current problems but also problems that might occur when sharing is used in the future portfolio.

4.1.5 Interviews and questionnaire

The interviews targeted 01 owners. They were performed after the complete service was experienced. This way it was possible to know what owners had to perform when sharing their car. And if concerns are the same and if they were experienced among more. During the interviews, questions were asked, based on observations during the experience of the service. Besides pre-structured interviews, there were also spontaneous conversations with 01 owners on the streets. More information about the interviews can be found in Appendix H.
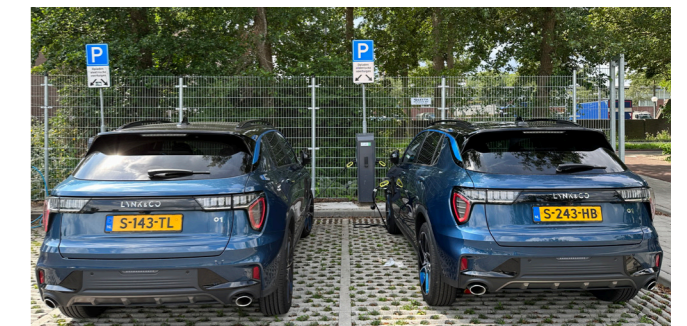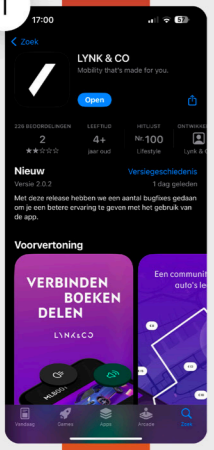

Figure 24: Flyers on windscreen to gather input from 01 owners.

Figure 25: Test setup of experiencing the car as borrower and lender.

4.2 Current Interaction

4.2.1 Borrower interaction

In this part, the tested borrower experience is shown. A chronological step-by-step overview of the most important parts of the current car-sharing experience as a borrower. Including images of the performed actions, related screens and relevant insights supplemented by existing research of Lynk & Co.

01 not connected to charging station

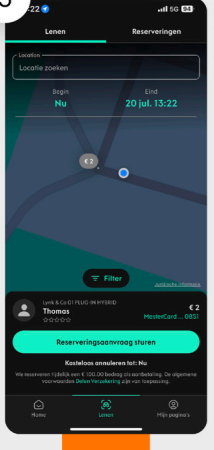**1** Download 📱 mobile app

"Reviews do not look promising..."

2 Open 📱 app

First create an account.

After that, setup sharing with a license check, personal details, payment method and activation of digital key.

3 Send 📱 request

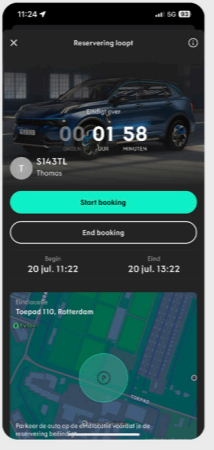Wait to be accepted. When accepted there is a notification and the screen changes.

"Often I get rejected ..."
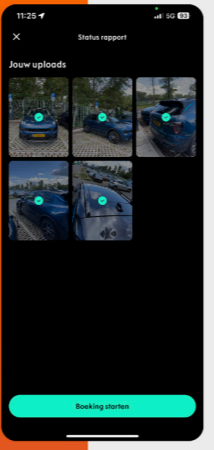
"I'm in!"

Accepted

Rejected

4 Start 📱 booking

Start the booking when near the car.

"Think I can start the booking, not sure what to do else..."

5 Condition report 📱

Borrower needs to take pictures of car to indicate damages.

"Like the rental cars on vacation"

6 Opening 01 📱 🚗

[Participant unlocks the car with the digital key] "Never used it, easy!"

7 Car is connected to charging station 🚗 🔌 💻

Borrower needs to unplug cable.

[Participant stands still for a while] Indicates that he is not sure and in doubt.

Getting card

"Have to check my Whatsapp, we discussed before."

"Must not forget to put this back"

Unplugging from charging station

[Participant first tries to pull out.. not working, tries with card and hears beep]

Unplugging from car and putting cable away.

[Participant just pulls charger (car is unlocked so it works)]

"How do I open the boot? Car looks fancy so must be electric"

[Participant first puts the cable on top, not knowing this hatch was there]

8

Entering the 01 🚗

Borrower enters the 01 for the first time.

"I have no idea where to begin and what I am allowed to touch since it is not my car"

"Looks really good!"

"Would be nice to have some type of guide for questions"

[Participant starts with touching screen via swiping and ticking]

9

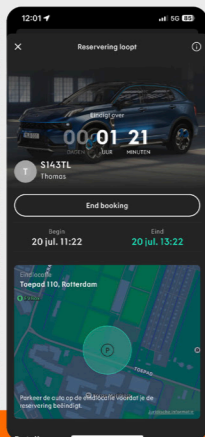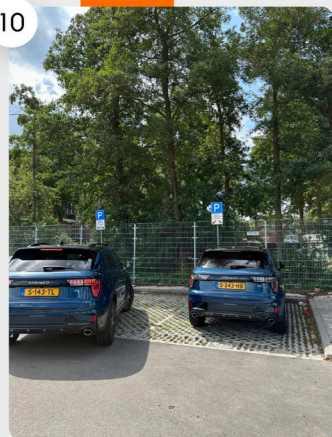### Driving the 01 🚗

[Some struggle with how to operate the car]

[Participant ask a lot about how things work and what is possible]

"Car drives great!"

[Hesitant to try out things]

10

Returning the 01 🚗📱

Borrower needs to return the car in time to a pre-defined spot buy the lender.

"Wait, I need to check the app to see where I have to park."

[Participant looks worried when asked to charge car again]

"Am I in time? What if I'm not?"

11

Charge the 01 📱🚗

"I heard a click sound and the colour switched, which means something happened."

"Is this alright?"

[Participant unlocks petrol filler cap]

[Trouble finding button to open charging port]

"Plugging in I now know."

[Boot opened via button on tailgate, not in car] Indicates that participant is not aware of all features.

12
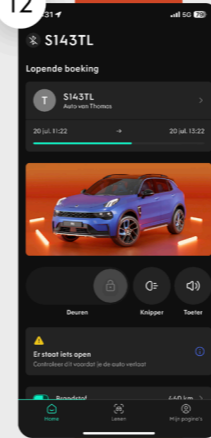
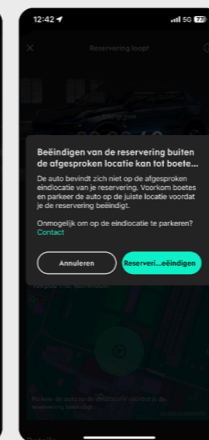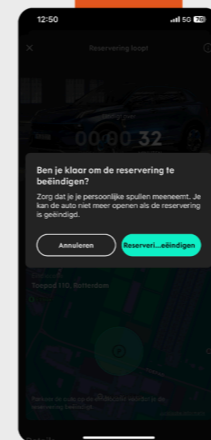### End booking 📱🚗

Borrower needs to close everything and get app to end booking.

"What now? What happens if I end my reservation?"

[Participant looks very stressed and unknown]

[First reaction was to click 'contact']

13

Condition report 📱

Borrower needs to check again for damages.

"What if my battery had died?"

"I did this before, I know how it works"

Review and receipts 📱

15

"Ah this is handy"

"Was this price before?"

"Not sure if I used it to the max and best way possible"

Leaving car 📱🚗

14

Borrower can walk away from the car and the booking is ended.

[Participant forgot to put charging card back]

"Would like to thank the person that I borrowed from."

"Can I just walk away?"

From the performed service interaction several insights emerged. These are discussed below.

Confirmation
The first one is that first-time users, ask a lot of questions during the journey and ask for guidance. They want to get a lot of confirmation of what they are doing. Because the service and the car are new.

Unclear exploration
Secondly, people are afraid to use things. It was found that the borrower does not try everything for fear of doing something wrong. They are not familiar with the car and therefore hesitant to use them to their full potential. This unfamiliarity with the car also sometimes causes the user to use the car incorrectly.

Carefulness
At last, the borrower was very careful with the car. Partially because the actions were not performed alone and thus the participant knew that he was being watched. But also because he did not want to do anything wrong, which could influence the car in a bad way. This personal and close interaction brings a certain carefulness with it.
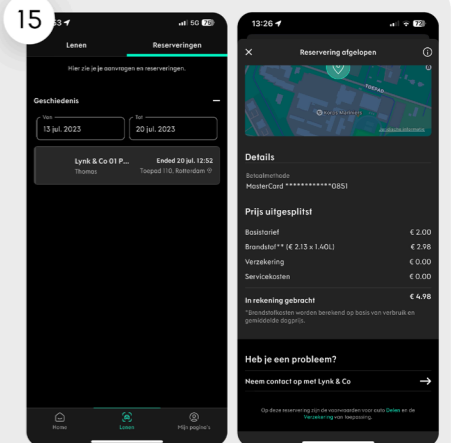
4.2.3 Lender interaction

In this part, the lender experience is shown. Again a chronological step-by-step view of the most important parts of the current car-sharing service from a lender point of view. The experience is supplemented with images of the performed actions, related screens and relevant insights.

1 Setup car-sharing 📱

The lender can set up car sharing. This is done in two parts:

The first part can be accessed via 'get started'. It starts with setting up your personal details, adding an earnings account, adding insurance details (if car is bought by cash) and last set price and equipment.

2 Lender parks 01 🚗📱💻

Lenders parks the 01 and views information in the mobile app.

"Hope this will be returned in the same way."

"Hope this will stay here."

"I can just leave, my settings will stay."

3 Start car-sharing 💻📱

The second part consits of starting the sharing and thus making the car available. Additional information can be provided such as what is available in the car and the price.

This can be done via the mobile or in-car app.

"Would like to give more information."

"In-car app does not do much."

"Will it even be used?"

"Nice that I can give some explanation."

6 Before 📱 booking

User gets updates about the booking on the application screen.

"Can I still change some things?"

5 Confirm 📱 booking

User can confirm the booking by accepting it. Next to that, this page shows all the important details.

"Will it really be back at this time?"

4 Request 📱 notification

User gets notified in app. In the sharing section, user can see new requests.

"Who is this? Is there a picture or info?"

"A request!"

7 Ongoing 📱 booking

User can see limited information about the ongoing booking.

"I have no information at all."

[Keeps checking phone] Indicates curiousity and control

"Can I contact the borrower if needed?"

[Keeps refreshing the application]

"Progress bar is clear"

8 Booking ended 📱

User gets a notification about the ending of the trip by the borrower.

9 Review 📱

User can leave a review based on how the car is returned and the condition of it.

"I still have no idea who borrowed it."

"Not sure what I can rate."

4.2.4 Lender interaction insights

From experiencing the service as a lender relevant insights that are present with lenders became clear. In general the car-sharing system works well (when the connectivity works), such as the information shown and the different in-car user accounts but the full potential of the present systems is not yet used.

Control

Similar to the literature found, the lender has no sense of control. A related example was the fact of constant checking of the phone. There is little to no information about the user, nor is there any data about the car in the mobile app during the booking.

Interaction

Besides that, it became clear that the lender wants to be able to interact with the borrower. Both for the booking to give information but also to be able to answer questions about uncertainties.

11 Return to car 🚗📱💻

User returns to the car and starts to check how it looks.

"I have my own settings again."

[Looks around and checks the car interior]

"See some finger prints."

10 Stop sharing 📱

User can stop sharing and see history of car lending sessions.

"Clear overview."

Chapter 05
Journey

5.1   Persona
5.2   Journey Map

This chapter converges all previous research, observations, and interview insights into a persona and a lender journey. The persona consists of the lender and borrower and shows a representative version of a potential Lynk & Co lender and borrower. In the journey map, the most important aspects of the journey are shown with the related emotions, touchpoints and activities.

5.1 Persona

5.1.1 Research

Before the journey map is created, a persona has been made. This persona reflects a two-way interaction between the lender and the borrower and is based on user research and observations. In addition, it will be used to design for the target audience as it mimics the most common use case of car-sharing.

Location
The persona is representative of highly urbanized areas, city centres and medium-sized cities such as suburbs. It takes place in the city centre because this is where Lynk & Co is highly represented.
An interview is conducted with a consultant shared mobility and mobility hubs within the municipality of Rotterdam (Appendix F). From this interview, it was made clear that in cities, the car is part of a transition in the coming years. From being prominently parked on the streets to being subjected to designing liveable areas where the car plays a secondary role and is parked in garages (Gemeente Rotterdam, 2022). Besides that, the charger is included as this is in line with the future portfolio.

This combination of most Lynk & Co cars in the city and the interesting transition the car will undergo in the coming years was chosen as the default for the persona. Which is visualised in Figure 26 on the next page.

5.1.2 Borrower persona

Since this is a two-way interaction between lender and borrower. The borrower is included in the persona. He is needed to use the car, and if no one borrows the car there is no reason for the lender to offer it.

Living situation
He lives in a city and is at the start of his career. Acquiring a private car is therefore too expensive and he does not have the space to keep it.

Personality
Personality traits of him are that he loves cars and the newest innovative tech products. He is an extrovert and very active in his community. At last, he is determined and serious, due to a lot of things that keep him busy he can be chaotic and tend to forget things. This makes car-sharing interesting but overwhelming.

Car usage motivation
He loves going on road trips during the weekend with friends. And sometimes he needs a car to visit cities for business trips or prefers to use the car instead of the train for longer journeys outside the city.

5.1.3 Lender persona

The lender part consists of a family of two people. They decided to get a car because from experience they know they cannot get everywhere with public transport only.

Motivations for the 01
They have a subscription to Lynk & Co 01 because it is a flexible way to have a private car, as they can cancel it whenever they want without any extra costs. Besides this benefit, the car has a lot of features included as standard at this price (e.g. panoramic sunroof, 360° camera and automatic tailgate). They are no true petrolheads, they see the car more as a means of transport and choose it due to the interior and experience.

Personality
The personalities of both are quite similar. They are acquainted with digital tech and know how everything works in their car, they know all the ins and outs.

Their life is well organized in terms of planning their weeks. They want to have control over everything, their daily life but also bigger things such as their financial life. With their stuff they are organized as well, they know where everything is and are therefore very neat. Inside their house, but also in the car interior, which they want to keep clean.

Both of them are quite introverted, during their hectic lives they love some time for their own. However, they also like to spend time with family and friends from when they were younger and new friends from their neighbourhood. In contradiction to her, he likes cars. He likes the looks of them and is very careful with the 01, loves to keep it clean and good-looking. But in general, they relate more to the car in terms of experiences.

Car-sharing
She shares the car sometimes with friends, but he is a bit hesitant about that. He does not want the car to have any damages or a badly-treated interior.

During sharing they cannot see any information about their car, this is not a big problem as they know how their friends are and behave. But it holds them back from sharing the car with more people.

When they offer the 01 on the sharing platform they get requests from a lot of people, that they reject because they do not know who these people are. When lending the 01 they always give some basic instructions.

Lender Subscribed to a 01

- 🏠 Family of two
- 📅 Middle aged
- 📍 City centre
- 💼 Office jobs (hybrid)

Motivations
Subscribed to a 01 because they want a **flexible** way of having a car. Also chose for the 01 because of all the **features that it has as standard** and they **identify** with the **brand** and the perceived **lifestyle**.

Goals
- They make **environmentally aware decisions.**
- Plan and track their **time** to make it **efficient.**
- Want their **costs** as low as **possible.**
- Actively **participate in the community.**

Car usage
The car is occasionally used during the week for work. In general, during the week the car is only used some evenings for sports or visiting family. On the weekend days, they sometimes go out on a road trip or go to visit friends/family. At last, they use the car for their vacation. Due to hybrid working, the car is by default at home several days a week. The car is also not used every weekend. Besides that, when on vacation the car stands still for multiple weeks. When the car is not used it is parked inside a private garage plugged in the charger.

Personality

Technophile	Tech-savy
Disorderly	Organized
Untidy	Neat
Obeyer	Control freak
Unbothered	Car geek
Introvert	Extrovert

Car-sharing motivation
- When I share my car I have **no information**.
- Car sharing does **not feel personal**, I have no idea **who** will borrow it and how this person behaves.
- I hope the **car will be returned as I left it**.
- I hope they do **not misuse my car**.

- I am **currently sharing** the car with some **friends** and **people in my neighbourhood**.
- I might want to share with others if I have more information about them and the **sense of control**.

Borrower

- 🏠 Living alone
- 📅 Young adult
- 📍 City centre
- 💼 Office job

Personality

Owning	Using
Unmotivated	Determined
Untidy	Neat
Obeyer	Control freak
Introvert	Extrovert

Car-sharing motivation
- Getting a private car is **too expensive**, therefore I want to use car sharing.
- I am **not familiar** with the **car and the service**, which holds me back.

- I frequently ask in the community chat if I can **borrow things**, for me a car seems a bit too much.
- I would **love access** to a car for **certain trips**.

Figure 26: Lender and borrower persona.

5.2 Journey Map

In this journey map, the focus is on the lender. The journey map is combined by insights from people who did offer their 01 and people who have doubts about offering their car on the sharing platform. It is used to find important moments throughout the journey and to identify opportunity gaps.

The service has been divided into different stages. It consists of the activities the lender undertakes and the needs they have in doing so. Furthermore, the journey includes touchpoints to show how users interact with the service and with each other. Also included in the journey is an emotional line, which shows how the lender feels over time. And where the pains and gains are.

5.2.1 Explanation of journey map

On top of the journey map the part of the service is described.
Then there are three main parts, which can be divided into: the activities, the emotions and the touchpoints.

Activities
A title gives a brief description of the activity, which is further elaborated below with some text. Besides the text, there are drawings in which the activities are visualised.

Emotion
The emotion section focuses on the emotions of the lender throughout the journey. Above the middle line, the positive emotions are shown and below, the negative ones. Emotions are combined and represent the most common ones based on user research via the questionnaire from Appendix A, interviews from Appendix H and own observations. They are structured via the Product Emotion Measurement Instrument (PreMo) from the Delft Design Guide (Van Boeijen et al., 2020).

Touchpoints
The touchpoints section shows what the lender uses in order to be connected to the service, or related parts of the service. The touchpoints can be the mobile app, the HMI in the interior, the charging station and the exterior of the car (lights and sounds).
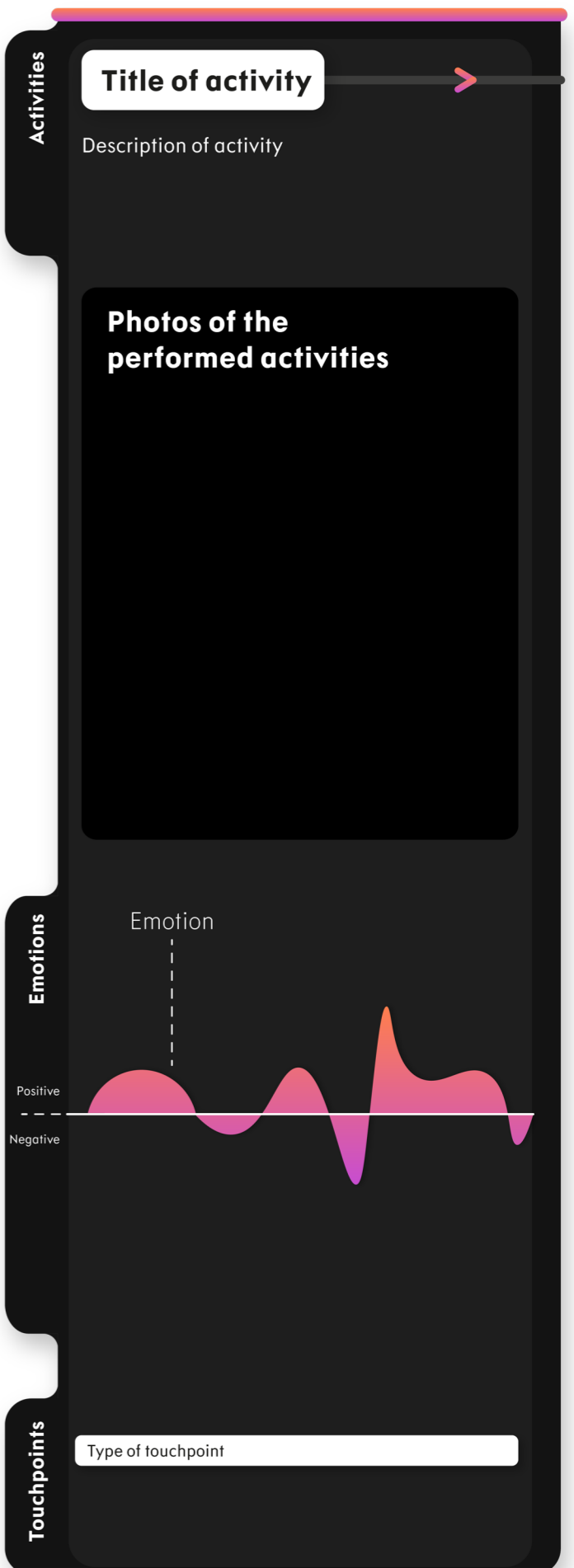
Part of the service

Activities

Title of activity >

Description of activity

Photos of the performed activities

Emotions

Emotion

Positive

Negative

Touchpoints

Type of touchpoint

Activities

Driving the car

The lender drives the 01 to a destination. While using and enjoying all features in the car.

Parking the car

Lender parks the car in the streets or inside a garage.

Plugging the car in

Lender gets the charging card, plugs the charger in the car and in the charging station.
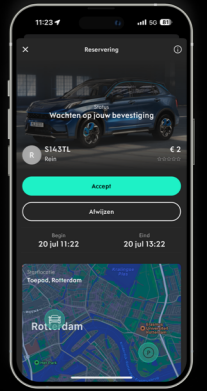
Car is idle

Lender does not use the car for a day or even multiple days.

Setting up car-sharing

Lender can set up car-sharing via the phone or in-car mobile app.

Decide on requests

Lender receives request from borrowers and can decide to share the car, thus accept or decline.

Emotions

Relaxed and joyfull

Relieved

Satisfied

Positive

Negative

Unbothered

Annoyed

Cautious

Touchpoints

Application

Car HMI (interior)

Car HMI (interior)

Car exterior

Charging station

Lending: Ongoing booking

Closing: Booking is ended

Before booking

Lender looks at the phone to view information about the booking.

Ongoing booking: Borrower uses the car

Lender is occupied with other tasks, but starts to worry and get stressed about the car. There is no sense of control, because there is no information in the app, except the booking progress bar.
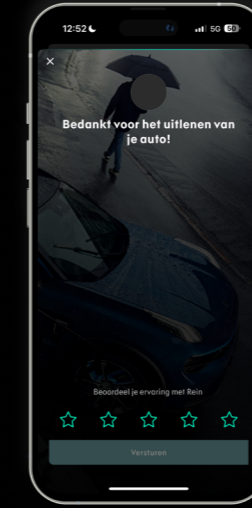
Booking ended

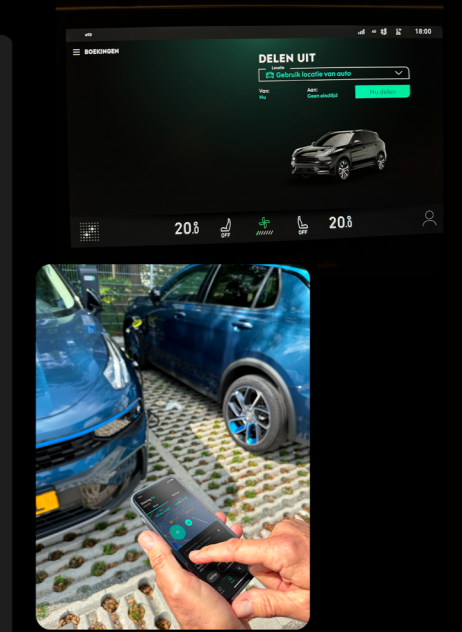Lender receives a notification that the booking has been ended and thus the car returned.

Review and payments

In the app the lender sees what will be paid by the borrower. Besides that, a rating can be given.

Turn car-sharing off

Lender can decide to turn off car-sharing. This can be done via the (in-car) application.

'All information disappears'

Curious

Excited

Unsure

Relieved

Stressed

Car HMI (interior) 🖥️

Car exterior 🚗

Return to car

Lender returns to the car. This is the first time the lender sees the car again and immediately starts to examine the exterior and interior.

Unplug the car

Lender unplugs the car from the charger.

Driving the car

Lender enters the car and checks out how the car is returned. There is some worry about how it has been used.

Curious

Bored

Unsatisfied

Car HMI (interior)

Charging station

5.2.3 Insights

According to the peak-end rule, people judge an experience based on its most intense points and how it ended (Frederickson & Kahneman, 1993). The same goes for this journey map and related experience. It has some high points, with positive emotions but also some deep lows and not an ending with a positive feeling. In conclusion, the lender does not experience the complete service as good and therefore not beneficial.

The most influential points present in the journey map can be categorised into three sections: Stimulation, information and closing.

Stimulation
The first section and intense negative emotion happens at the point where the car is idle. The car is parked, being charged, and available for the lender whenever needed. There is no stimulation for the lender to provide their car on the sharing platform. This possibly leads to the fact that the lender does not share the car on a regular basis. And if the car is provided, the lender rejects a lot of people, which makes the acceptance rate low (Lynk & Co, 2023c). Most of the time they only share with people they know (e.g. family and friends). Rejecting a lot of requests brings frustration to the borrower. Which will eventually lead to less demand on the sharing platform.

Information
Secondly, there is the fact that people have no control or even the feeling of control during the booking. Control about the user, their behaviour and the car itself during the booking. Participants indicated that they do not want to have the exact locations of the car, but the fact that everything disappears makes them stressed.
This also relates to the fact that people cannot interact with each other. This is not only for the lender difficult, but also for the borrower who does not know the car. They cannot ask questions about the booking and the car.

Closing
At last, at the end of the journey, the lender gets back to and into the car and has doubts about its usage of it and how it is returned. Therefore, the experience does not end with a positive emotion. The only indication, that the booking is ended, is the notification when the borrower ended the booking. The money that the lender earns with sharing comes several days after the booking. Besides that, the lender has to take care of the car again, by refuelling, charging or cleaning. Therefore, there are no clear benefits shown and thus sharing feels more like a hassle.

5.2.4 Desired interaction

With these critical journey points in mind, the desired interaction for the lender can be described. This is done via the emotion line from the journey map, which is shown in Figure 27.

The three main differences take place in the earlier mentioned sections that came from the insights.
The first one is where the car is idle. At this moment the lender feels unbothered and is not thinking about sharing. In the desired interaction the emotion should be more neutral and the lender should be stimulated to actively participate in car-sharing.
The second moment is where the lender feels the lowest emotions, in the current interaction, this is during the booking. In the new version, the lender should feel calm and relaxed.
At last, there is the end of the interaction, where the lender should have a high positive emotion by making them excited to perform the same interaction again.
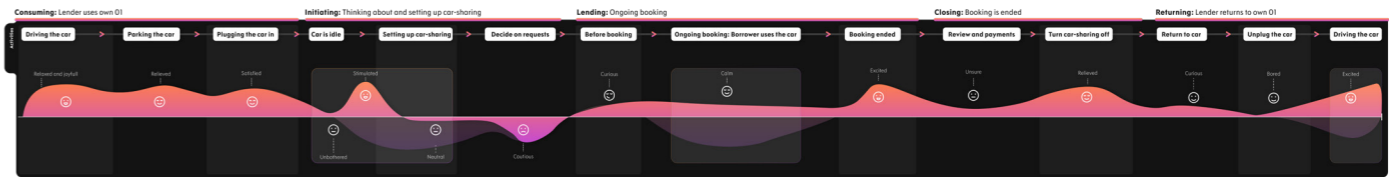

Figure 27: Desired interaction moments for the lender in the car-sharing journey.

Chapter 06
Design Brief

6.1 Summarizing
6.2 Envisioning
6.3 Scope
6.4 Design Direction

This chapter provides a revised design brief. The design brief consists of the design direction, that shows the more specific problem statement and related design statement. The scope gives insight into which part of the journey will be focused on, what the time frame is and what the opportunity gap is. At last, there is a vision with related concept drivers.

6.1 Summarizing

In this chapter, all insights that came from different research methods are mapped out. This is done to see how all relevant insights that were found are connected and what the underlying topic is.

### 6.1.1 Explanation mind map

Mind mapping is a method to create an overview (Van Boeijen et al., 2020). The mind map is built upon different aspects, reasons against providing the car and the concerns that come with this, reasons why people provide their car, and insights from field and literature research that influence the lender's willingness for P2P car-sharing.

The original mapping can be found in Appendix I. For this report, a digital version is made. The light blue 'sticky notes' are reasons why people provide their cars for P2P car-sharing. The dark blue ones are reasons against providing the car. The dark green ones are opportunities or needs. Besides this, the part of the research where the insights came from is shown.

The mind map is shown on the next page in Figure 28, and conclusions are discussed in the next section: 6.1.2.

6.1.2 Key drivers

From mapping all the insights and connecting them, different themes emerged. These themes are used as key drivers for the ideation.

Trust and guidance
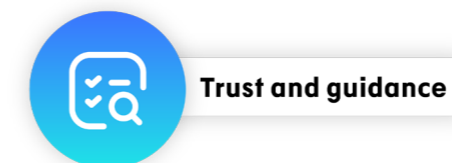
Trust and indication
All lender concerns about providing their car can be generalized into one theme, which is trust. Trust in the user, the usage behaviour and in the system itself. The lender feels responsible for their car and therefore wants to have an increased feeling of control. This control does relate to control during the booking, but also before and even in the end. And in order to gain trust, a better indication of the borrower is needed.
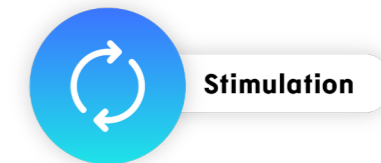
Stimulation

Stimulation
Supply and demand on the sharing platform are closely linked. More borrowers create more car-sharing opportunities for lenders, and when more lenders accept booking requests from borrowers, it makes them return. It is therefore important that the lender has a stimulus and guidance to share the car on a regular basis and thus keeps coming back and being active on the sharing platform.

Critical journey points

Influence critical points
Lynk & Co creates its solutions based on the complete user experience. The car-sharing experience for the lender currently has some points in the journey that negatively influence the overall experience. The ignition of the service, the control during sharing and the ending without a high positive emotion. Therefore, one of the key drivers for the to-be-designed solution is the focus on specific points in this journey.

Product service interaction
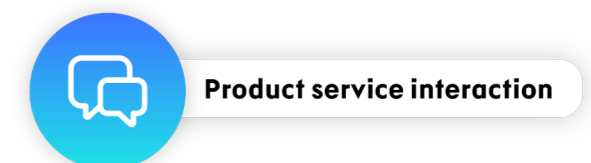
Product service interaction
The last important driver is the complete product service interaction and especially the Human-Machine Interaction, which is about how information from the system is perceived in a visual, haptic or auditory way. This key driver is derived from research but also personal ambitions.
The interior is the space that is shared and thus in which both users, borrower and lender, take place. Besides the fact that in this area the biggest concerns arise, the HMI in the interior also has the highest potential, it can influence both borrower and lender within the same system. Next to that, it is important to include how these interactions are visualised towards the lender.
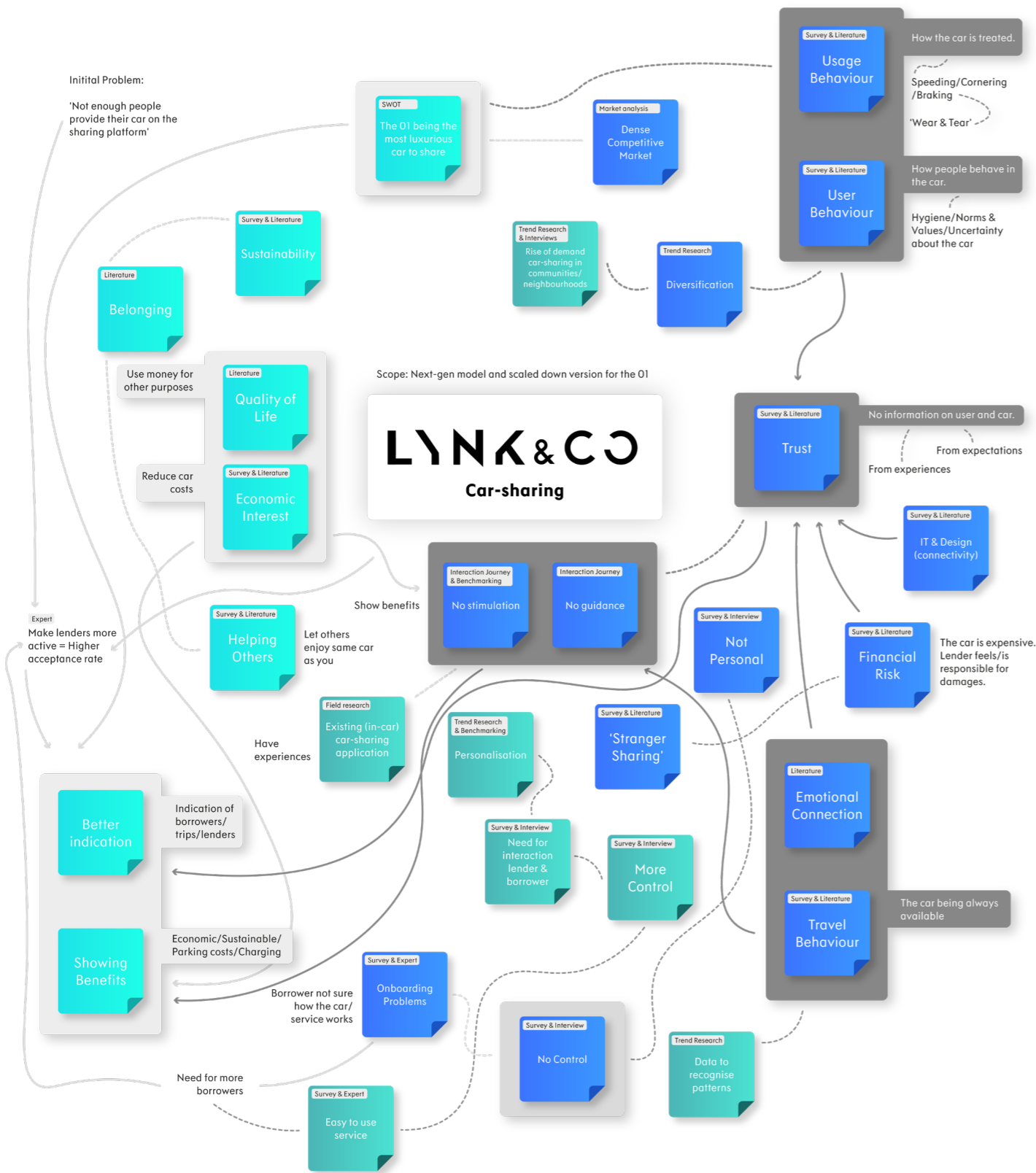
Figure 28: Mind map with most relevant insights from the research phase.

6.2 Envisioning

In this chapter, the vision and the analogy are shown. Both are used to continue with the next phase and start ideation. The analogy helps in communicating the vision to others.

6.2.1 Vision

A vision is an expression of the desired future. Besides giving a future direction, it also functions as a starting point from which will be designed (Hekkert & van Dijk, 2014).

In the vision, the focus is on the lender, as this is the actor present with peer-to-peer car-sharing that decides to take part in car-sharing or not. From the research came that car-sharing at the moment is a hassle, instead of a benefit. The car-sharing experience should therefore be enjoyable, it should not feel like an obligation or extra hassle of things the owner has to worry about and take care of. Providing the car must be something that lenders do not think about and must give satisfaction during and after the booking is ended.

Statement
The following vision statement is therefore conceived:

" Make sharing a privately owned car beneficial, instead of a hassle. "

6.2.2 Analogy

An analogy is used to convey the underlying message of the vision towards stakeholders. It can be found in another domain and is a strong way to clarify the desired interaction (Hekkert & van Dijk, 2014).

The underlying message is described via an analogy. The desired interaction should feel like:

" Bringing your children to their grandparents for a day. "

Doing this is beneficial due to the fact that people feel a certain certainty and safety which makes it worry-free but still controllable. People feel secure as they know how they will take care, they know and trust that everything will be alright or even do a better job. It feels worry-free, which means they do not have to think about it. However, people still remain on stand-by if things go wrong or if help is needed. This can be via direct interaction or via instructions that were provided beforehand. And at the end of the day, after the 'experience' it feels relieving and relaxing.

Product qualities
From this analogy, the product qualities emerge. These are qualities to elicit the interaction, by using these product characteristics the user will experience the use of the product in the way as been defined and envisioned by the designer. The qualities do not describe what kind of product will be designed, but they do develop an understanding of the to-be-designed product at a qualitative level (Hekkert & van Dijk, 2014). The product qualities that come from the analogy are human touch, secure, worry-free, relieved and enjoyable.

6.3 Scope

6.3.1 Place and time

At the start of the project, the scope for the research was already limited to Europe and for the stakeholder, market and user research even to the Dutch market. This was done to be able to include relevant stakeholders and make them tangible in the research phase, while still being representative of car-sharing in Europe.

Place
The scope continued to focus on highly urbanized areas (large and medium-sized cities). This is where most of the Lynk & Co 01 owners live and where the biggest changes in terms of car usage take place. At last, there will be looked at car-sharing from someone's home location. This is due to the fact that the car stands still most of the time at home.

Time frame
For the time frame, it was decided to design the next-generation car. But the current design is used to test and prototype the working principle. By designing for the near future, approximately 3 years, emerging trends and developments, which will influence car-sharing in the future, can be taken into account. This design can be used as a strategy to work towards and adapt the current cars accordingly.
In addition, this coincides with Lynk & Co's future portfolio plans and their shift of focus area. Which is currently only flexibility and will be more on car-sharing.
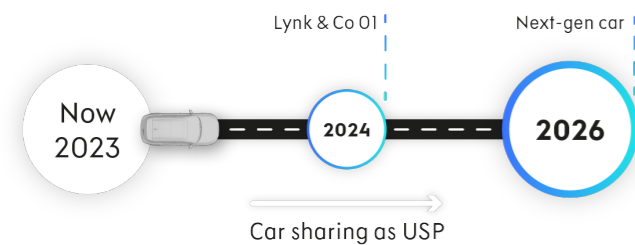

Figure 29: Timeline from now to 2026.

6.3.2 Opportunity gap

To recap, the opportunity gaps that came from the journey map are the stimulation for offering the car, the information during and how the experience is concluded. During the research phase, it was also found that the main part of the opportunity is located in the interior of the car. This is the place where both users take place and where the systems and their connected sensors can potentially use data to influence the user, track behaviour and give feedback. More specifically, the focus is on the (digital) systems in the interior (AVN screen and providing feedback) and the connected touchpoints for the user in the form of the mobile app.

6.3.3 Focus area

Lender
The lender sees the interior as a personal space. They keep personal belongings in it and adjust the settings to their preferences. In this place, all features can be accessed and settings changed. It is the last touchpoint before the lender leaves the car idle for a certain time. Therefore, it has a high potential to influence the lender to provide their car on the car-sharing platform. Not only before car-sharing, the interior and related systems can play an important role but also after the car is returned at the end of a booking. The lender returns to the interior and has doubts about its usage and hygiene. It is the space that brings the negative or neutral emotion when a booking is ended and has the potential to change this into a positive feeling that persuades the user to share again.

Borrower
Focusing on the lender, the borrower cannot be neglected. The earlier-mentioned need for a higher acceptance rate is not only related to the lender but also to the borrower. More returning borrowers on the platform who know how the service works will persuade more lenders to provide their cars more often.
At the start of a booking, borrowers want to get into the interior and drive off. However, in the current situation, people are overwhelmed with all the information and possibilities. Lynk & Co is a unique sharing car due to the level of equipment. The systems and sensors in the interior could potentially influence the borrower during the booking but also at the end of it when the interior is 'handed over' towards the lender again.

Figure 30: Top view of opportunity gap: interior.

6.4 Design Direction

The design direction gives an insight into what will be designed, it is more specified than the initial design statement and therefore provides guidance for the next phases of the project.

6.4.1 Problem statement

This project started with the initial problem statement: "Not enough people provide their car on the sharing platform".
During the research phase, via literature, user and market research and by negotiating with different disciplines the initial problem was specified. The key drivers reflect the biggest concerns of P2P car-sharing amongst lenders and borrowers and led to the new problem statement. From these first two phases, discover and define, emerged a new statement which consolidates into:

> " How to get a higher acceptance rate on the sharing platform, by creating a stimulus, trust and benefit, in order to make lenders provide their car on a regular basis? "

6.4.2 Design statement

The design statement is derived from the problem statement. On the basis it is the same, however, it shows actionable points of the to-be-designed solution. This statement includes and reacts to the What, When, How, Who, Where and Why questions and is based on the WWWWWH Method (van Boeijen et al., 2020).

> " Make the service persuasive for the lender and guiding for the borrower (**Who**) by designing a car-sharing focused concept (**What**) inside the car (**Where**) for current generation cars with the future portfolio in mind (**When**) in order to make the acceptance rate higher (**Why**) by using digital systems and sensors to provide more trust, better user indication and stimulation (**How**). "

This statement is the basis for the next phases, develop and deliver. How stages from the previous phases are connected are visualized in Figure 31.
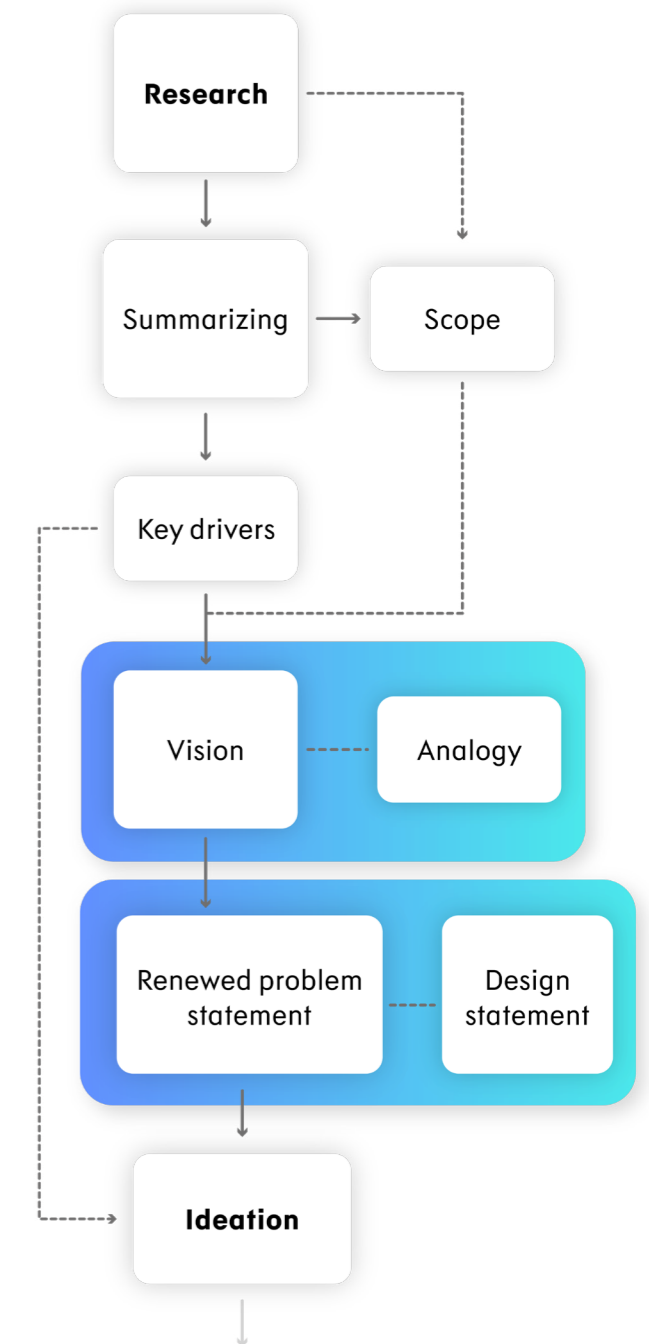

Figure 31: Visual representation of the steps in the redefined design brief.

Chapter 07
Exploration

7.1   Ideation
7.2   Sparke
7.3   Stimulus
7.4   Groop
7.5   Chosen Concept

In this chapter, the idea exploration and related topics are shown and discussed. The methods used for idea generation are elaborated on and the most important insights which developed the concepts are stated. The reasoning behind the chosen concept is also shown.

7.1 Ideation

After the design statement, the ideation phase began. From day one of the project, ideas started to emerge, but this phase explicitly used different methods to generate ideas. The Delft Design Guide (Van Boeijen et al., 2020) was used to find suitable methods: How-Tos, Mind Mapping, Brainstorming, Braindrawing and SCAMPER. During the ideation, the opportunity gaps and user journey are kept in mind, in order to gain valuable ideas. All ideas can be seen in Appendix J.

7.1.1 Methods

How-Tos
The key drivers were used as a starting point for the ideation. Once ideation started, questions arose and How-Tos were used to answer them. How-Tos are problem statements written in the form of questions in order to support idea generation (Van Boeijen et al., 2020). All the How-Tos can be found in Appendix J.

Technology exploration
Another method used during ideation is a technology exploration. This method was chosen to map the relevant technology in the car, in order to know what can be used or not. This whole exploration can be found in Appendix J.

Brainstorming and braindrawing
Along the ideation process, brainstorming is done in order to generate a great number of 'simple' ideas. It is done together with braindrawing, where ideas are drawn instead of written down in text (Van Boeijen et al., 2020).

SCAMPER
At last, SCAMPER is used for ideas that have a high potential. It is a creativity method used in a later stage of the ideation phase, to improve ideas and concepts. It is used via the application of seven heuristics: Substitute, Combine, Adapt, Modify, Put to another use, Eliminate and Reverse (Van Boeijen et al., 2020).

7.1.2 Structure

As discussed in Chapter 6.4 the acceptance rate of bookings needed to be higher, this rate can be higher due to the stimulation of the lender, the trust in the borrower and guidance through the system. Ideas were generated based on these topics, this ideation is an iterative process and therefore difficult to clearly show. The general structure of how the ideation happened is shown in Figure 32. The most promising ideas, which eventually led to the concept directions are shown in the explanations of the concept directions in Chapters 7.2, 7.3 and 7.4.
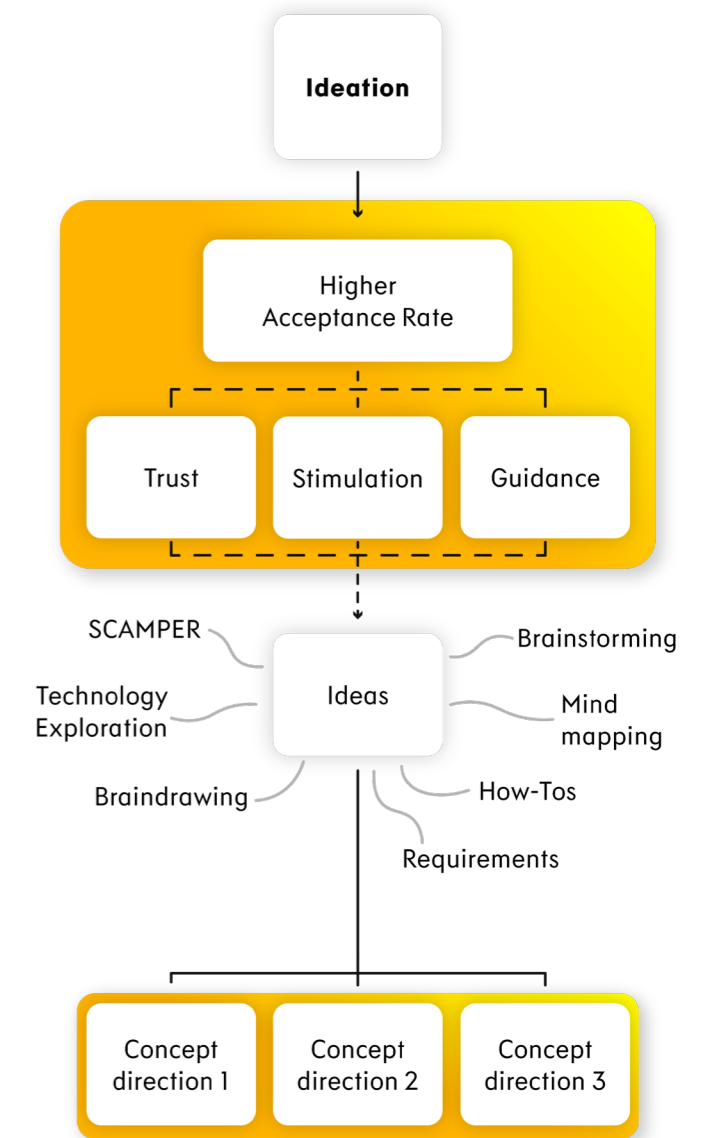

Figure 32: Abstract structure overview of ideation process.

7.2 Sparke

The first concept direction is called 'Sparke'. It focuses on the ability to initiate and stimulate car-sharing from a lender's point of view. This direction responds to two moments in the entire user journey: 'Initiating', the moment when the car is made available, and 'Closing', the moment when the journey is concluded.

7.2.1 Approach

The first important part in the journey, is the part of convincing the lender to make their car available for sharing, how people can be stimulated to do so is discovered via a How-To (Figure 33).
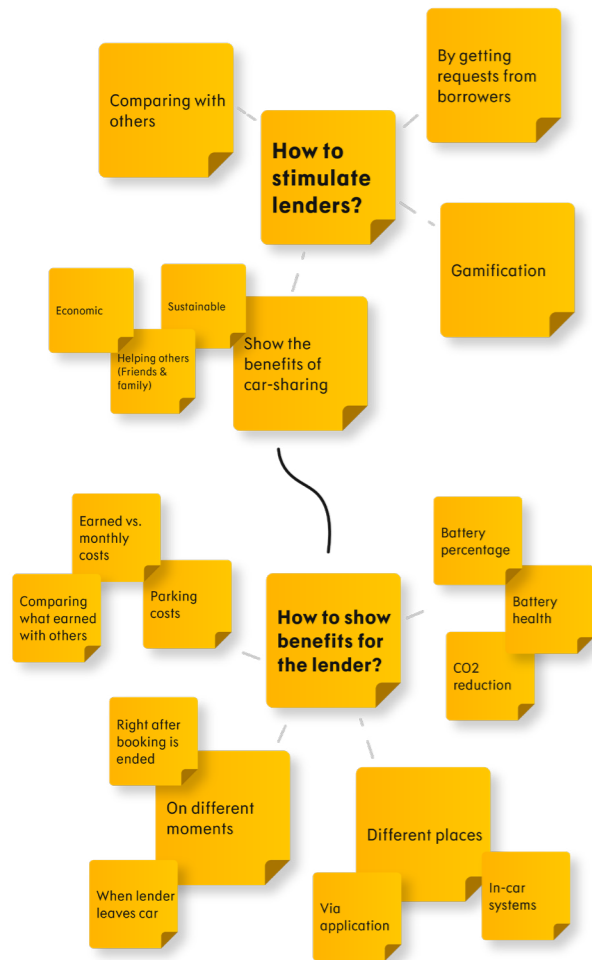

Figure 33: Stimulation How-Tos.

In general, the answers related to different types of benefits and when and where they occur. Based on these answers, several ideas emerged. One of them was to show people what they are able to earn via potential borrower data.

7.2.2 Type of benefits

However, lenders share for different purposes: economic, sustainable or to help others. These reasons were further narrowed down into what they consist of and how that can be turned into stimulations.

Economic reasoning

Lenders with economic purposes can be stimulated by emphasizing what they earn and how this influences their monthly car price, by showing which costs can be reduced or by comparing what they earn with others.
The principle of gamification has been used, using game thinking in a non-game environment in order to create a reward structure that encourages desired behaviour (Winkler & Gomes, 2017). A ranking can be displayed in which lenders can compare themselves to other sharers in the same city/group/neighbourhood.
The gamification is also reflected by showing the total monthly subscription amount (for subscribers) and progression since the last booking.

Sustainable reasoning

For people who share for sustainable reasons, the amount of CO2 reduced can be shown or how much the battery will be charged when the car is returned. It can take the hassle of a low battery percentage to the benefit of it being full by someone else charging it.

Helping others

Helping others can be stimulated by getting requests from people. Borrowers can create requests, consisting of a brief introduction of themselves, why they want to borrow a car and indicate when they need it. These requests create a marketplace, with people asking for a car.
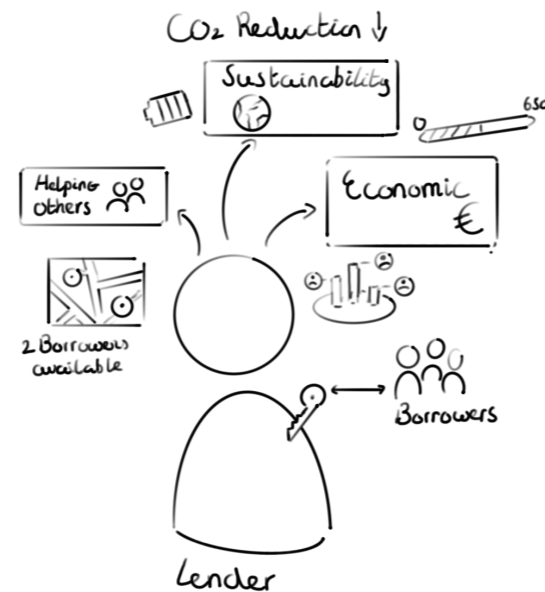

Figure 34: Different types of stimulations.

7.2.3 Stimulation variables

Besides the types of stimulations, it is also important when they are shown. During the field research, it was found that the stimulation can take place on two systems, in-car and on the mobile app.

In-car

The lender can be stimulated when about to leave the car, via the AVN Screen and with audio, visual and haptic feedback on systems present in the car.
With the systems in the car, the ideal moment to stimulate the lender is right before the journey ends or when the lender is about to leave the car. This is the moment when the lender does a final check of the car and is able to take a deeper look at the AVN screen to consider sharing. Audio, visual or haptic feedback can be used to gain attention. The steering wheel could provide vibrations when entering a high-potential sharing area. Lights in the side panel can flicker in order to create awareness.
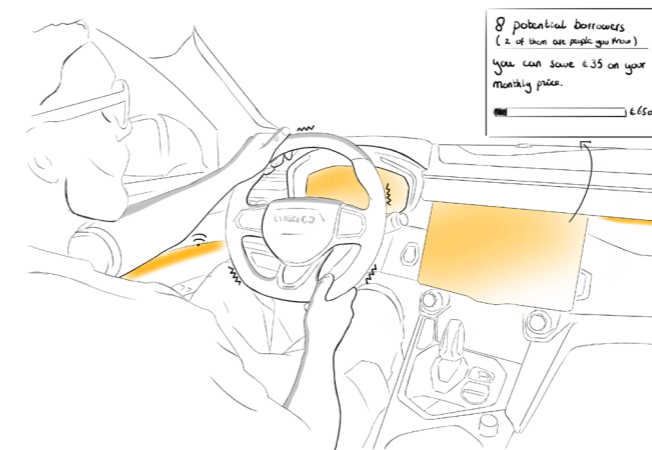

Figure 35: Haptic and visual feedback about car-sharing opportunities.

Mobile app

The other system able to provide the stimulation is the mobile app. When the car is idle for a longer period or by predicting the car usage behaviour based on the past, lenders can be stimulated. People have a living pattern, going to work during the week. The system sees when the car is used and thus patterns are recognised. A suggestion can then be provided to share the car via the mobile app.

7.2.4 Returning

The stimulation influences if people participate in the service but that is no guarantee that people use it again. Therefore, the benefits are also shown at the first touchpoint for the lender at the end of the car-sharing journey. This way, there is a bigger emphasis on the good parts by reminding them.

When the journey ends, the lender can either return to the car or look at their phone. On the phone, the benefits specific to this person are shown by mapping and keeping track of them (e.g. a progress bar that shows the total amount earned).

However, in the car, there is currently no beneficial indication that someone participated in car-sharing. On the AVN screen, extra emphasis can be placed on which benefits were achieved by showing them when the lender takes place in the interior again.

Figure 36: Showing of benefits from car-sharing.

Figure 37: Visual explanation of concept direction 1.

7.3 Stimulus

The second concept direction is called 'Stimulus'. This direction focuses on trust via more advanced profiles and a more comprehensive reviewing system from the user and the system.

7.3.1 Approach

Another important part, connected to the first concept direction Sparke, is how people can be stimulated to accept the received bookings. It relates to the trust and the reward, which in most use cases is the financial benefit. However, there are different approaches on how to increase trust, for this a How-To was used (Figure 38).

Figure 38: Trust How-Tos.

It was concluded that more specific car-sharing information is needed from borrowers in order to create a better indication.

7.3.2 Reviews

A better indication can be created via information about the person and experiences with them. These experiences can be divided into two parts: Personal opinions about the borrower from the lender and how the borrower behaves in the car. The last one is something that the lender has no insights about.

In-car technology
The technology exploration (Appendix J) resulted in different systems and sensors that could potentially be useful for car-sharing. However, the general conclusion was that more driving data can be used for this and even the most simple one will be beneficial.

It was found that the behaviour of the borrower with the car can be tracked by using data about as speeding, braking, accelerating and cornering. Borrowers get a score based on how they behave in the car and can be rewarded for good behaviour.
During the booking, the systems could also provide feedback about the trip score. Which adds to the sense of control over the use of the car for both borrowers and lenders.
The steering wheel was chosen to provide feedback via vibrations. This way, the borrower can focus on the road with the hands on the wheel and there is no confusion with already existing sounds from the safety systems in the car.
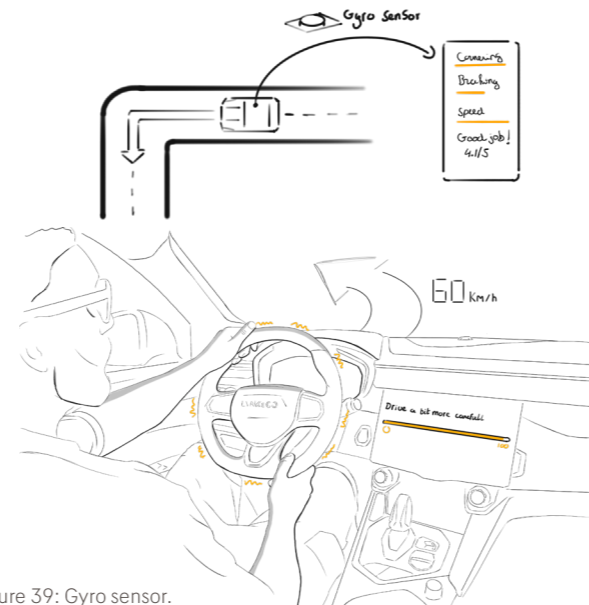

Figure 39: Gyro sensor.

The parts where the lender does have insights into, are how the car looks after it has been returned, the hygiene and how people act before the booking. However, at the moment there is no possibility to review borrowers on these aspects. Lenders can only give a ranking on a scale from 1-5. In order to encourage people, suggestions are given for categories to review (Norman, 2013).

7.3.3 Profiles

These reviews give insight into people who borrow on a regular basis. In order to also get a better indication of first-time users, more comprehensive profiles are made.

Borrower
First, the borrower provides personal information when creating an account. Examples of this type of information are age, location, studies or work and languages. Suggestions will be provided to fill in this information. With all this information, the lender should be able to make a better assessment of this (first-time) borrower. Besides that, it will allow lenders to find people who are similar and thus show similar behaviour (TED, 2016).

The borrower profiles consist of three parts: personal information, lender reviews and trip scores (Figure 40).
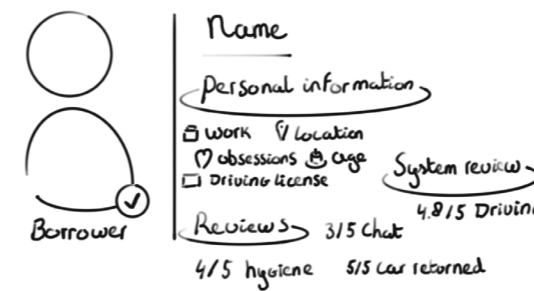
Figure 40: Borrower profile.

Lender
Not only does the borrower have an enhanced profile but also the lender. In order to provide trust for both parties and to facilitate the right match. Besides that, the lender is also able to borrow another car when needed and thus becomes a borrower.

The lender must provide relevant personal information for the borrower (e.g., location) so that profiles are easier to match when searching for bookings, to eventually increase the acceptance rate. To exploit this principle even more, the lender has an introduction about himself.

Figure 41: Lender profile.

Figure 42: Visual explanation of concept direction 2.

7.4 Groop

'Groop' is the third concept direction, it builds upon one of the already strong features of Lynk & Co, sharing within communities.

This concept is approached from another point of view, the borrower. It was indicated that borrowers had difficulty understanding the service and thus participated. Guidance is needed in order to attract them, to get more bookings which eventually increases the acceptance rate.

7.4.1 Group focus

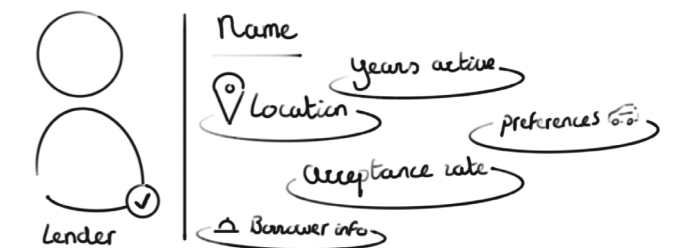This guidance was combined with the borrower indication from the previous concept.
Borrowers could be grouped, based on different trips, experiences and relation to the lender.

Currently, Lynk & Co lenders tend to share more with people close to them: friends, family, neighbours and colleagues.

The first iteration enhances this strong point by giving the lender the opportunity to create their own group on their sharing profile (Figure 43). The group can consist of people who always have access to the car when it has been made available by the lender to share. So, friends, family, neighbours and colleagues can use the car, without having to send a booking request. Instead, the lender gets a confirmation, on which no reply is needed. Because sharing with people close to you is often without economic interest. The price is automatically based on the current fuel/electricity price.
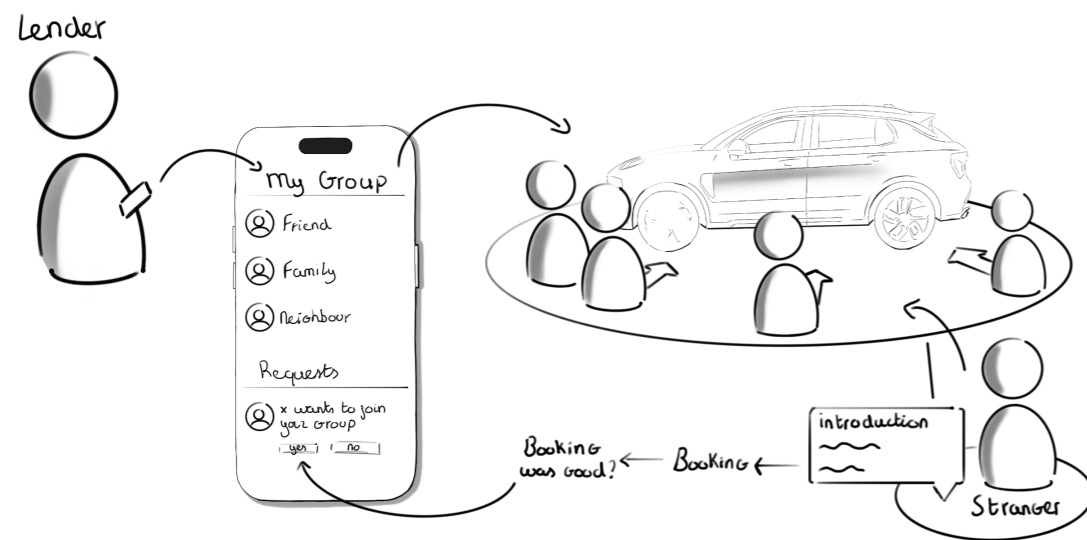

Figure 43: Lender can make own group.

7.4.2 Experience focus

The second part of this concept is based on the fact that if people want to borrow a car there is always a reason for this. Borrowers know beforehand where the car will be used for and where they are going, such as on a weekend trip or transporting large items.

Therefore, sharing with strangers is still possible. The car can be offered to the public by making it available for specific trips.
The borrower can search for a car based on the trip and related experience they want to make. Knowing for what the car will be used, gives the lender a sense of control. The price is also self-calculated by getting data about the duration of the booking, prices of other sharing companies in the area and fuel/electricity prices.

When the booking is successful and the lender is satisfied. The lender could add the borrower to their group, to give the borrower easier and more frequent access to the car.
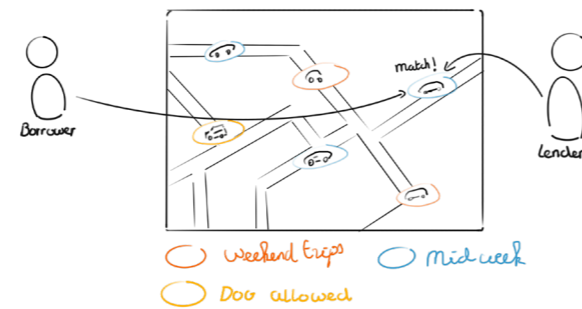
Figure 44: Different trip experiences.

7.4.3 Technology

From the technology exploration other technologies emerged that influenced these ideas and the ability to guide the borrower.

B-Pillar
One of them is the small screen in the B-Pillar, this screen could communicate in different ways with (potential) borrowers in order to persuade and guide them to use the service.

It can see who is near the car and communicate to the borrower concise information about that specific car for car-sharing. Times until when the car is available that day but also which days it can be booked in the near future can be shown.
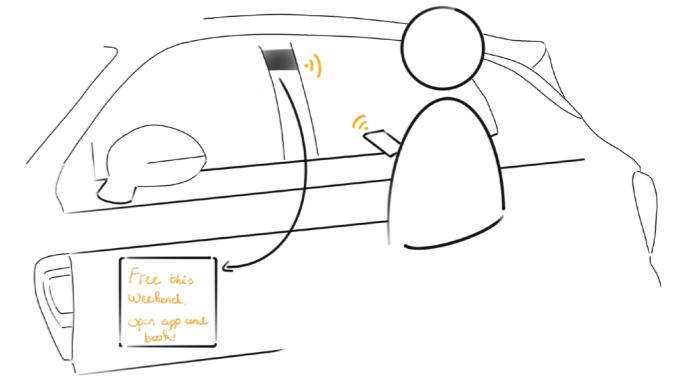
Figure 45: Different communication states of B-Pillar.
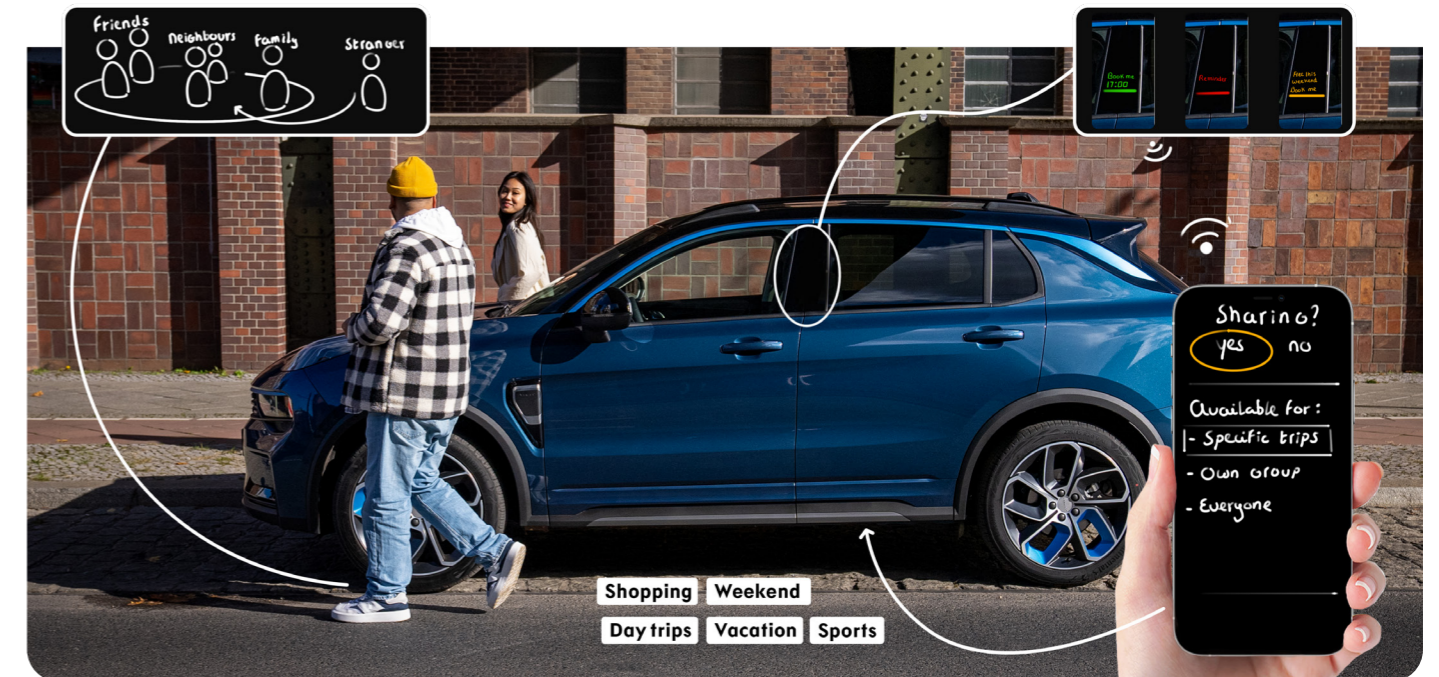
Figure 46: Visual explanation of concept direction 3.

7.5 Chosen Concept

With three different concept directions a decision needed to be made about further devlopment. In this chapter, an explanation of this decision is shown.

7.3.1 Weighted Objectives

The Weighted Objectives method is used in order to decide which concept to further develop. With this method, the three design concepts are compared based on their overall value (Van Boeijen et al., 2020). The method is visualised in Figure 48 on the next page.

Requirements explanation
It was decided to use six different values: Brand Identity, Personal Ambition, Novelty, Stimulus, Trust and End Journey Focus.

The brand identity was chosen because Lynk & Co is very brand-focused. The solution therefore needs to be in line with their values and design.
The personal ambition is about my ambition on what to design. What I find interesting and what is most relevant for my future career.
Then there is Novelty, which was chosen to verify the uniqueness of the solution.
Stimulus is about how the solution stimulates the lender to share their car. It came from the opportunity gap within the user journey map.
Trust also came from this journey map, it has to do with how the solution provides (perceived) trust in the system and borrower.
At last, there is the Focus on how the car-sharing journey ends for the lender. It was concluded that this is a vital point in the whole experience and has a high influence on how lenders experience the service.
The weights were estimated on what is most important for Lynk & Co and for this project.

7.3.2 Discussion

Besides this structured method, the three concepts were also reflected towards the view of experts at Lynk & Co and the supervisors.

General
Concept Stimulus was seen as most general and thus able to help most users. Whereas, Sparke had high potential but many things to work out as it targets different user personas. Groop had some concerns on how to approach it from a legal point of view.

7.3.3 Conclusion

After the scores were analysed. It became clear that the concepts had different strong features, but were all intertwined. The decision was made to continue with a combination of 'Stimulus' and 'Sparke'.

Stimulus has the highest total score, highest potential, and preference from Lynk & Co and myself and is therefore used as the leading direction. It provides more trust for the lender by using a more extensive review and profile system. This complete system is based on reviews from humans and the system. These scores relate to the HMI interaction, as they provide feedback and guide the borrower. However, this direction will be supplemented with Sparke. Because it scored very high on the stimulus and end-of-journey values, something where Stimulus scored less. The digital touchpoints and cognitive ergonomics are used to provide a stimulus for the lender. Besides that, this showing of benefits can also be used to influence the ending of the car-sharing journey.
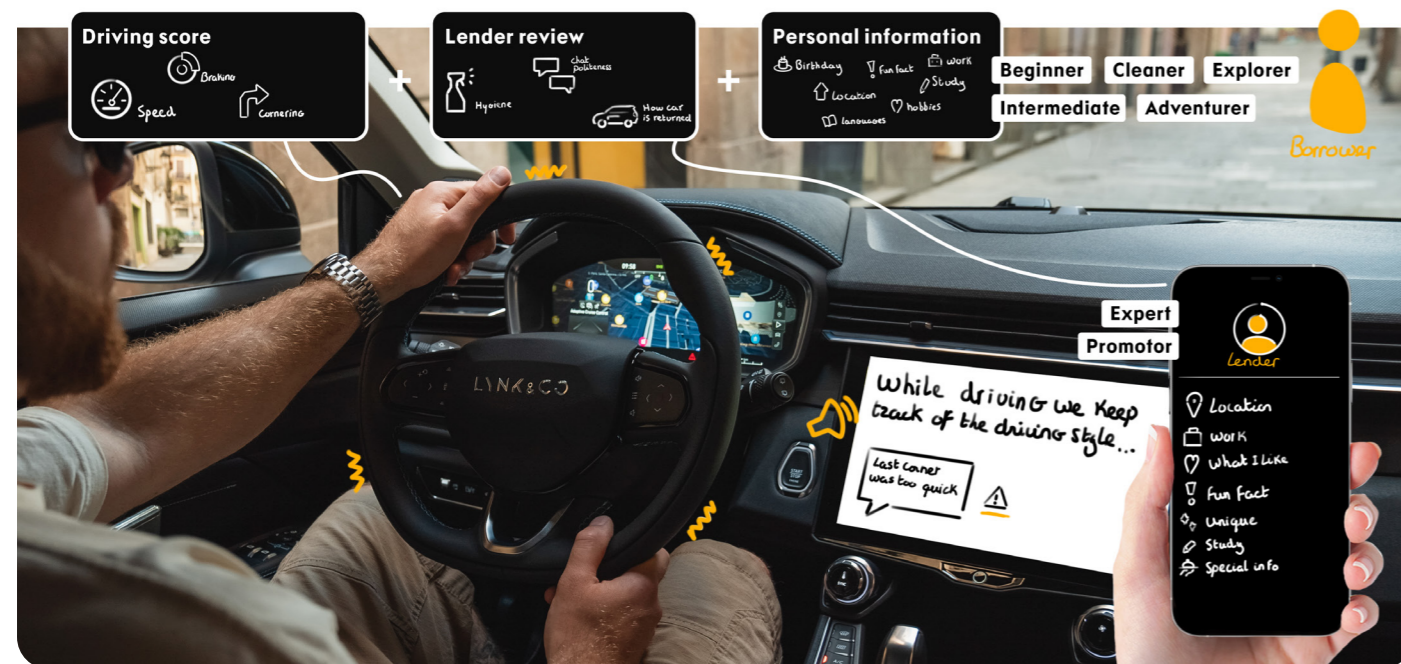
Figure 47: Chosen concept direction.

	Weight	Sparke		Stimulus		Groop	
		Score	Total	Score	Total	Score	Total
HMI Focus	15	7	105	8	120	7	105
Novelty	10	6	60	4	40	5	50
Brand Identity	15	5	75	7	105	8	120
Stimu-lation	20	8	160	5	100	4	80
Trust	20	4	80	9	180	6	120
End of Journey	20	9	180	6	120	3	60
Total Score	100		660		665		535

Figure 48: Results of the Weighted Objectives method.

Chapter 08
Conceptualising

This chapter explains the different parts of the chosen concept: Stimulus. A distinction is made between ergonomics and mobile app design. For both, the previous research is shown, the method of testing with the corresponding results and insights.

8.1 Structure

Stimulus further development is divided into two parts: the cognitive ergonomics and the mobile app design, both of which can be summarised in one service where everything comes together. How this is constructed is shown in Figure 49.

8.1.1 Cognitive ergonomics sprint

The cognitive ergonomics at Stimulus is about the feedback the borrower receives while borrowing a car. This feedback consists of visual feedback complemented by haptic feedback. Haptic feedback should serve as complementary, not primary, feedback (Apple, 2023), therefore the visual feedback via the AVN and DIM in the car is also taken into account.

There are two questions that need to be answered. The first is about communication of feedback to the borrower and secondly, there is the question if tracking driving is seen as a hassle or benefit in relation to the complete service. Respectively the questions are:

" How should the feedback be delivered? "

" Does the trip score make it easier and more beneficial for borrowers to use the service? "

8.1.2 Mobile app design sprint

The mobile app sprint considers the design of the associated screens, that provide information to both borrowers and lenders throughout the car-sharing journey.
The to-be-designed screens can be divided into categories: new profiles, new review system, marketplace and onboarding.

The design and information should contribute to the sense of trust by providing a better indication of potential borrowers.
The final question associated with this section focuses on the lender and is therefore:

" Does the new more detailed system increase the acceptance rate of booking requests? "

Finally, how everything comes together in the new concept has also been designed.
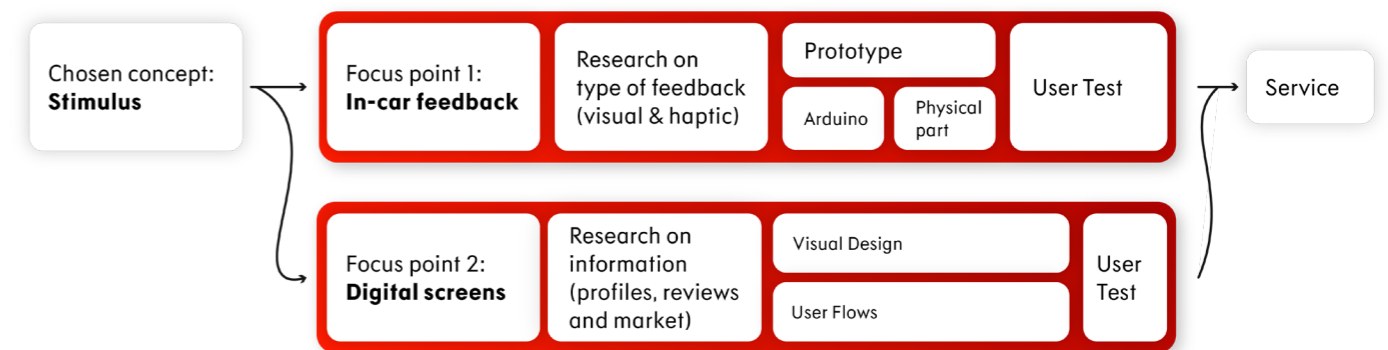
Figure 49: Structure of the focus points of the chosen concept.

8.2 Ergonomics Sprint

This chapter is about the development of in-car cognitive ergonomics. Because a part of Stimulus is the haptic feedback to inform the borrower about their driving behaviour.

8.2.1 Haptic feedback

Haptic feedback uses touch (vibrations) to communicate with the user (Ultraleap, 2019). In Stimulus, the borrower is informed about their driving behaviour via this form of feedback.

Haptic feedback explorations
First, different forms of haptic feedback are explored. In general, they could be divided into success, neutral, ongoing, failure and warning. It was decided to take two different types to reflect on the driving behaviour: 'success' and 'warning'.
Haptics are physical metaphors. A physical metaphor is essentially how a person interprets the semantic meaning of a physical interaction (Baker, 2019). This shows that both vibrations must have a distinct shape. The 'warning' is a staggered vibration with high intensity and the 'success' is an ascending vibration where the intensity varies. Thus these vibrations are different in frequency and amplitude, visualised in Figure 50.
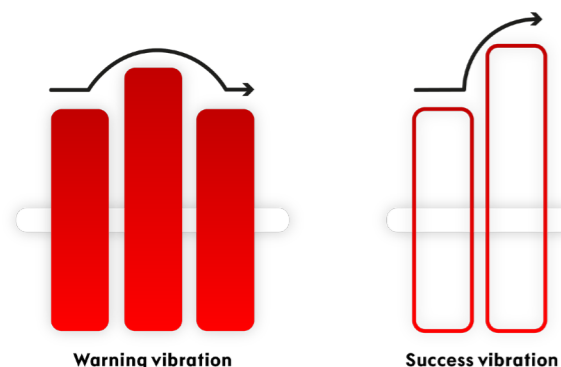

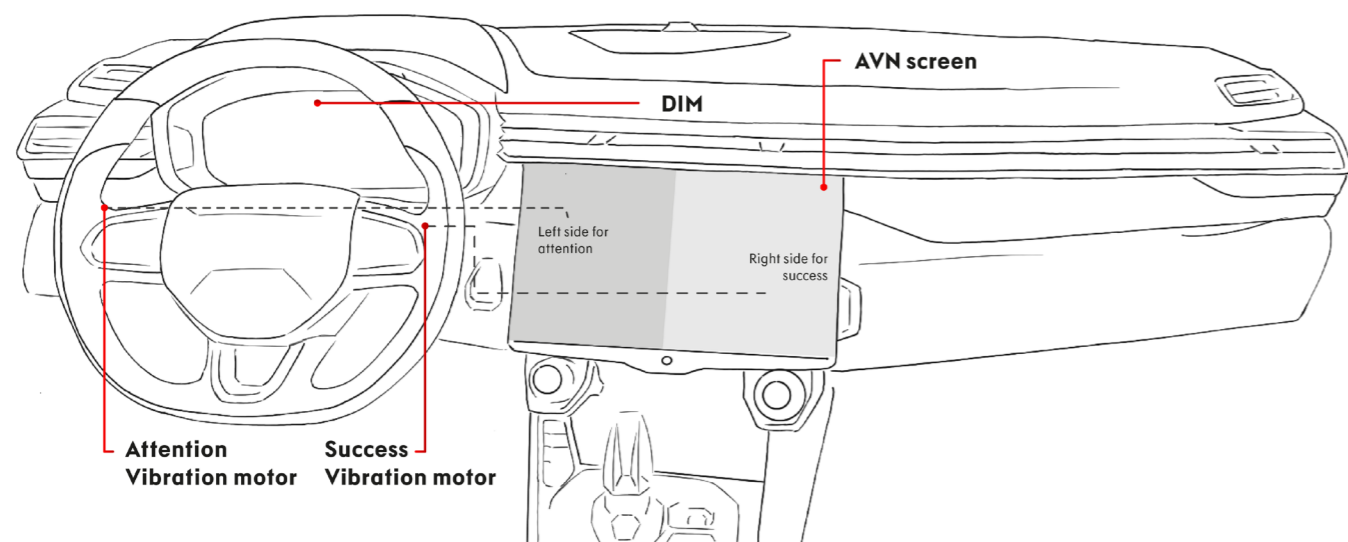Figure 50: 'Success' (right) and 'warning' (left) patterns (Baker, 2019).

Figure 52: Location of vibration motors on the steering wheel and how they are reflected on the AVN screen.

Feedback timing
Besides the type of vibration, it has been considered when the feedback should take place. Four elements were chosen for the test: hard braking, sharp cornering, quick acceleration and speeding (Figure 51). This is because these actions increase the wear and tear of the car and can be dangerous.
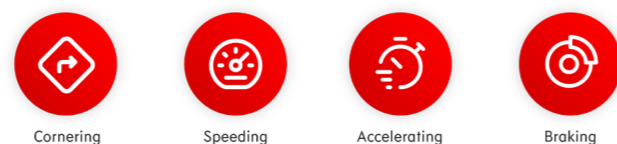

Figure 51: Actions that will be taken into account in calculating the trip score of the borrower.

Mapping
After deciding the types of feedback and their timing. It was found that the vibrations could be even more useful. This was done via mapping, which is having a clear relationship between controls and the effect they have on the world (Norman, 2013).

The 'warning' vibration is located on the left of the steering wheel. This way the visual feedback will be shown on the left of the screen. The 'success' vibration is located on the right side of the steering wheel as this corresponds with the location of the feedback on the screen. The screen that shows the corresponding information is the AVN screen, how everything is located inside the car interior is shown in Figure 52.

Steering wheel prototype
For the test, a prototype was composed of two separate prototypes.
One prototype is the steering wheel with integrated vibration motors, as shown in Figure 53. This prototype needs to communicate the haptic feedback towards the driver.
The motors are placed in a way that the participant does not feel them, in addition, they are hidden behind fabric (Figure 54). The wiring is concealed behind the dashboard, as shown in Figure 55.
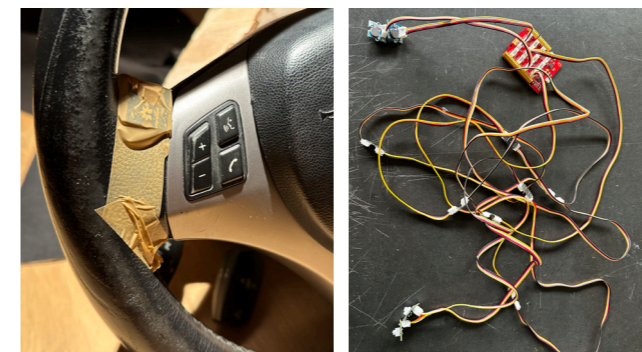
Figure 53: Steering wheel prototype with the location of the vibration motors and wiring.

Figure 54: Steering wheel prototype with the covered vibration motors.

Figure 55: Wiring behind the dashboard to make the steering wheel prototype work.

These motors are controlled via buttons by the researcher from the rear of the car. The controlling works via a code that was programmed in Arduino (Appendix K).

In-car
The prototype was built into a car, as shown in Figure 56. Furthermore, a video screen (Figure 57) was used with a video made by IPG Carmaker of a driving car through a neighbourhood, showing situations that potentially could influence the driving score: cornering, braking, acceleration and speed.

Figure 56: Steering wheel prototype embedded in the car with the Arduino code.

Figure 57: Picture of steering wheel built in the car with the test setup on test days.

8.2.2 Visual feedback

Besides the vibrations, the borrower also receives more comprehensive information about driving behaviour while driving via the AVN screen.

Design
For the test, the existing widgets were used and two different designs were created for these to show on the screen (Figure 58). These designs build on the current design where the 'driving score' is added as a widget. The first design corresponds to the idea that feedback is given after each action. The second one only provides feedback when the score is influenced and thus works over time.

Figure 58: AVN screen prototype for scenario A (top) and B (bottom).

Figure 59: Animations in the Driving score widgets for scenario A (top) and scenario B (bottom).

Screen prototype
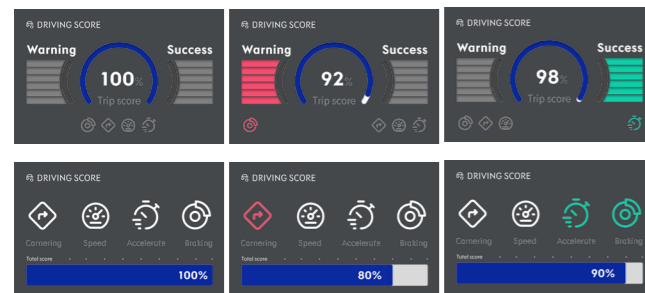A digital screen in the form of an iPad has been used and built-in (Figure 60), like the Lynk & Co 01's AVN screen it is the same size. It is controlled from a distance by the researcher, to show the correct screens in relation to the driving action performed. These screens were created via Figma.

Figure 60: iPad screen with the digital prototypes from Figma.

8.2.3 User test

To investigate which way of providing feedback to the borrower is preferred, a test was set up.

Method
For this test, it was chosen to do an A/B test, a randomized controlled experiment to compare two versions of the haptic and visual feedback (Gallo, 2017).
One version is where the feedback is delivered after every action performed in the car. The other version is where feedback is given after a certain amount of time, with a big drop in the driving score, and reflects on what went wrong or good over that period. Each scenario took around 8 minutes. How this test procedure looks can be seen in Figure 61.

Besides this, the Wizard of Oz method was used to conduct this test. This is a method where participants interact with a system that they believe to be autonomous (Geison, 2019). The researcher was located behind the participant to steer the system.
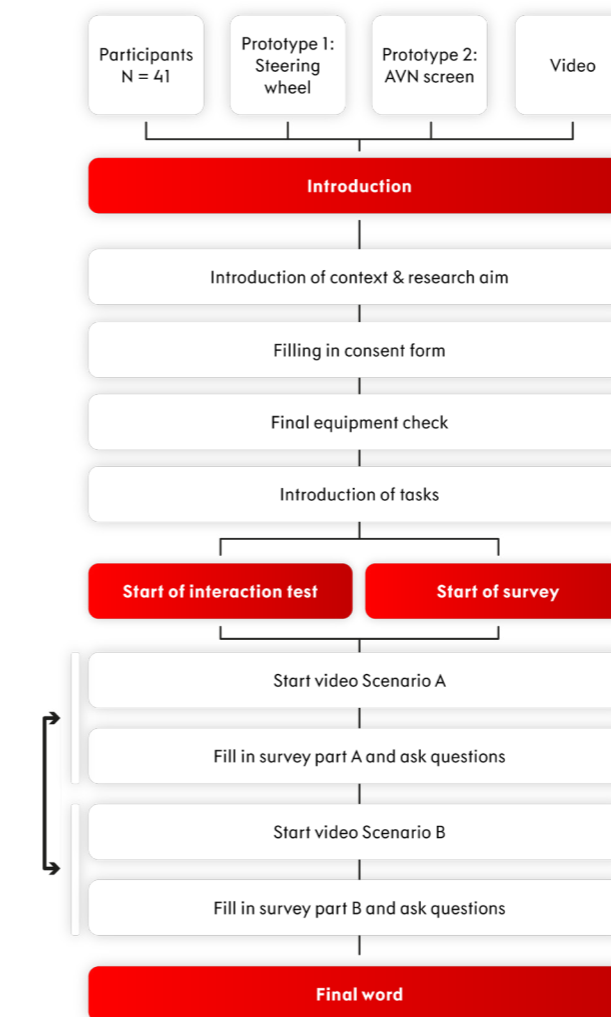
Figure 61: Diagram of test procedure.

Participants
The requirements for participants are that they were familiar with driving and fell within the target group of car-sharing (around 20-30 years). 41 participants took part in the test, of which 39 had a driving license. These were mainly students, with 25 men and 16 women participants, in the 18-30 age group. The group that is most open to car-sharing. To ensure that not all participants were from the same group, passers-by from a higher age group were also asked to participate. This allowed to see if there was no big difference in responses by age group.
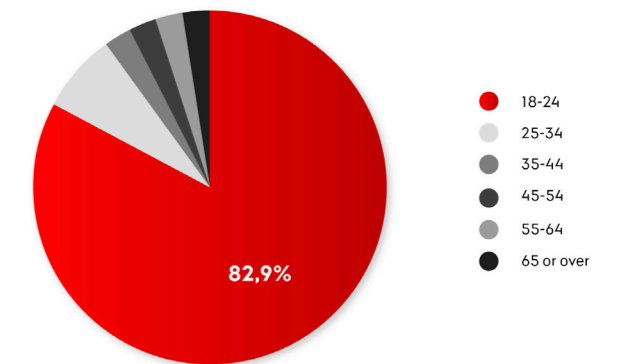
Figure 62: Division of participants.

Test setup
The test setup used beforehand is shown in Figure 63. In this top view, the location of equipment and people is shown. Besides that, it can be seen how the wiring goes.
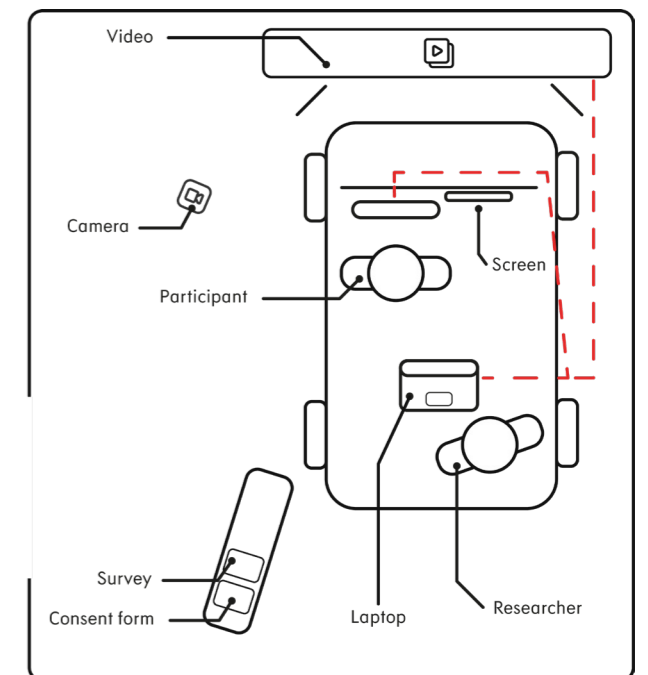
Figure 63: Test setup.

8.2.4 Insights & Conclusions

Several insights emerged during the test, this section explains the most interesting ones with the conclusions in relation to the design. The insights are divided into the vibrations, the visual part and the concept in general and the complete survey can be seen in Appendix L.

Haptic feedback
The vibrations while driving were generally not perceived as disturbing, for both scenarios A and B (see Figure 64). However, people did have to get used to it at first. It was also indicated that, as in scenario A, the vibrations will become annoying on longer journeys and could therefore become distracting and simultaneously feel patronizing.

Scenario A - The feedback during driving was disturbing

Totally disagree | 51,2% | 19,5% | 29,3% | Totally agree

Scenario B - The feedback during driving was disturbing

Totally disagree | 53,7% | 14,6% | 31,7% | Totally agree

Figure 64: Results on the question if vibrations disturb while driving for both scenario A and B.
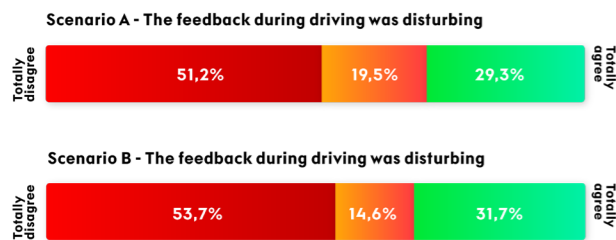

'I believe this was more wrong'

Figure 65: Participant reacts to 'warning' vibration.

It was also found that for most people the success vibration was not very easy to distinguish from the warning vibration (Figure 65). Some of the participants immediately linked the vibrations to already existing vibrations within other mobile apps and were therefore able to identify a clear difference.

Scenario A was most motivating
Haptic feedback will stay after every wrong driving action.

Scenario B was least disturbing
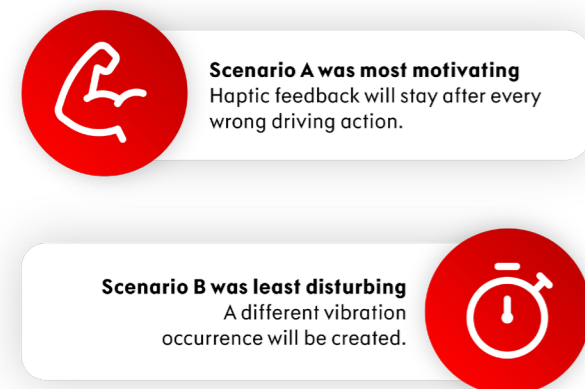A different vibration occurrence will be created.

Figure 68: Points that will be taken into account in the design of the haptic feedback.

Participants therefore indicated that they thought the two different vibrations were gradations in how wrong something was. And expected visual communication via the progress bar to become more red, when something worse happened.

The vibrations in scenario A were seen as more motivating than in scenario B (Figure 66). A frequently mentioned reason for this was that the vibration comes immediately after a driving action so it was more clear what needs to change.
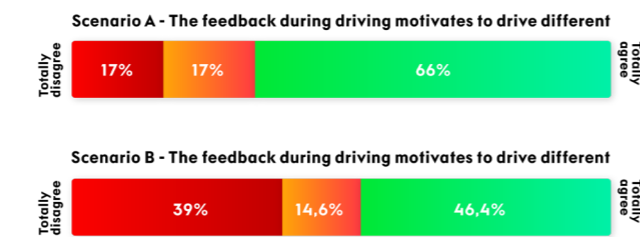
Scenario A - The feedback during driving motivates to drive different

Totally disagree | 17% | 17% | 66% | Totally agree

Scenario B - The feedback during driving motivates to drive different

Totally disagree | 39% | 14,6% | 46,4% | Totally agree

Figure 66: Results on the question which scenario motivates more to change driving behaviour.

'Must be that corner.'

Figure 67: Participant thinking out loud and indicating what he thought went wrong.

From these insights, a number of conclusions can be drawn in relation to the vibrations. That will be incorporated into the design.
It was found that the vibrations from scenario A, i.e. giving feedback with every action, were most clear and most motivating while least annoying. The vibration with each action when something goes well will be deleted, it was not that clear, not really needed and does increase the number of vibrations significantly. The timing and occurrence of the feedback will therefore be changed in the new design.

'Success' vibration
This vibration will be deleted. Because its function was unclear.

'Warning' vibration
This vibration will be enhanced and therefore able to take different intensities.

Screen time
During the tests, it became clear that in the first scenario of the two, which was A for some participants and B for others, people looked relatively long to the AVN screen (Figure 69).
They wanted to see what information was shown, which resulted in less focus on the road and thus less safety.

[Takes 6 seconds to find the information]

Figure 69: Participant looking at the AVN screen for a long time.

Visual part
Questions were also asked specifically about the visual feedback of both scenarios A and B. It was indicated that the feedback from scenario B was clearer than A, see Figure 70. Even after participants started with B and then did A, they still felt that A was not clear enough.
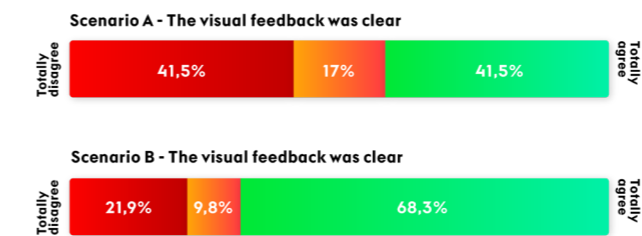
Scenario A - The visual feedback was clear

Totally disagree | 41,5% | 17% | 41,5% | Totally agree

Scenario B - The visual feedback was clear

Totally disagree | 21,9% | 9,8% | 68,3% | Totally agree

Figure 70: Results on the question on how clear the visual feedback was for both A (top) and B (bottom).

Scenario B visual parts
This widget will be continued, the AVN will serve for detailed information.

Long AVN screen time
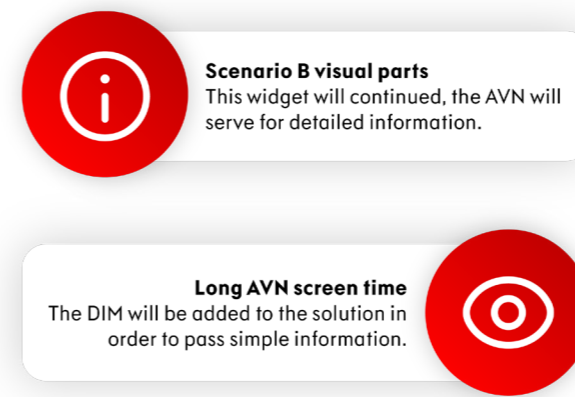The DIM will be added to the solution in order to pass simple information.

Figure 72: Points that will be taken into account in the design of the visual feedback.

When asked why, several answers emerged which can be clustered into a number of themes, shown in Figure 71.

Colours
Easy to link type of vibration to colours
Red and green very clear to differentiate
Colours were linked to driving actions people just took

Icons
The icons need some explanation beforehand
Icons do not really stand out
Icons in combination with everything else is too much to absorb

Score bar
Difficult to link how wrong a driving action was
Score bar was clear as it stands out
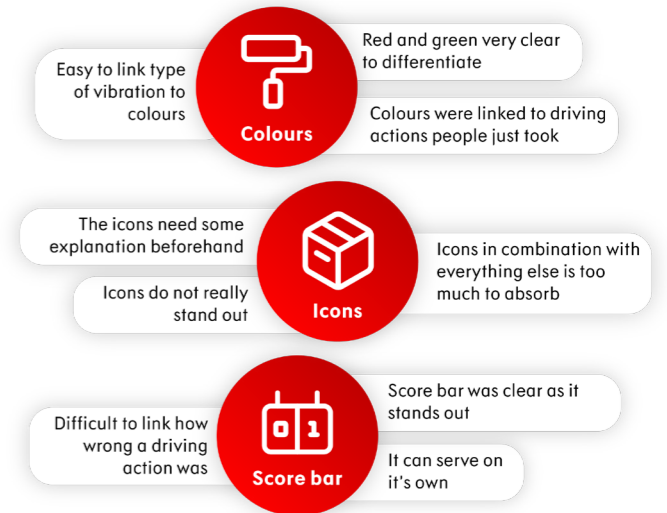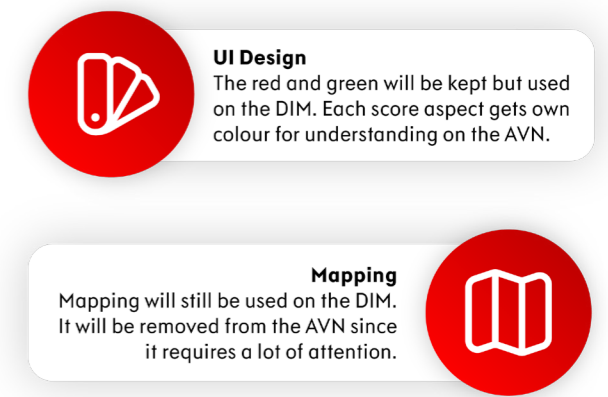It can serve on it's own

Figure 71: Clustered reasons about the visual feedback.

These insights result in changes in the design of the widgets on the screen. The AVN screen will still be a part of the solution but will contain more detailed information. The DIM will be added to the solution. This screen is easier to look at, while still looking in front of you. It can provide the simple information directly to the user.

With the addition of this screen the design changes as well. It was also found that all the information in one place and at the same time is a lot to absorb and process. Therefore, there will be a change in their location and timing. However, the colour scheme worked well and thus will be continued. The icons were clear after some time and will therefore be added as well. On the AVN screen users will still see how good they were performing. At last, the mapping will still be used but will shift to the DIM with a different working principle.

UI Design
The red and green will be kept but used on the DIM. Each score aspect gets own colour for understanding on the AVN.

Mapping
Mapping will still be used on the DIM. It will be removed from the AVN since it requires a lot of attention.

Awareness

For the majority, the vibrations were a signal of feedback and helped to attract attention (Figure 73), but for some, the link was not made right away with the driving score.

Vibrations - The vibrations helped to get notified during driving
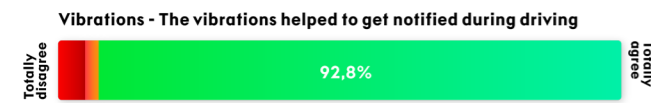
Totally disagree | 92,8% | Totally agree

Figure 73: Results to the question if the vibration helped participants to get notified about their driving actions.

In almost every test, it became clear that people did not know right away how the vibration was connected to the whole concept and that it was linked to something happening on the AVN screen. To not surprise and scare people an explanation of the service is needed.
When people book a car and get into it, they just want to drive away so this is not the right time to explain it. For the design, this means that onboarding should take place before people get into the car, i.e. through the mobile app.

Service

Beyond the specific questions about the feedback, there were also questions about the service in general.

Gamification
The progress bar motivated people to improve and will therefore be continued on the DIM. Each icon gets an own progress bar on the AVN.

Figure 75: Points that will be taken into account in the design of the service.

People were asked whether they see the tracking of driving behaviour as a benefit to them. After all, tracking driving behaviour is something new and also something that is not entirely seen as a benefit for the borrower at first sight. Because it can be associated with a declined feeling of privacy. Nevertheless, participants indicated that they believe it is beneficial (Figure 74).

Driving score - Believe that a driving score helps to get a car booked

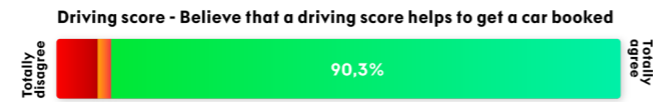Totally disagree | 90,3% | Totally agree

Figure 74: Results on the question if a driving score is seen as a benefit for borrowers.

Apart from the benefit people think they get out of it by getting a booking accepted more easily, another thing stood out. Most people saw the system as a game, they wanted to get the bar with the corresponding score as high as possible. It corresponds with the initial idea of Nissan, to use a progress bar that reacts on how sustainable someone drives. This way people tend to drive more economically in order to get the progress bar as full as possible (Nissan, 2020). This principle is also used by Lynk & Co in their 01. This idea of gamification will be developed further in the solution (Figure 75).

Onboarding
People need information about the driving score and working principle before the booking is started.

General

When asked whether people are willing to have their driving behaviour tracked and shared with lenders and the company, there was a surprisingly large majority who said 'yes', this can be seen in Figure 76.
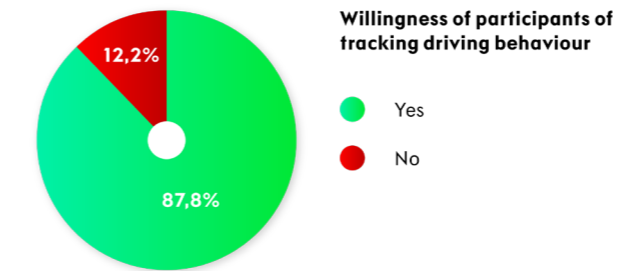

Willingness of participants of tracking driving behaviour

12,2%

87,8%

- Yes
- No

Figure 76: Results on the question if people are willing to let a compnay track and share their driving behaviour.

What is also interesting is to see that people with a higher age do not differ in their opinions. The opinions in favour and against are shown in Figure 77.

In favour

Trade-off
Benefit of being able to drive a car is bigger than the downside of being tracked.

Don't care
People related this with cookies. "If it makes me able to use the service why not?"

Ownership
People indicated that they would like to know this info if they share their own car. "It is not my own car."

Lender perspective
People mentioned it is beneficial for the lender.

Personal data
Participants did not see this tracking as perosnal.

Against

Downgrade in pleasure
This way driving is solely seen as a functional thing. "It affects the sense of freedom and living."

Exposure
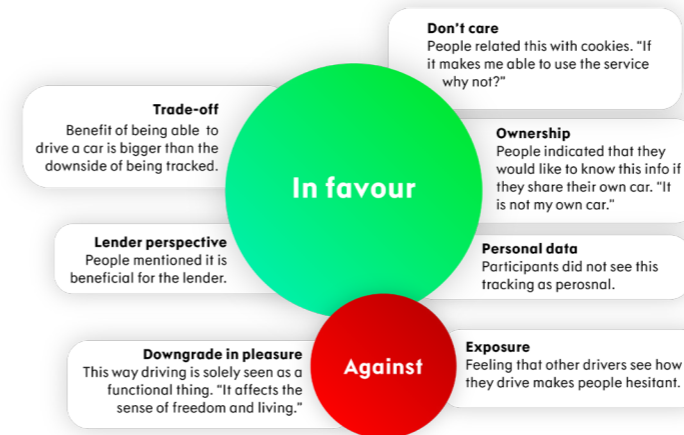Feeling that other drivers see how they drive makes people hesitant.

Figure 77: Clustered reasons about the willingness in tracking and sharing.

All these conclusions will be taken into account during the iteration of the concept. How these findings influenced the final design is shown in Chapter 9: Showcase.

8.3 Mobile App Sprint

The information obtained from tracking the borrower's driving behaviour will be communicated to the lender via the mobile app. This chapter therefore looks at the development of the screens in the mobile app.

8.3.1 Hierarchical Task Analysis

At the beginning of this sprint, the current app structure was explored through a Hierarchical Task Analysis (HTA). This made it easier to see how the app is currently structured and what logical places for Stimulus to build on further in the current mobile app. Figure 78 shows the HTA and where the new screens are added within this HTA.
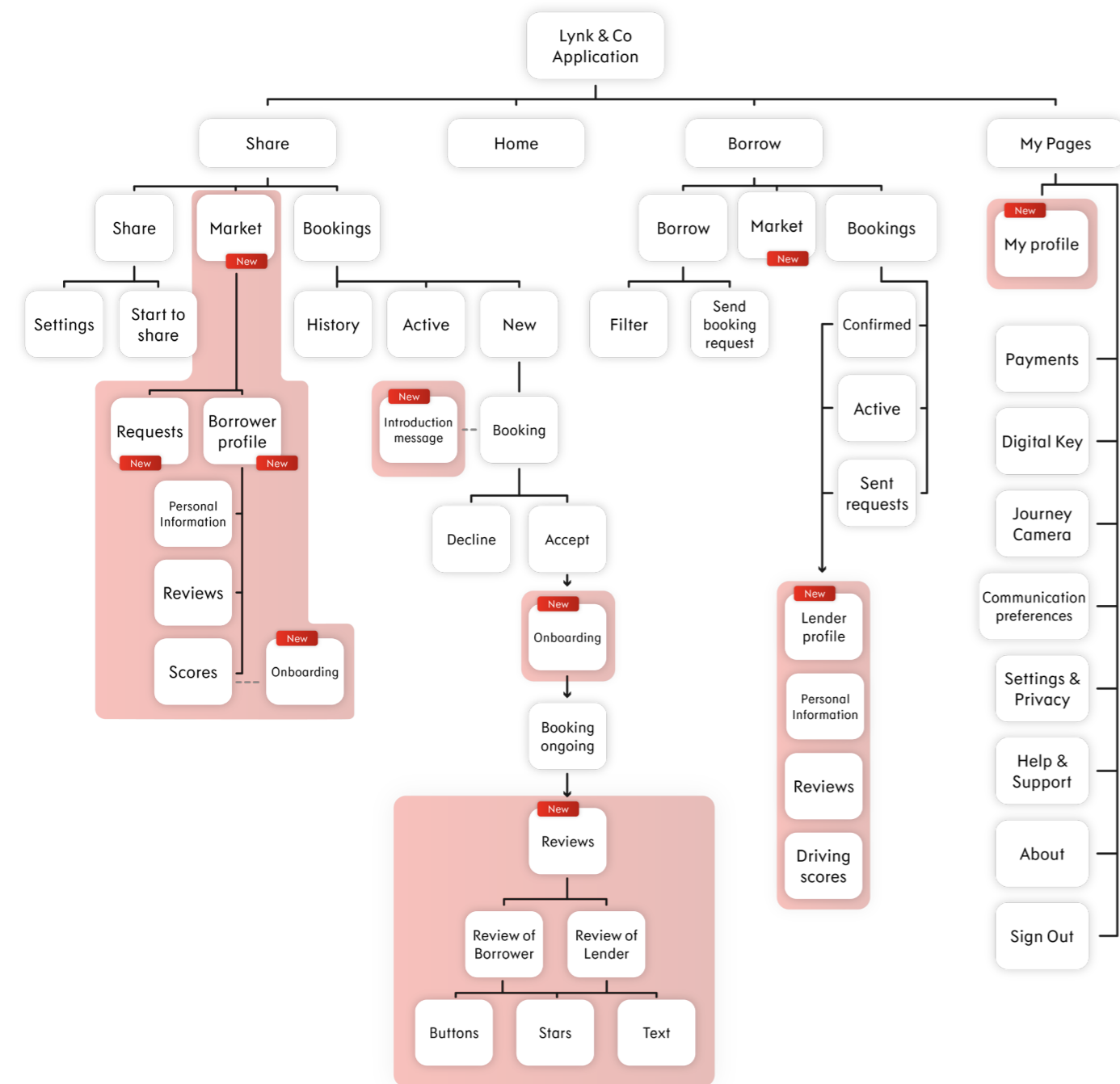
The concept Stimulus has several topics that should recur within the mobile app.
A renewed more detailed profile for both lender and borrower is developed. In this profile the trip score is included. There is also a more detailed review system that follows after the booking and is also part of the new profiles. Next to that, there is an entirely new 'market' section, in which borrowers can place requests to borrow a car.

Some parts of this HTA will be discussed in Chapter 9: Showcase, including the onboarding.

Figure 78: Hierarchical Task Analysis of the Lynk & Co mobile app.

8.3.2 Review system

Another part of the current service that changes with Stimulus is the review system. In the current system, a rating can only be given through a 5-star rating system, as shown in Figure 79. The rating is based on a person rating the experience on a scale of 1-5 (Scarbrough, 1975). Besides that, people can voluntary add some comments in the form of text.
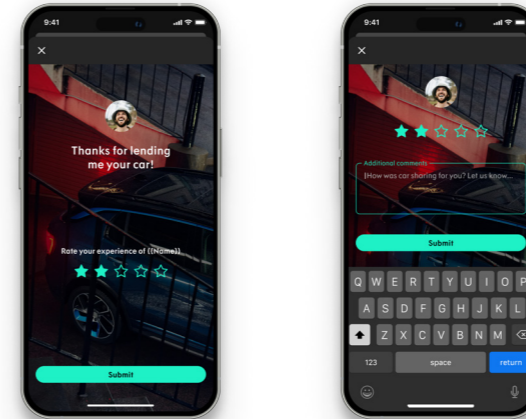

Figure 79: Current review system in the mobile app.

That is because most users only give the rating via the stars, and no additional specific information about the booking is provided. The current system does not give enough insight about the user and important parts related to sharing a car.

Test
A different, more comprehensive, system was designed for Stimulus. Mobile app screens and user flows were prototyped via Figma and discussed with an expert. The first user flow (Figure 80) is based on stacking information on top of each other. This way the review can be started with the easiest one built upon this. The second flow (Figure 81) focuses on limiting information overload and showing each review part separately. This way every step feels mandatory. The third flow (Figure 82) shows all the information simultaneously.

Figure 80: Review system user flow 1.
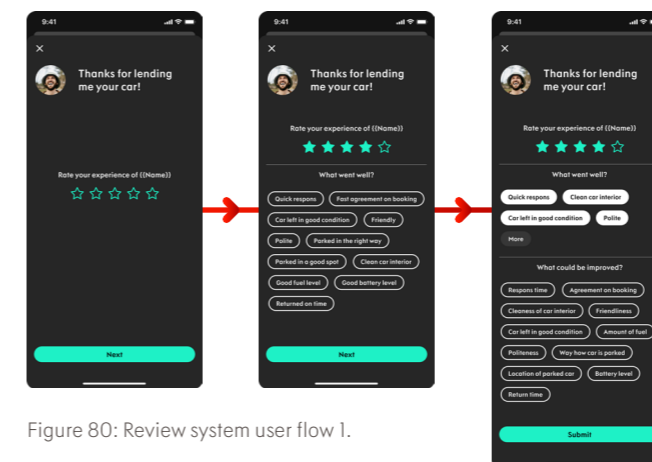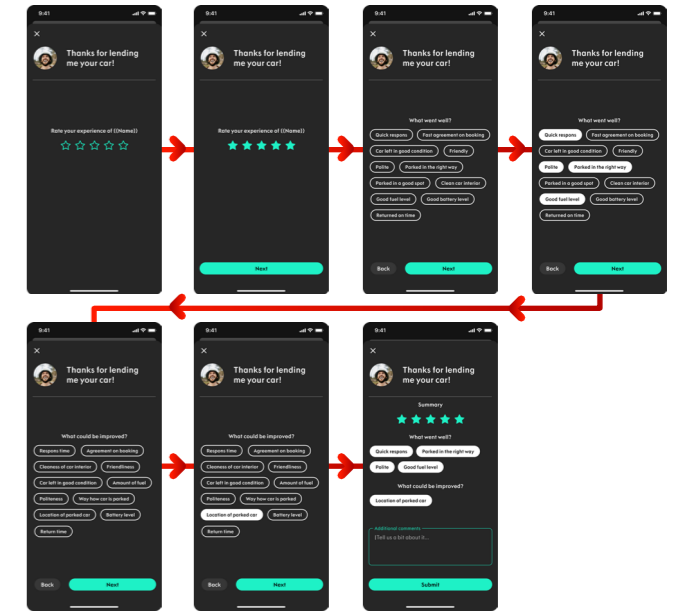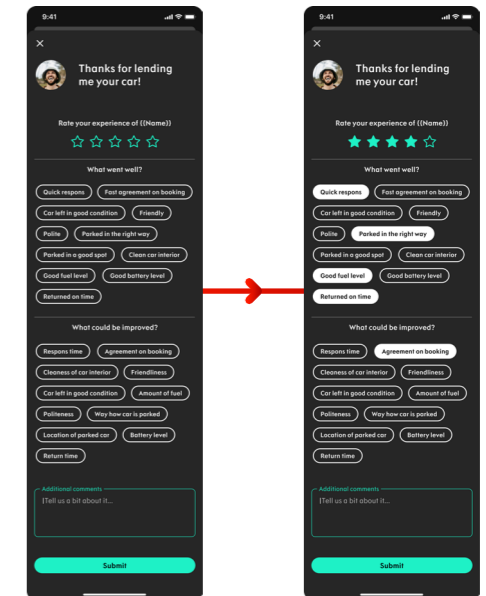

Figure 81: Review system user flow 2.

Figure 82: Review system user flow 3.

Insights
During the expert discussion, it was found that user flow 2 works best in order to get the more detailed review. Besides that, suggestions were provided for the 'chips', these are the words that can be selected to mention what went well or not. These findings will be used and showed in Chapter 9.

8.3.3 Profiles

The scores and reviews belong to a person and are therefore linked to their profile. But current borrower and lender profiles only consist of a name, photo and reviews in the form of stars (Figure 83). Next to that, the profiles cannot be clicked to access more information about the specific user. For this project, the borrower profile was designed.
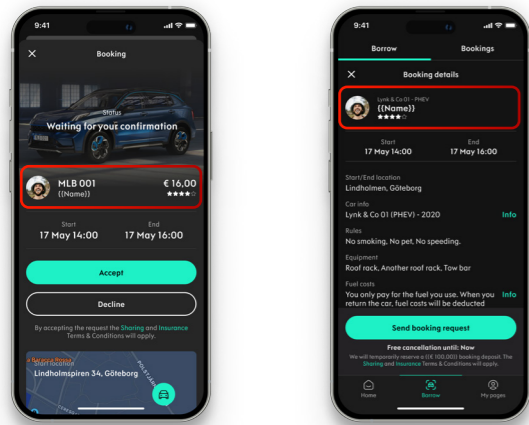

Figure 83: Current profile view in the mobile app before a booking (left: lender perspective. Right: borrower perspective).

Therefore, more detailed profiles are needed to better assess information on the potential users. And to make it easier to match people who are alike, might increase the trust for both users (Aufmann, n.d.; Airbnb, 2023).

Test
This borrower profile screen summarizes all newly designed aspects (review, trip score and requests) and is present for lenders at a new booking request. A test was conducted to see if this information made them more willing to accept a new booking request.

With this test it was important to make a comparison between the current and new design. But a comparison also needed to be made between different amounts of information.Because not all information is mandatory and it was found that not everyone is that willing to fill everything in. Therefore, the test was conducted with four printed screen variations (Figure 84).
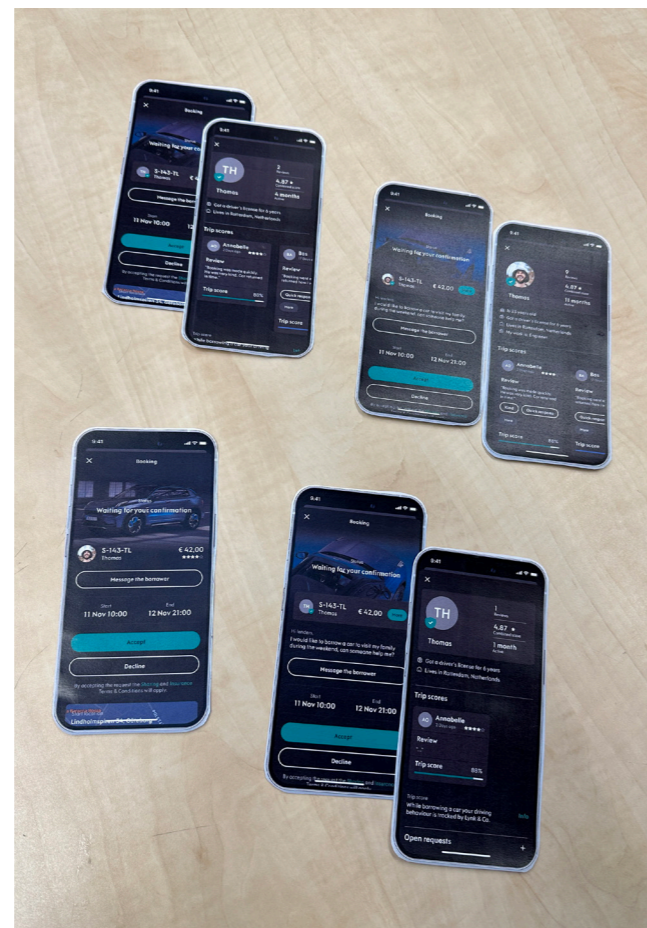
The first screen (Figure 85) is the one currently live and it appears at a new booking request. The second screen (Figure 86) shows the design with only mandatory information. The third screen (Figure 87) shows half of the information and the fourth screen (Figure 88) shows the design with all information.

Ten participants were involved from which 2 are 01 owners and 8 are students.
With every participant there were four comparisons. Every time the old design was compared with one of the three new designs (differentiation in information), the variantions were shown in random order. Participants were asked to choose between the two variants. The decision needed to be made based on three things: trust, ability to indicate and willingness to share.

Besides testing the information to see if the new desings with different information could increase the acceptance rate. The design of the screens were also discussed with an expert from the mobile app design team.

Figure 84: Printed and tested mobile app screens.
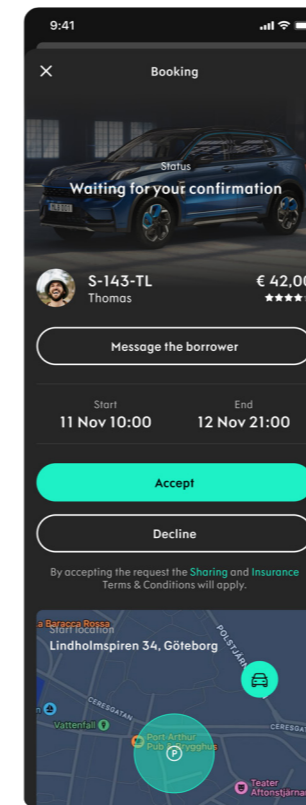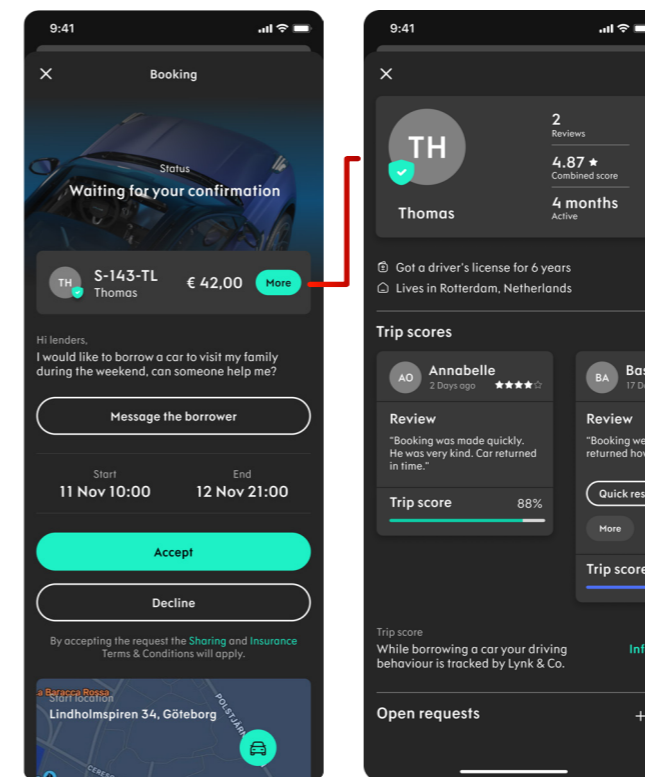

Figure 85: Currently live variant.

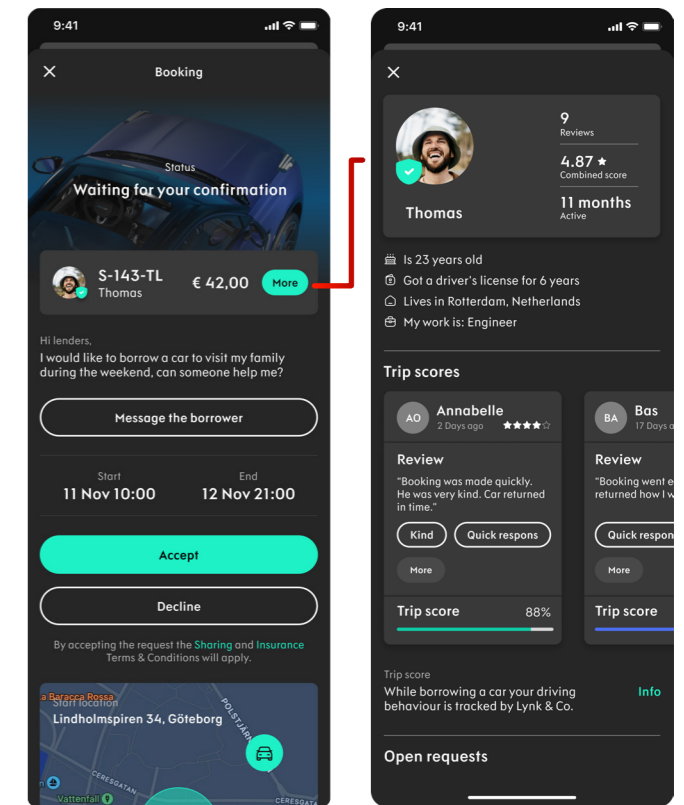Figure 87: New version variant with all information.

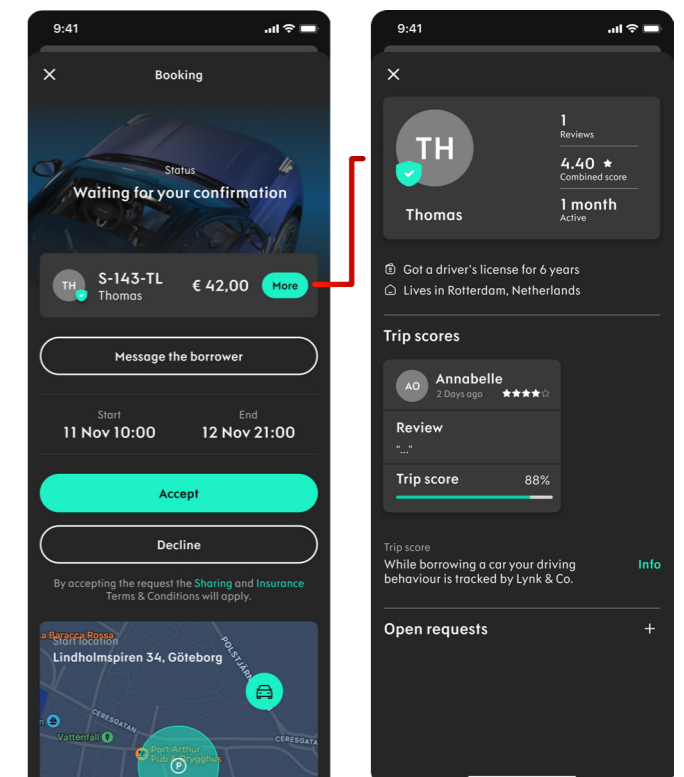Figure 86: New version variant with half of the information.

Figure 88: New version variant with only mandatory information.

Insights
The test showed that all the three newly designed screens (all, half and mandatory information) compared to the one that is live scored higher on trust, ability to make an indication and the willingness to share, as can be seen respectively in Figures 89, 90 and 91. The new design scores higher than the one currently live, also when only mandatory and half of the information is provided. All answers and results of the test are shown in Appendix M.
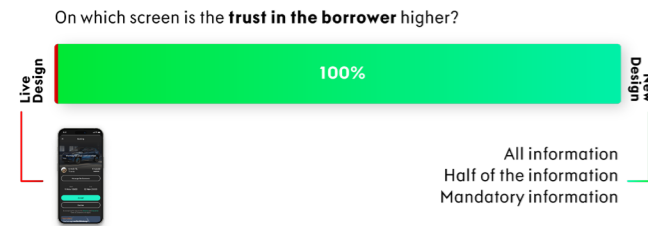
On which screen is the **trust in the borrower** higher?

Figure 89: Results on the test where the 'Live Design' is compared to the 'New Design' based on trust.
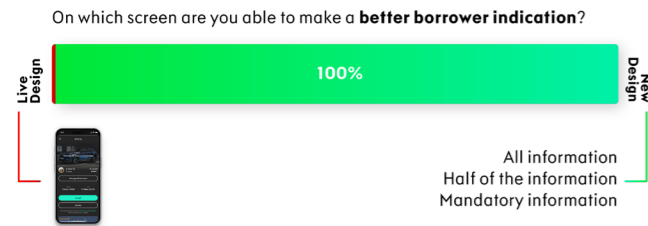
On which screen are you able to make a **better borrower indication**?

Figure 90: Results on the test where the 'Live Design' is compared to the 'New Design' based on borrower indication.

Based on which screen are you **more willing to share** with the borrower?
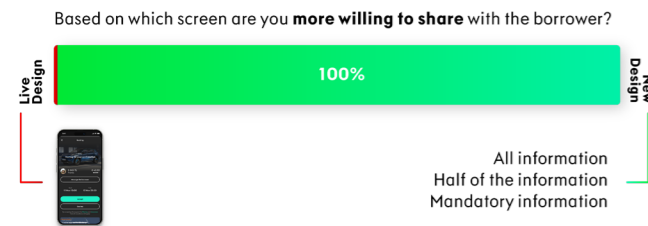

Figure 91: Results on the test where the 'Live Design' is compared to the 'New Design' based on the willingness to share.

From the discussion with the expert, other design and information related topics emerged. A breakdown is needed, which is a list that explains how the score was formed. This way, lenders get more insights than just a percentage. Next to that, a visualisation of a warning is needed for people with low trip scores. Lenders can be warned this way for people who misuse cars. At last, four types of information need to be prioritised: The amount of money, the time of the booking, the profile card and the accept button. This is needed because data analysis from the current app shows that this is seen as most important when considering a booking request. These insights are included in the final design, showcased in Chapter 9.

8.3.4 Market

Besides the new profiles and the components (scores, reviews and personal information) that come with them. The stimulation at the beginning of the service for the lender is also included in the product service. And to stimulate the lender a new section has emerged: Market. It shows requests to borrow a car for lenders.

For the lender, this tab will be located between 'Share' and 'Bookings'. For the borrower, it will be located on the Borrow page between 'Borrow' and 'Bookings' (Figure 92).
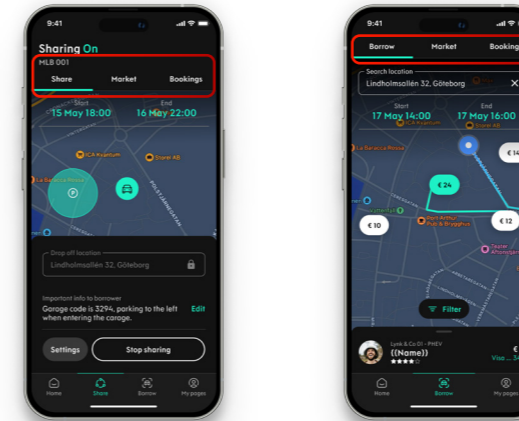
Figure 92: Proposed location of Market tab in the mobile (left: lender perspective. Right: borrower perspective).

In this section, the most important thing is to see as many requests as possible on one view of the screen, i.e. without scrolling. In doing so, it is important what information is displayed, how it is structured and how it looks.

Test
Three different designs were created (Figure 93) and again discussed with an expert from the mobile app team.
Variant 1 uses the principle of showing as many requests in one view. Because of this it only shows the most important information: the time and date. When a lender is not available at the requested time there is no need for other information.
Variant 2 shows some more information than this by showing the time and date but also the money that can be earned and the rating. By seeing the benefit, they might consider sharing.
Variant 3 shows all information available so lenders see all the information needed to make a decision to share or not.
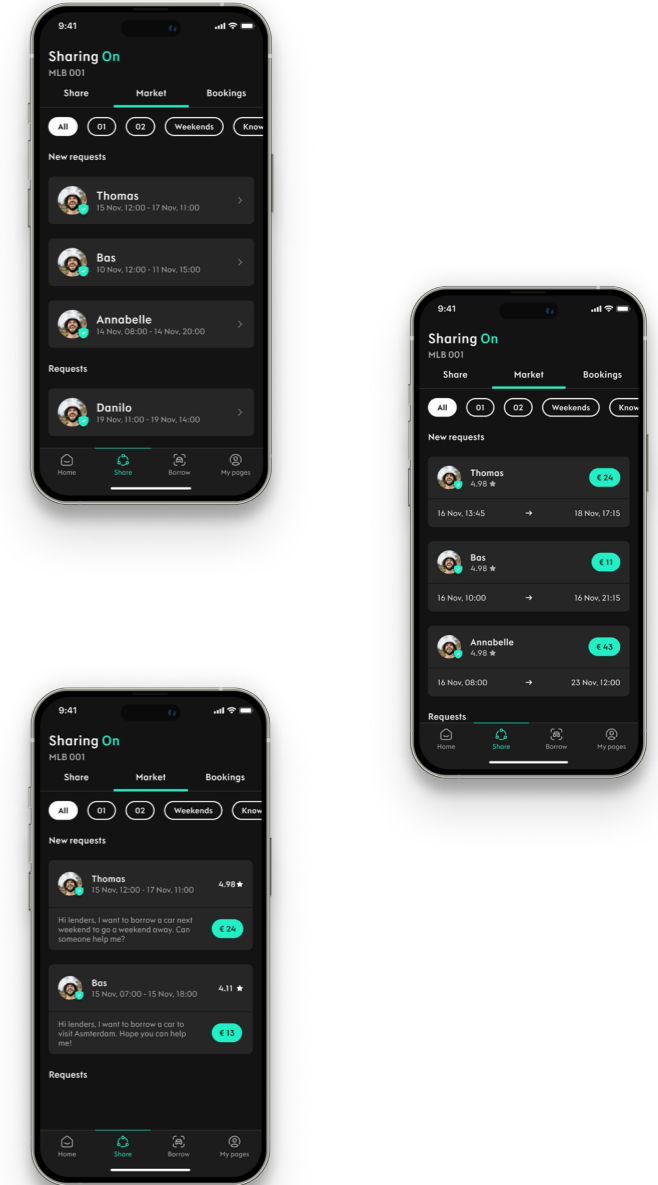
Figure 93: Three variations of the Market section design (top to bottom: Variant 1, Variant 2 and Variant 3).

Insights
Advised by the expert it was found that the most important information to show here is the time, date and the money that can be earned. Next to that, the requests for the lender should be able to be filtered and the lender should not have to think too much. Besides that, feedback was also provided on which screen will follow and what information should be included. All the feedback is included in the final design which is shown in Chapter 9. Some parts of the feedback are further discussed in Chapter 10.1: Recommendations.

Chapter 09
Showcase

9.1   Annotated Prototypes In-car
9.2   Annotated Prototypes Mobile App
9.3   Product Service

This chapter shows Stimulus. The working principle of the concept and how it influences the current service. The product service journey summarizes the process and shows the in-car prototypes and mobile app.

9.1 Annotated Prototypes In-car

9.1.1 Digital screens

The final design of the digital in-car parts of Stimulus is divided into two: the DIM and the AVN. Both are shown below and explained with annotations on the next page.

The DIM is used to show essential information. To not distract the driver while driving. The trip score is integrated into the hub on the right side.
Gamification is used by showing the progress bar to stimulate the users to get it full.

Figure 94: The DIM design of the Lynk & Co 01 with the integrated trip score hub on the right.

Progress bar behaviour
This blue circle progress bar shows the overall trip score based on each part scored. The brighter the blue and the more the circle is filled, the better the score. When a wrong driving action is performed the bar blinks. Blinking happens with the same frequency as vibrating—this way the user is attracted to the right part of the screen.
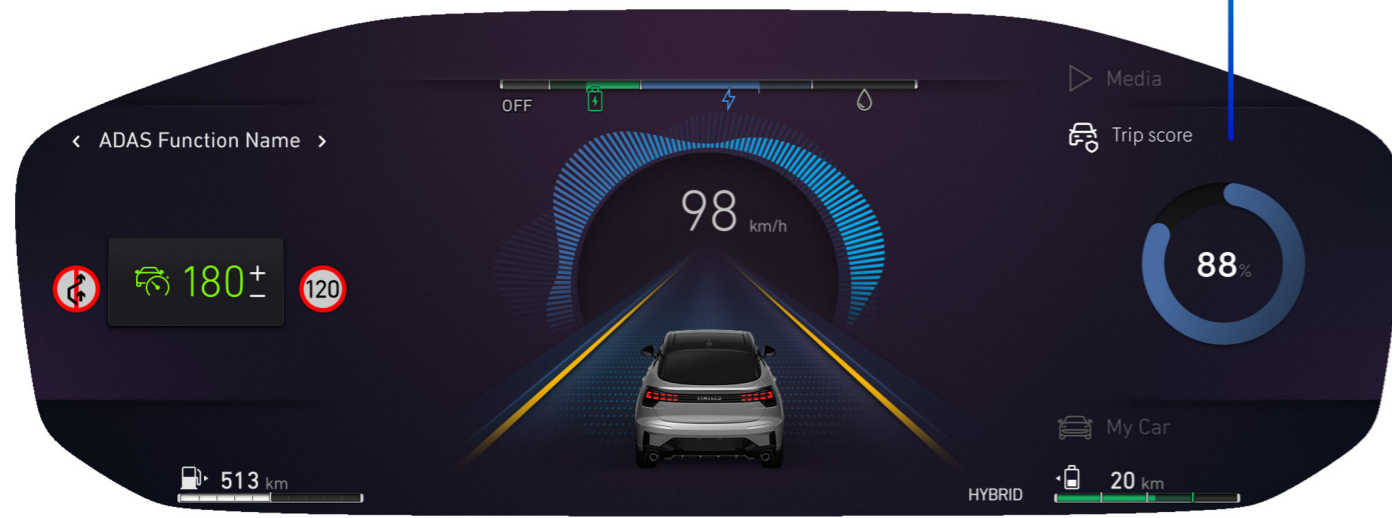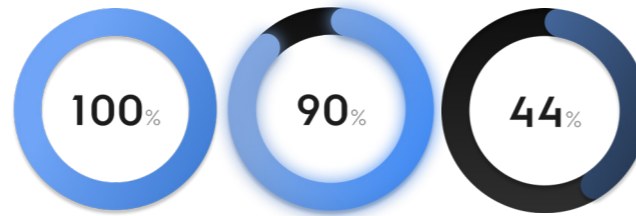

Figure 95: Different states of the progress bar.

Integration
The DIM is also used to show the circles when Apple CarPlay, Android Auto or the navigation is used on the AVN.
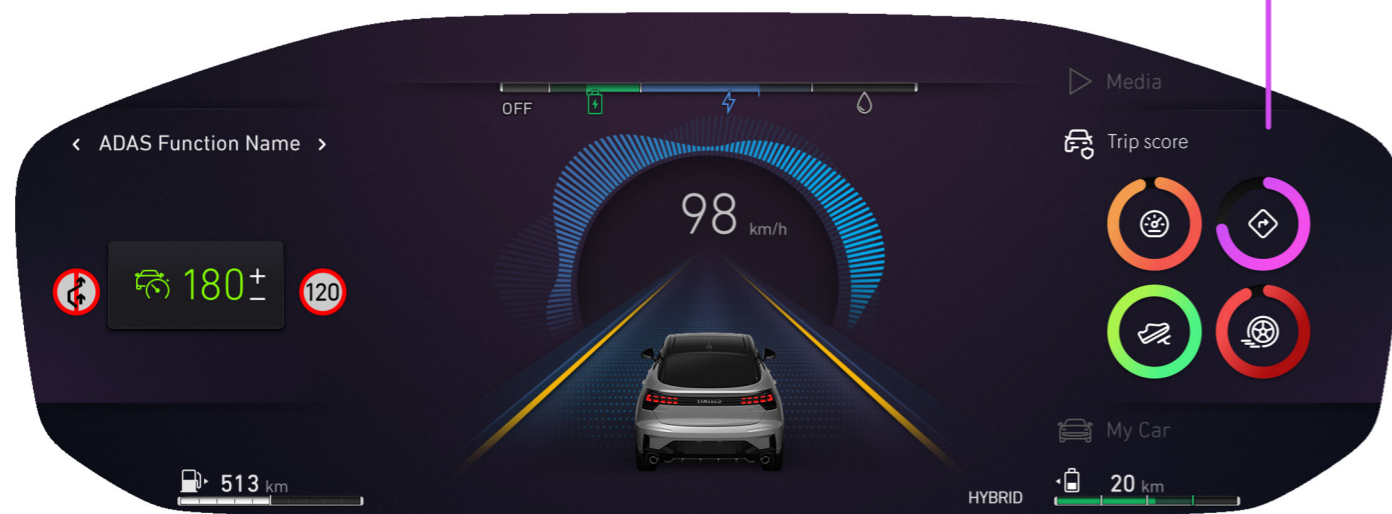
Figure 96: The DIM design of the Lynk & Co 01 with the integrated trip score hub when other applications are used on the AVN.
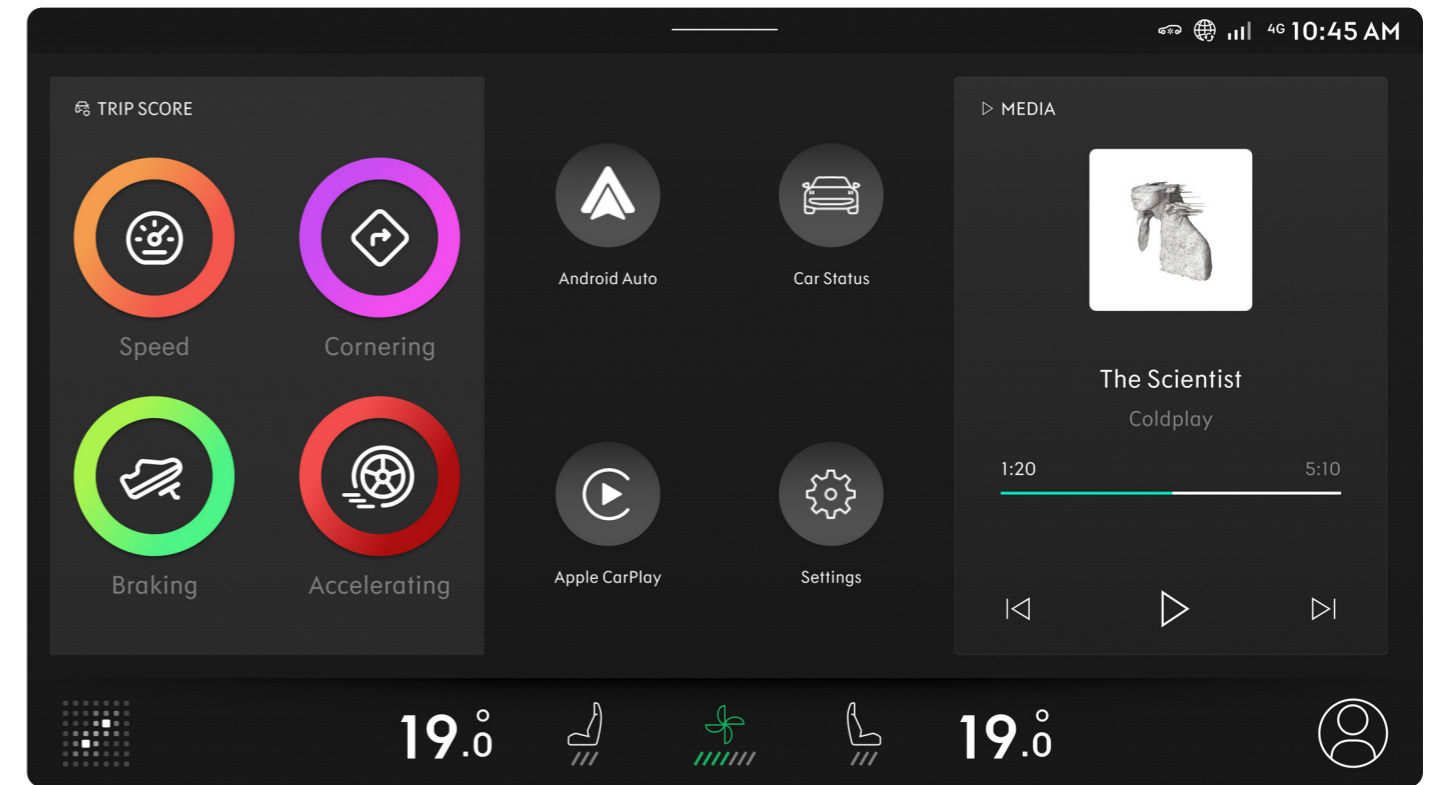
Figure 97: The AVN design of the Lynk & Co 01 with the integrated trip score widget on the left.

AVN design
The AVN provides more detailed information about the driving behaviour in a concise way. A widget is used to show information.

Breakdown
The principle of gamification is further exploited. Each part of driving that is scored is given a different colour. This way they are easier to distinguish from each other and easier to relate and link to the driving actions. To have coherency the colours on the AVN are the same as in the mobile app.

It was decided to use distinctive colours to make each aspect that is scored stand out and easy to remember. Speeding and accelerating are coloured in warm tones, orange and red. The braking is green and the cornering is purple on both to stand out, as shown in Figure 98.

The progress bars increase or decrease based on the driving. There is chosen to not let them blink in order to not attract too much attention. People already related the drop in score and the related vibration with the action they just performed.

Figure 98: The different colours for speeding, accelerating, braking and cornering.

9.1.2 Haptic feedback

The digital parts are connected to the haptic feedback that the borrower receives when driving the car. In this section both scenarios are shown with their vibration patterns and the related visuals.
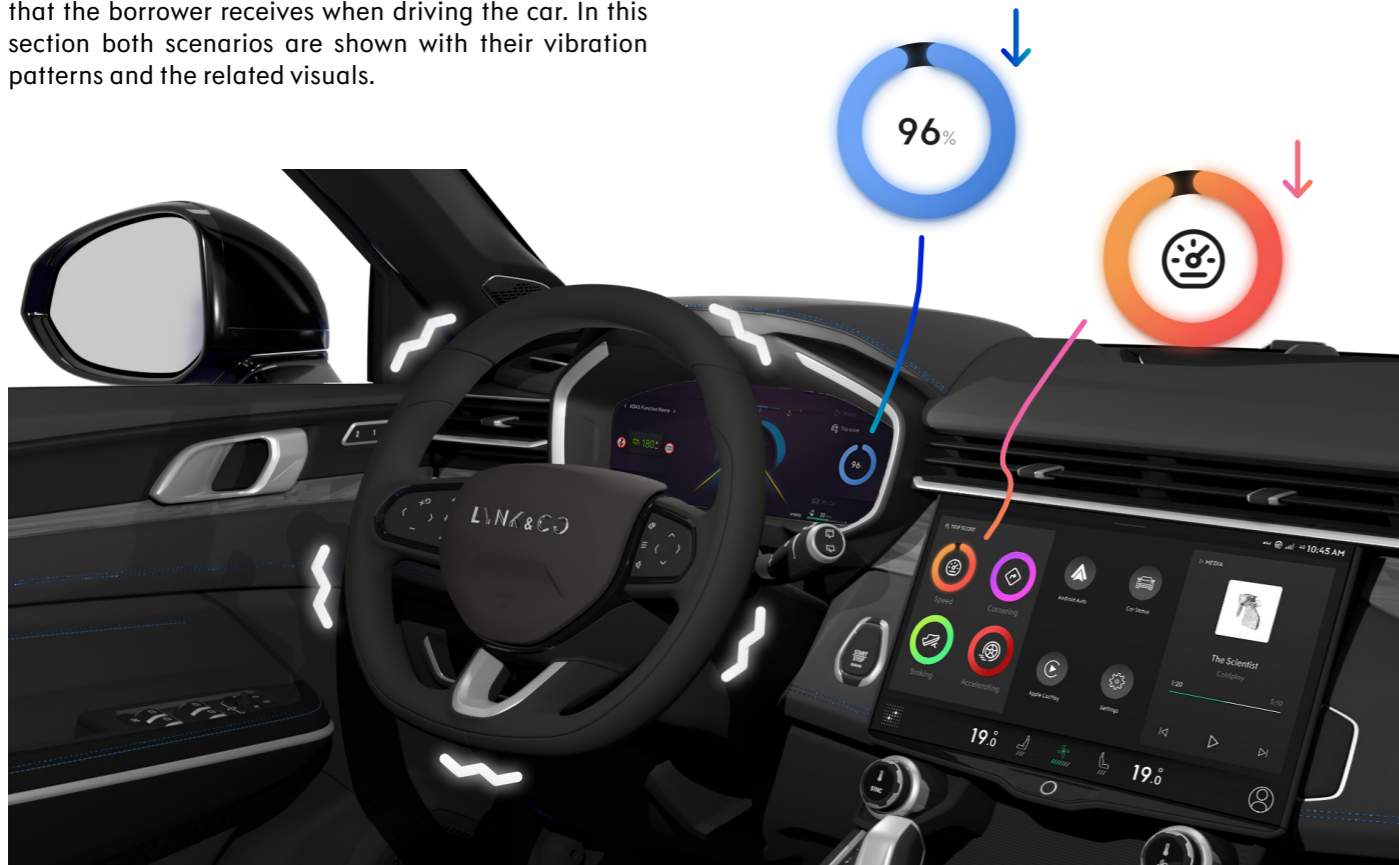
Figure 99: Haptic feedback when a wrong driving action is performed.

Wrong action

With hard braking, fast accelerating, speeding and sharp cornering the borrower gets a warning via haptic feedback. These vibrations relate to what happens on the screen, to have a clear relationship between controls and the effect, which makes it understandable to the user (Norman, 2013). In Figure 99 the scenario of a wrong action, in this case speeding, is shown.

Wrong action vibration pattern

The vibrations differ in their intensity and pattern. The more influential a driving action is on the score, the higher the intensity and the longer the vibration occurrence, creating a stronger and more attentive vibration. With less urgent driving actions a soft vibration is used, with a lower intensity and different pattern (Figure 100).

Pattern and intensity of strong feedback

Pattern and intensity of soft feedback

Figure 100: Strong (left) and soft (right) haptic feedback pattern.

Normal driving

When the borrower drives normally, the score is adjusted accordingly. At first, it stays the same and when driving well for a longer time the score increases, as can be seen in a visual representation of both screens in Figure 101.

Haptic feedback is only provided with a driving action that decreases the trip score and is therefore not provided to the driver when the score stays the same or increases.

Only visual feedback can be seen on both DIM and AVN, via the changing number and length of the progress bar. On the AVN the part that went well during driving is changed accordingly. In this example, the speed, cornering and braking went well so the bars are increased. Accelerating can be improved and thus stays the same.

Figure 101: Feedback with normal driving.
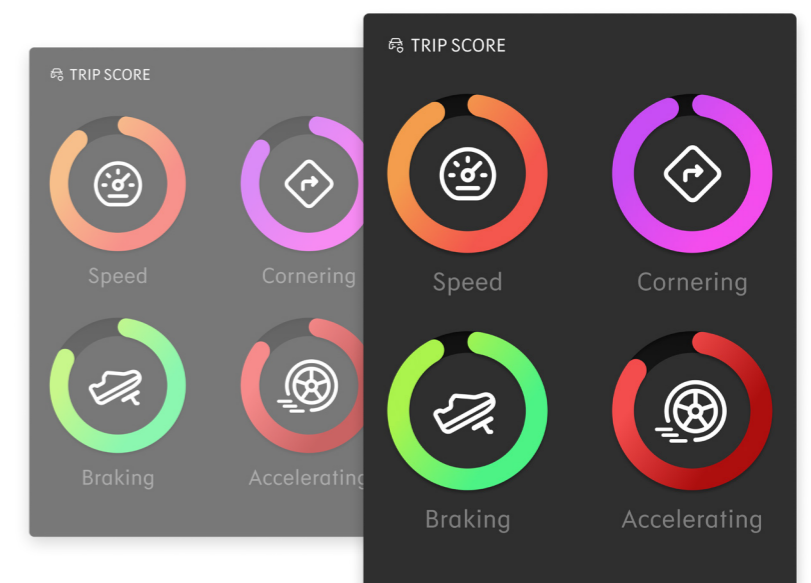
9.2 Annotated Prototypes Mobile App

In this chapter, all new mobile app screens are shown and explained via annotations.

9.2.1 Mobile app screens: Onboarding

Before a borrower uses a car, onboarding takes place to inform the user about the tracking of driving behaviour. This happens on three points: when the borrower opens the share tab for the first time (Figure 102), before every booking and on the profile (Figure 104). The lender also needs a type of onboarding. By trying out how a trip score is made. This way they can relate scores from borrowers better (Figure 103).

In the current mobile app there is an onboarding for borrowing a car.

An extra step is added to explain the tracking of driving behaviour.
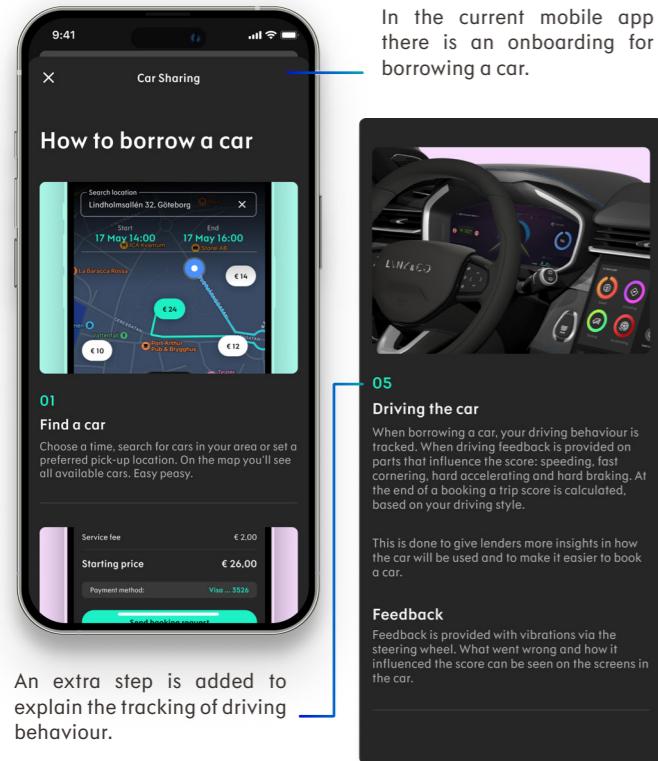
Figure 102: Onboarding trip score, first time open share tab by borrower.

The lender receives this dialog at the share tab. By accepting, the lender can try out in their own car how a score is built up.
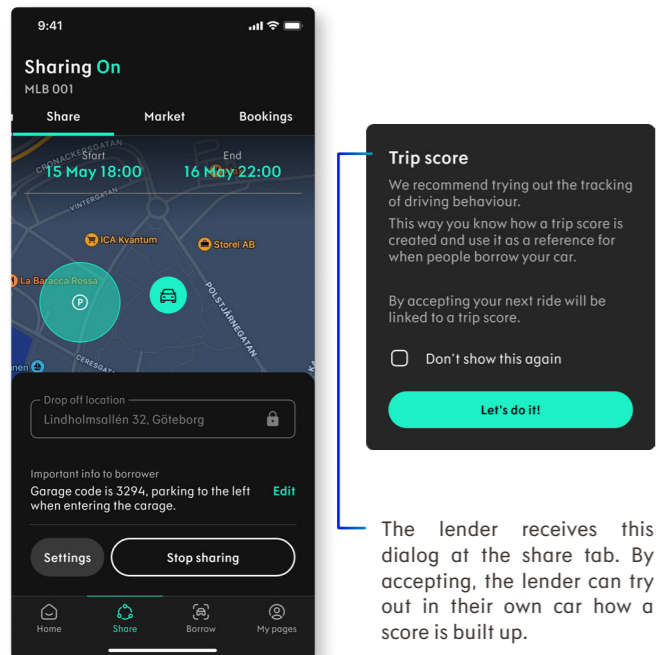
Figure 103: Onboarding trip score for the lender.

The borrower sees this screen before the booking. With relevant information: the new profile, the ability to send a message and the price.

Clicking on 'More' directs the user to the connected profile.

Before the booking, the potential borrower is reminded about the tracking. Clicking 'info' opens up a more detailed explanation.
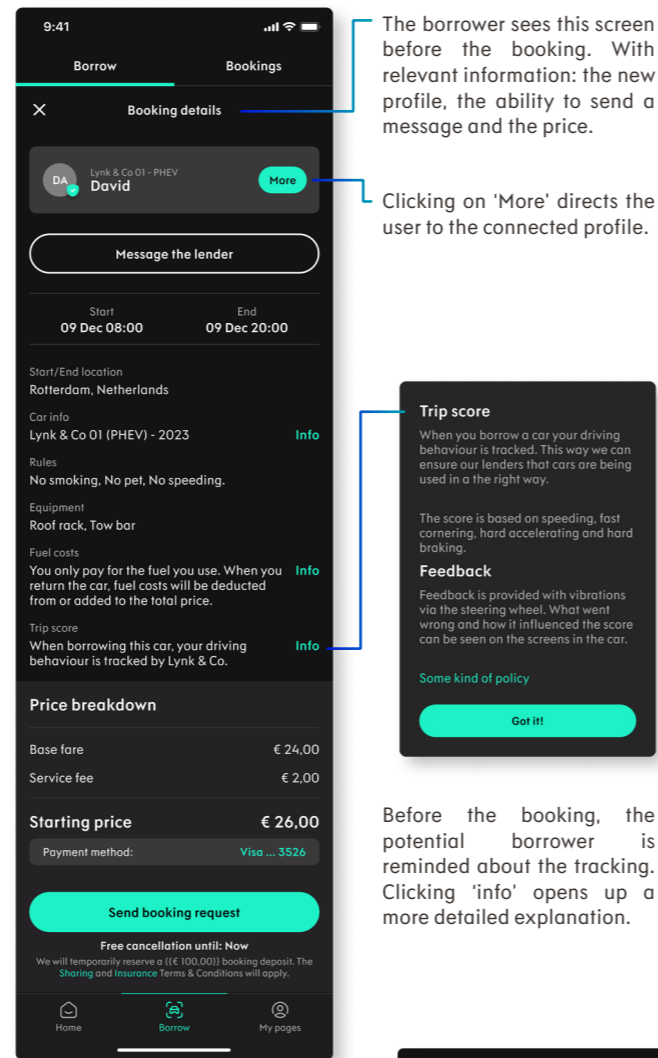
On the profiles both lender and borrower can see trip scores and click 'Info' to open up a more detailed explanation.
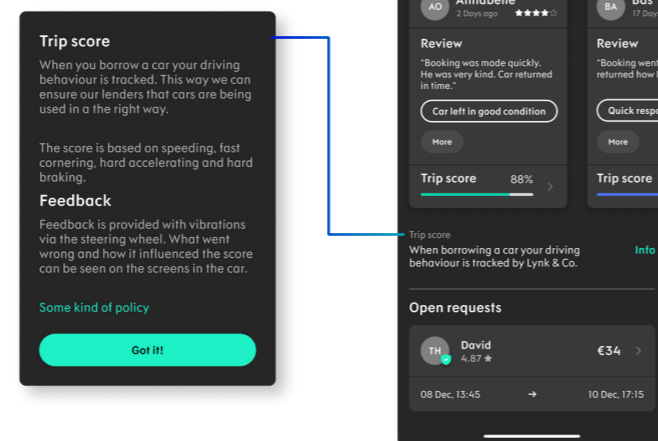
Figure 104: Onboarding tracking driving behaviour, before the booking is accepted and on profiles.

9.2.2 Mobile app screens: Profiles

The idea is that the new profiles, as shown in Figure 105, offer insights for the lender over the potential borrower. They contain personal information, combined ratings, reviews, trip scores and open requests.

This profile card shows the name, profile picture, verification of the user, the reviews, the overall combined score and how long someone is active.

In the trip cards, everything from a previous booking review is shown. The time when the booking took place. The review of the lender in the form of stars, text and chip suggestions. The system provides the trip score, which changes colour accordingly.

Clicking on the arrow icon opens a new screen. On this screen a score overview is shown. This way lenders can see how the percentage is built up.

Figure 105: Borrower profile.
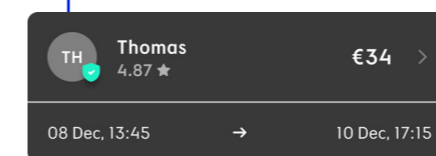
The 'Open requests' section shows all requests from a borrower. This way lenders can see potential bookings. It is an easy way to provide the car more often when satisfied with this borrower. The requests are further discussed in Chapter 9.2.4.

A breakdown is shown to see how the user scored per part.

The booking duration is also shown in order to relate the score to the time borrowing.

Figure 106: Trip score breakdown.

9.2.3 Mobile app screens: Reviews

One part of the profile cards is the reviews. A new flow with chips, which are the outlined suggestions, is created. The flow is explained via each step divided into four screens (Figure 107 - Figure 110).

Figure 107: Review flow step 1.
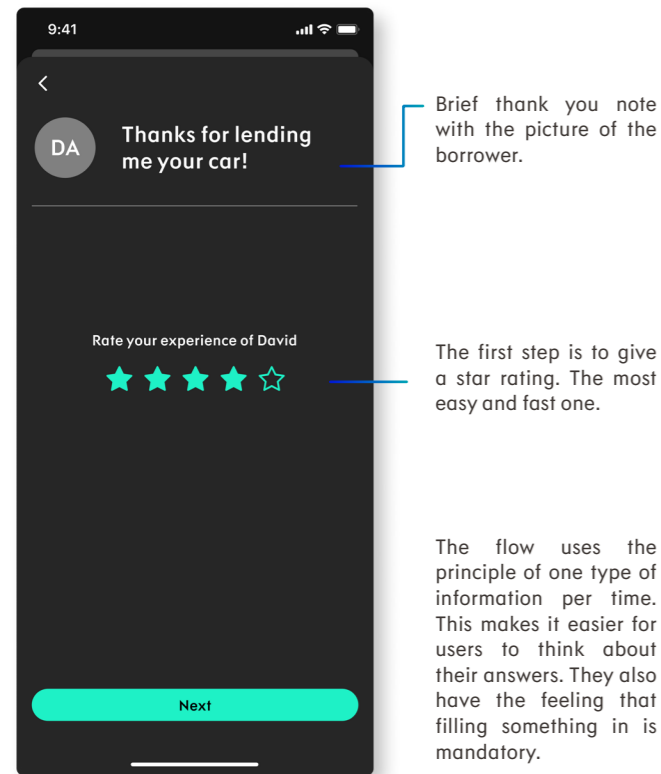
Brief thank you note with the picture of the borrower.

The first step is to give a star rating. The most easy and fast one.

The flow uses the principle of one type of information per time. This makes it easier for users to think about their answers. They also have the feeling that filling something in is mandatory.

Figure 108: Review flow step 2.

After the star rating. The lender gets suggestions to review on what went well.

Topics suggested are relevant to P2P car-sharing. When selected they are turned white.

Figure 109: Review flow step 3.

In the third step lenders get suggestions about what borrowers could improve.

Figure 110: Review flow step 4.
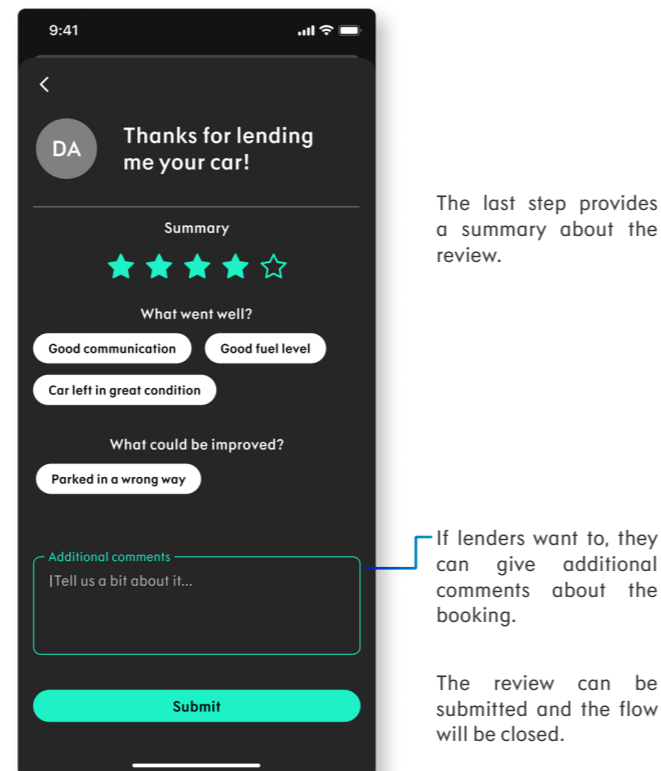
The last step provides a summary about the review.

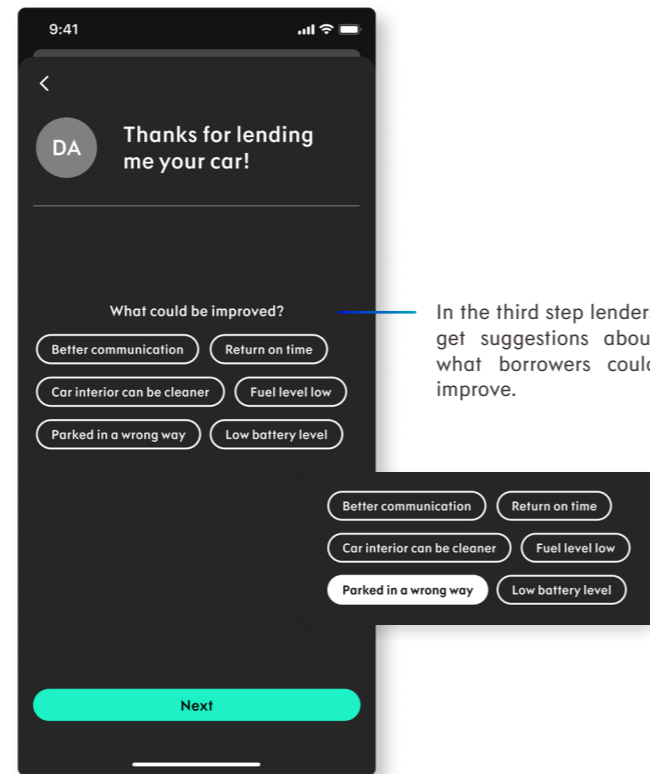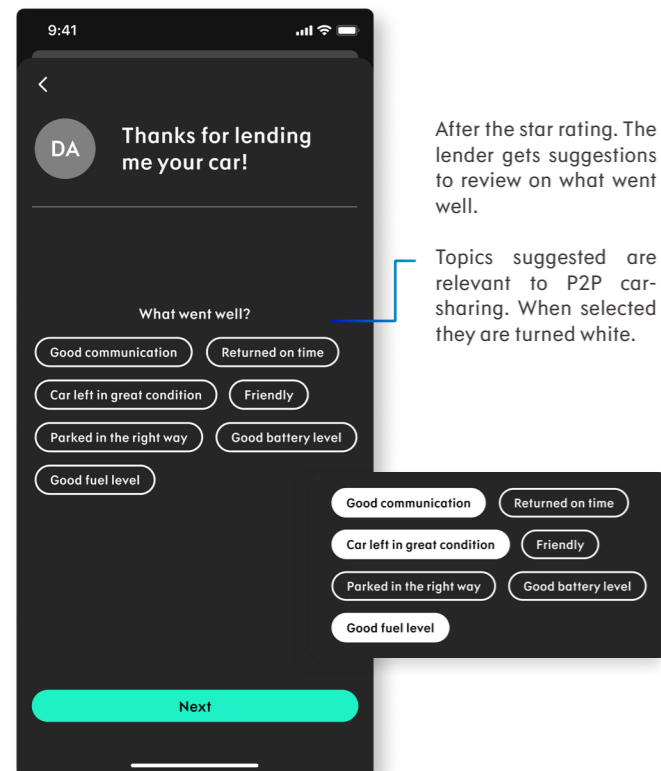If lenders want to, they can give additional comments about the booking.

The review can be submitted and the flow will be closed.

9.2.4 Mobile app screens: Market

The requests that were shown on the profile of the borrower, are also located on the 'Market' page. Besides this page, it is also shown what a lender sees when wanting to accept a request.

Figure 111: Market page.
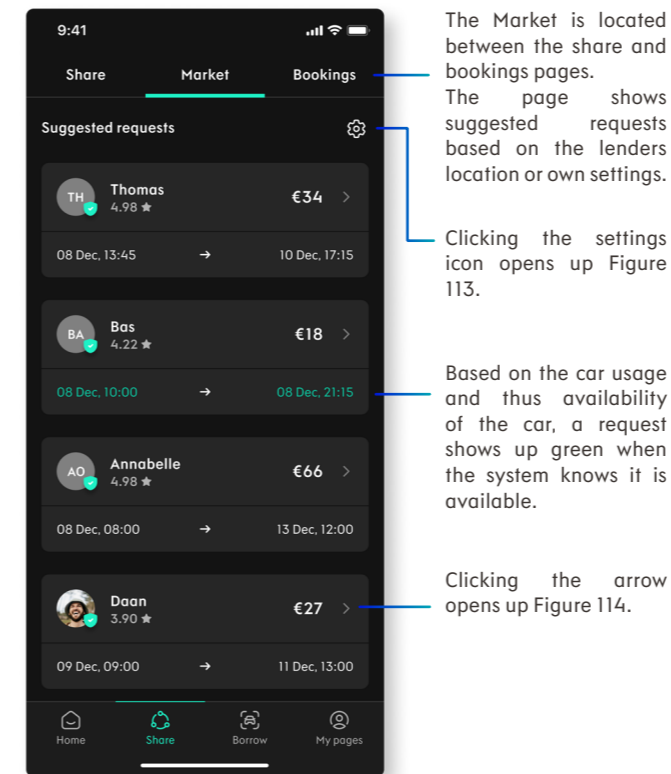
The Market is located between the share and bookings pages.
The page shows suggested requests based on the lenders location or own settings.

Clicking the settings icon opens up Figure 113.

Based on the car usage and thus availability of the car, a request shows up green when the system knows it is available.

Clicking the arrow opens up Figure 114.

Figure 112: Request construction.
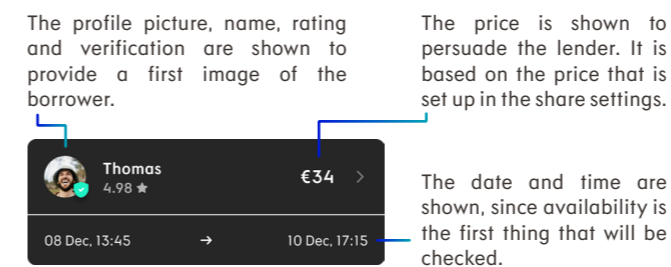
The profile picture, name, rating and verification are shown to provide a first image of the borrower.

The price is shown to persuade the lender. It is based on the price that is set up in the share settings.

The date and time are shown, since availability is the first thing that will be checked.

Figure 113: Request settings.
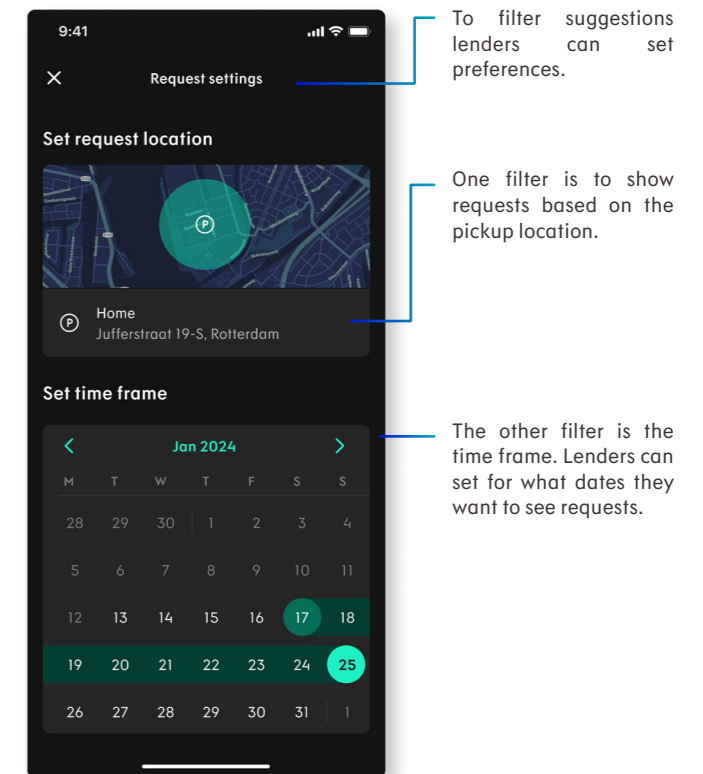
To filter suggestions lenders can set preferences.

One filter is to show requests based on the pickup location.

The other filter is the time frame. Lenders can set for what dates they want to see requests.

Figure 114: Request details.
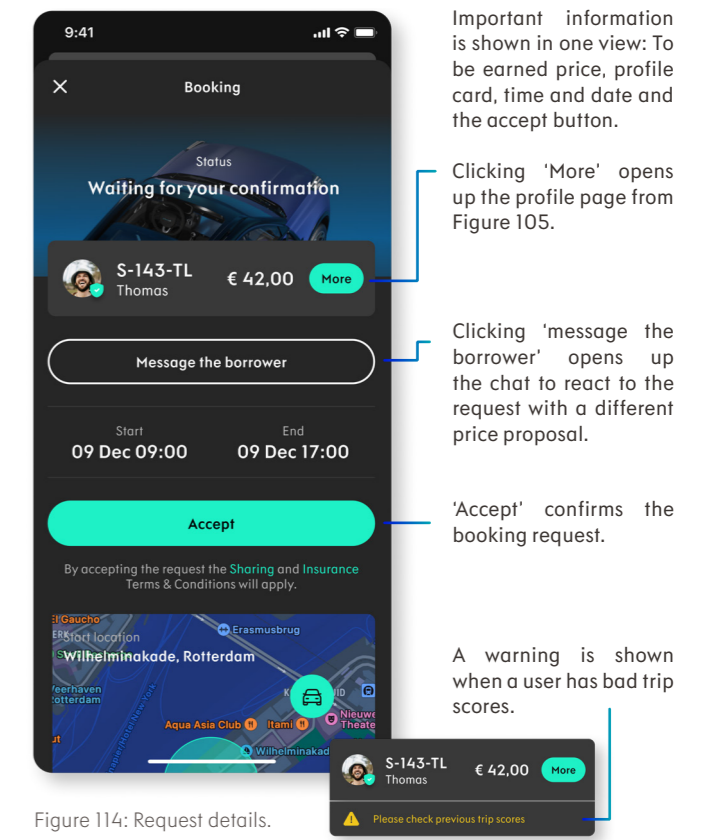
Important information is shown in one view: To be earned price, profile card, time and date and the accept button.

Clicking 'More' opens up the profile page from Figure 105.

Clicking 'message the borrower' opens up the chat to react to the request with a different price proposal.

'Accept' confirms the booking request.

A warning is shown when a user has bad trip scores.

9.3 Product Service

Besides the explanation per screen, the next three pages show how the new system influences the current car-sharing journey from a lender point of view.

9.3.1 Service journey lender

1

Lender: being stimulated

The lender can browse on the market page to see potential earnings.

2

Lender: researches the potential borrower

The lender clicks on the profile to view relevant information. To make an indication about the driver and their behaviour.

3

Lender: decides on booking

The lender checks the final details. He can message the borrower with a price proposal or accept via the suggested price.

4

Borrower: booking starts

5

Borrower: receives feedback during driving

The borrower starts ends the trip and got a score of 91%.

During the trip the score is adjusted to the driving style.

The borrower receives feedback after a wrong action.

The borrower starts with a score of 100%.

6

Borrower: returns car

7

Lender: returns to car

The lender returns to the car again and sees how it is returned and looks.

Lender: waits on ongoing booking

The lender knows the system keeps track of the car usage.

Lender: reviews booking and borrower

The lender knows what to review on and uses the suggestions to make a fast and detailed review.
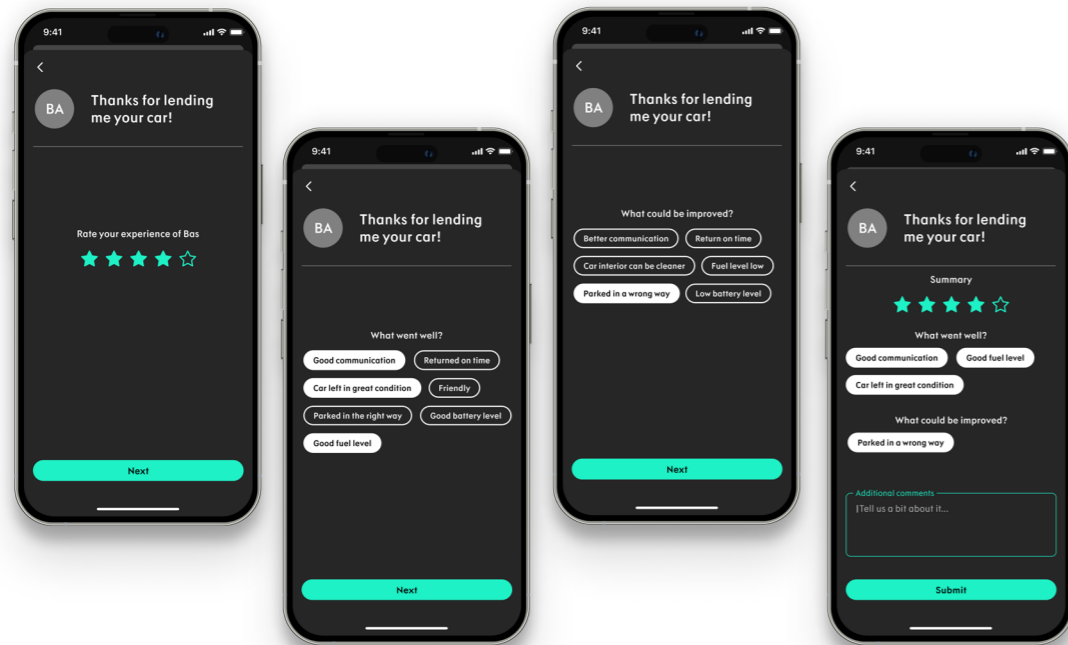
9.3.2 Current journey influence

Stimulus influences four parts of the current service, shown in Figure 116. The explanation of how to read the visual can be seen in Figure 115.

The first one is the stimulation when the car is idle. In the current service, lenders are not stimulated. The only trigger can be a booking request if they made their car available, so the car needs to be available first. In the new system, lenders are actively triggered to share their cars via the requests on the market page and the to-be-earned money.

The second one is deciding on a request, either from the new market page or the current way, when a car is provided for sharing. The new system differs from the one that is live (Figure 86 on page 83) because it provides more insights and more sharing related information (time active, license obtained, trip scores and reviews) for the lender to better indicate.

The third one is during an ongoing booking. Currently, the lender has no information about it. Due to legal and connectivity reasons, there is still no information during the booking. However, lenders feel more calm because they know the in-car system monitors and steers the borrower.

The fourth moment is the one after the booking. Where a more detailed and car-sharing-specific review can be provided about the borrower.
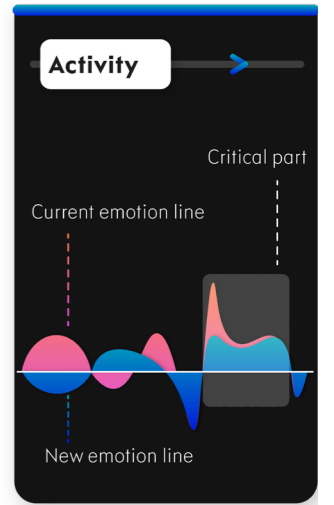
Figure 115: Explanation journey map.

Figure 116: Difference current and proposed car-sharing service journey for lenders.

Chapter 10

Conclusion

10.1   Recommendations
10.2   Discussion & Conclusion
10.3   Reflection

In this chapter, recommendations for the concept and the car-sharing service in general are shown. Next to that, the discussion and conclusion are stated. Finally, this thesis comes to an end with a personal and project reflection.

10.1 Recommendations

As this project lasted 20 weeks, further development and research is advised. The system should be further optimized and tested by borrowers a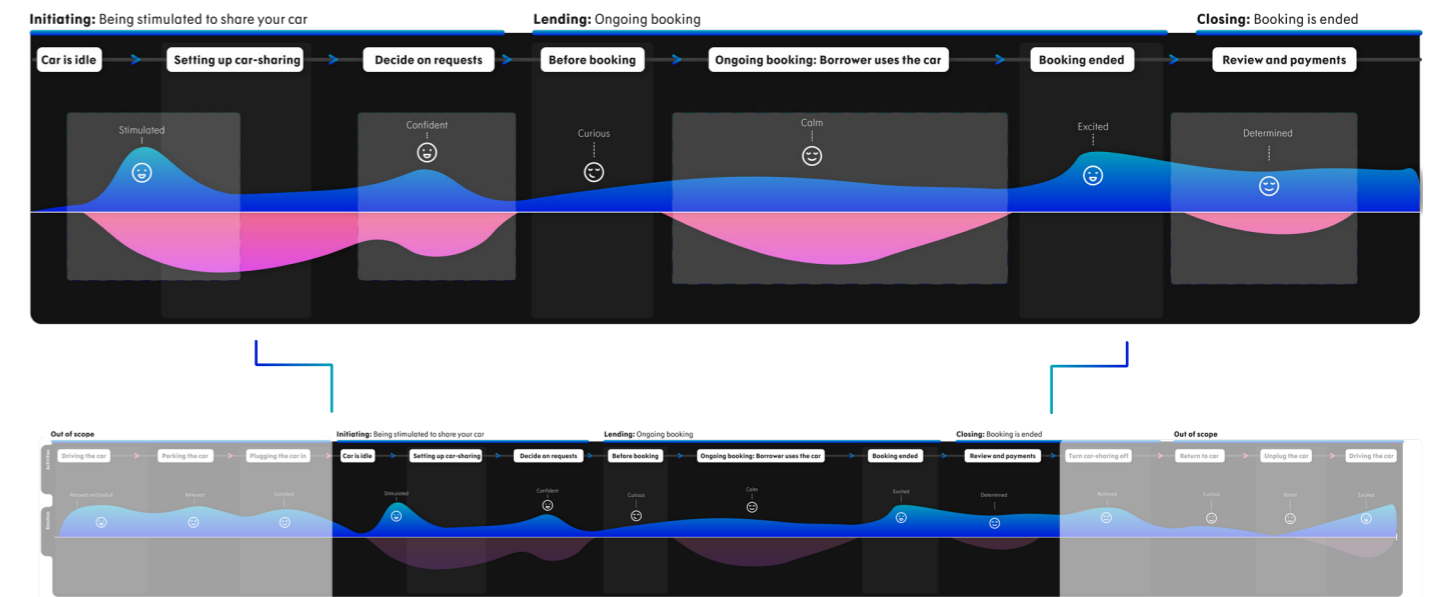nd lenders, which could lead to more recommendations. Examples of them and other topics that emerged during this project are listed in this paragraph.

10.1.1 Mobile app

In this section recommendations related to the mobile app are discussed.

Borrower view
During this project, everything is designed from a lender's point of view. Therefore, the first recommendation is to research and translate the designed screens into how they would look for borrowers. For example, how would the mobile app screen look when a borrower creates a request and what type of information do they find relevant? Or what would reviewing a lender from a borrower's point of view look like? Creating this could persuade borrowers to participate on the sharing platform. More borrowers on the platform create more demand.
To get more borrowers on the platform, the onboarding of them is also important. It was found that most people do not know the service or find it difficult to use it for the first time. A recommendation would be to give owners materials (e.g. flyers or onboarding videos) they can distribute in their neighbourhood. Another stimulation to get more borrowers could be to provide discounts for inviting people to the platform (e.g. first drive for half the price), this way people get acquainted with the service.

Besides focusing on the borrower to make the service complete. There are also recommendations regarding the designed lender screens.

Review system
The topics on which the lender can review the borrower are based on insights from the research. However, more research needs to be done on how to phrase these suggestions. They need to be concise but still convey a clear message. A user test could be performed in which owners of the 01 could rate what they find most important and frustrating with car-sharing. Next to that, people who borrowed a shared car could rate what they would have liked to give specific ratings on.

Trip score
There is a distinction between people who share for economic reasons and people who want to share to do good. With the latter, most people do not want to track how closely related people drive. Therefore a recommendation is that there needs to be a function to turn off the tracking of driving behaviour. This could be before every booking or when setting up the general car-sharing settings. Owners should be free to decide if they want to use this function or not, they should not feel obligated.

Market
Within the market section in the mobile app, it is also recommended to implement a feature that provides the opportunity for the lender to share for no money. Sharing with friends often goes without the idea of making a profit out of it. This way these existing customers are not forced to change.

With the requests and the borrower's point of view recommended earlier, it will also be useful to develop the ability to add an introduction message to these requests and to the already existing ability when a borrower reacts to an available car. This makes sharing more personal, which is something owners want when sharing their car. Suggestions on what to write are the purpose of borrowing and when it happens.

10.1.2 In-car system

Besides recommendations for the mobile app, the in-car system is also reflected.

Haptics
At first, I would suggest testing the principle in a driving vehicle on a closed road. After hat testing in public is needed. To continue the designed in-car haptic feedback, the vibrations could be further explored to find out what types are best perceived as different types of warnings. With this project, the working principle is researched and confirmed but to really be in line with Lynk & Co's brand identity, the experience with the vibrations is recommended to further explore.

Journey points
In the journey map, it was shown that there are two more critical points: stimulation before and ending sharing. A recommendation would be to change the current car-sharing application in the car.
First of all, use it to show the lender the amount of potential borrowers and what can be earned and saved when parking in this area. This stimulates them to provide the car.
Next to that, it would be good to research how to end the journey with a high positive emotion. A suggestion would be to show the benefits of sharing when on the AVN screen when entering the car again after it was returned. This is the time when the lender has concerns about how the car is returned, this emotion can be influenced by showing the (economic) benefits.

10.1.3 Others

Borrowers and lenders mentioned that the ability to chat with each other would help a lot in booking a car, it makes it more personal. It makes it more accessible for the borrower and creates more trust for the lender. Creating a chat function is therefore very relevant and would solve current problems.

10.2 Discussion & Conclusion

10.2.1 Discussion

I am aware that this thesis only touches upon some parts of the car-sharing service. And to make and change such a service, it is far more complex than described here. However, I believe that the biggest concerns are found and mapped. The thesis shows valuable insights into the current problems and even provides a solution for them. Even though the influence of this report is limited, the insights and conclusions in this thesis are still able to provide suggestions and recommendations to those currently working on car-sharing.

Feasibility
The solution builds upon existing sensors to get data and the current infotainment system and mobile app to show this data to the user. In the thesis, existing systems are used as a starting point. The mobile app is analysed and suggestions are based on the current structure, design guidelines and future design. The in-car system can be implemented via one of the widgets on the AVN and one of the hubs of the DIM. Therefore, the solution is not only theoretically able to be implemented but also practical.

Desirability
From the perspective of the borrower, it became clear that tracking their driving behaviour during a booking was not seen as an obstacle to using the service. It was even seen as a benefit. They clearly indicated that they wanted the same if they shared their car and that they could see the benefits of getting a car booked more easily.
From the perspective of a lender, the solution tackles their biggest concerns: lack of trust and transparency in how someone drives their car. The newly designed profiles were seen as more trustworthy.

Viability
The willingness and noticing of benefits of both borrower and lender to use the new system implies high viability. Next to that, Stimulus tackles the biggest concerns with car-sharing: providing better indication and giving more trust and control during the booking. Making owners more willing to accept booking requests.

Limitations
It is essential to acknowledge the presence of limitations that influenced the outcomes of this thesis. Time constraints, resource limitations, and external factors beyond control impact the depth and breadth of a project and the same goes for this one.

During this project I was located at the Amsterdam office of Lynk & Co. This is not the office with test facilities relevant for me. Therefore it was sometimes difficult to try out things from the service and the car and to test prototypes. I managed to work around this. But for obvious reasons, it would be easier and better for validation to be able to use a test car for my prototype.

The questionnaire, interviews and two user tests: in-car and mobile app, were mostly performed with students. Although it still provided relevant feedback on my prototypes. Participants were all from the Netherlands, around the same area. When implementing the proposed concept, it will be used across Europe, therefore a deeper understanding of cultural differences is needed.

Legislation is a vital aspect when introducing this concept. For the purposes of this project, legislation and policies are only briefly discussed within Lynk & Co with the legal and connectivity team. The relevant sensors (gyro sensor) and actuators (current infotainment system) are in place and they track data for the trip score. Collecting and using it may influence the development and introduction of the proposed solution.

Finally, not all sections of the journey are addressed. The points that were discussed in the recommendations still need development. To make the complete sharing journey for both borrower and lender more persuasive and beneficial all parts of the journey need to be researched and changed accordingly. Recommendations were provided as a starting point for what to develop next. The scope of this project did not allow it to recreate the complete journey. Therefore, implementing parts of the service is no guarantee to improve the overall service.

10.2.2 Conclusion

This thesis presents a new approach to P2P car-sharing for Lynk & Co. The solution especially focuses on the irrational aspect of car-sharing that is present among owners.

At the beginning of the project, the problem was formulated as 'Not enough people provide their car.' An attempt to understand the problem and reasoning was made via literature research and field research that was translated into a journey map. From this map, critical points of the service emerged. After summarizing other insights in combination with the critical points of the service a new problem statement was found: 'The acceptance rate of bookings needs to be increased.' Drivers that came from this are more trust in the borrower, control during the booking and stimulation to provide the car.

Through a combination of literature, field research, experiencing the current system, interviews and user tests of the concept, Stimulus is designed and has proven to work. It includes the irrational in its approach to tackling P2P car-sharing concerns amongst car owners. It stimulates owners to provide a car on a regular basis, it improves the capability for lenders to indicate borrowers and it increases the trust in the borrowers and the system during the booking.

10.3 Reflection

10.3.1 Project reflection

The project already started differently from other projects, normally a problem is provided. However, the project and its assignment were not assigned to me, but I came up with it myself. Something that was difficult in the beginning because everyone needed to be on board, the underlying problem needed to be found and I was free to shape the project.

At first, this freedom made it difficult in the beginning to make decisions. Therefore, the project was not that specific and focused on the topic that later on became important. At the start, there were also doubts from others, about how to make it academic and how to shape it in such a way that it is relevant for my further career.

If the project was done again there are two things I would do differently. First of all, I would change the way I approached the project. How I did it now eventually brought me where I am but I would limit the scope of the initial problem more than was done now. I investigated topics that in the end were not necessary or at least less time could be spent on them. Examples are the market analysis and the trends and developments. This way there would be more time for designing and testing. Secondly, I would perform tests with the target group (Lynk & Co sharing platform users) only. During this project, almost all tests were conducted with students. Even though the working principle was still proven it would be even more meaningful to test them with Lynk & Co sharing users. This way other valuable insights for the project and company could emerge during these tests.

However, in the end, I enjoyed this freedom and working on this project. I could use my passion, knowledge and skills in such a way that I was able to design something relevant to my career and to Lynk & Co. My passion for cars and thus the more emotional approach is used to design for car-sharing, which in my opinion was very valuable. I have used my digital design knowledge in terms of visualising, rendering, mapping and prototyping and combined it with my passion: cars. I have even developed in this period. Getting skilled in Figma, prototyping and animating. But also setting up user tests, getting relevant insights and changing the design accordingly.

I am very grateful that Lynk & Co gave me this opportunity. In addition, I thank everyone within Lynk & Co that I have worked with. This graduation project but also certainly my internship before that has helped me in my career and as a person.

10.3.2 Personal reflection

This graduation project was challenging at the beginning but very rewarding, not only on a project basis but also personally.

It was the first complete design project executed on my own. During the rest of the study, everything was in teamwork so this took some shifting. In hindsight, it has been precious, the hands-off and just-doing-it approach made me experience a design project on my own in the best way.

In addition, I was pleasantly surprised because I developed myself in different ways during the project. Both in my design skills, prototyping, setting up and executing user tests, involving relevant stakeholders and communicating the project, but most of all as a person. I found out what I am good at and what I am not. I now know what I enjoy doing. At the start of the project, my interests were still very broad, which I still have and I therefore always want to keep developing and learning. But one thing is for sure, my main interest is service and UX design. Strategically designing a complete service at the concept level is something I want to continue with in my future career.

The 20 weeks provided me with multiple learning moments, but two of them stood out. The first one, was after the research, during the difficulty of finding the underlying theme of the research findings. A lot has been done but what is the essence, a bit of a lost feeling. The most important thing I learned then was to write down everything that was done and connect it. It works enlightening, not only at that moment during the project but a learning moment for when I am faced with something complex. The second one, was in the process when I was setting up my user test. Here I kept postponing the actual testing. Eventually, a deadline was set. This created some pressure, but I actually just went straight to prototyping, even though there are things you run into, you always find solutions because of the pressure. Both learning moments can be combined in one lesson. You have to make choices and do it. How it exactly works out will be found afterwards. It either works out well or you learn from it, after which it works out well.

Not only do I want to reflect on this project but also my studies besides the design-related skills that were developed in these 5 years. With my design studies background, I will always look differently at everything in the world. I have become more creative, am more open to new things, improved my communication skills, and know how to work with different stakeholders and present myself in the right way. Therefore, I have gained much more experience during these 5 years, which I did not think of at the start and am grateful for that.

Chapter
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