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Mapping and Prioritising Use Cases of the Car

A study on consumer behaviour and preferences

Master's thesis in Industrial Design Engineering

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Master's thesis in Industrial and materials science (IMSX30)

Mapping and Prioritising Use Cases of the Car – A study on customer behaviour and preferences

Thesis in collaboration with the Perceived Quality department within Volvo Cars Corporation

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Cover image: Illustration of perceived quality experts performing a car evaluation

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ABSTRACT

When users interact with cars, how they experience its quality is of high importance; both for the customers' relationship with the car going forward, but also for the company that creates their car. If the car is perceived to be of high quality, it is easier for the company to build a longstanding relationship with their customers. Therefore, throughout the development process, the perceived quality of the car is evaluated by experts in the field. However, the processes used for evaluation are not always centred around the customers' actual usage of the car.

Because of this, the aim of this master's thesis is to map what use cases are relevant to consider when evaluating the perceived quality of a car. Moreover, the aim is to create a prioritisation for these use cases and develop a method for how they can be implemented in the work of perceived quality experts in order to support their decision making.

To fulfil this aim, this project followed the design thinking framework and the project team conducted several user studies to gather information. Expert interviews were held to gain an initial understanding of the problem space and the use cases that could be of interest. This was then followed by a diary study where the participants' car usage was in focus. Lastly, perceived quality experts were consulted through a series of workshops. The material from all user studies were gathered and analysed through several methods, e.g., a KJ analysis.

In the end, a complete customer journey is presented, showing all the use cases that occur in the interaction between a customer and a car. These use cases were then screened and a select few were presented as the ones most crucial for perceived quality evaluations. *Approach car*, *Drive car*, and *Ride car* are examples of some of the use cases from the final selection. Based on qualitative and quantitative insights from the user studies, these use cases were prioritised in a list that can be adapted based on the car project in question and the perceived quality specialisation that is in focus. All the results have been summarised in a process guide that perceived quality experts can implement when evaluating cars to support their work and decision making.

Keywords: use cases, cars, customer journey, user studies, perceived quality

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Sanna Göransson, Gothenburg 2022 Lina Ring, Gothenburg 2022

TABLE OF CONTENTS

1

Introduction

This project is a collaboration between two master students at Chalmers University of Technology and the Perceived Quality department at Volvo Cars. In this chapter, the project is introduced by explaining the background to why it is being conducted, information about Volvo Cars, their Perceived Quality department, as well as information regarding car usage. Moreover, the chapter includes the aim of the project as well as its delimitations.

1.1. Background

When developing cars there are a lot of aspects to consider, one of the most central being the customer experience. It is not only important that cars are functional and that they can transport someone from point A to point B. Customers deciding what cars suit their needs and what they should invest in, is also relevant. It is important that the car looks good and that its quality matches the customer's expectations (Armstrong, 2018). In order to evaluate the cars in a streamlined way and create an overall great experience, more knowledge is needed about the customer, both regarding their behaviour and their thoughts and feelings.

1.1.1. Volvo Cars and the Perceived Quality department

Volvo Cars is known as a premium car brand to its customers and has been present on the market for almost 100 years, selling about 661 000 cars during 2020. When adapting to the current challenges of the industry, e.g., electrification and autonomous driving, this is an image that Volvo Cars aims to retain. It is also prevalent in Volvo Cars' branding when they express on their website "*We want to provide you with the freedom to move in a personal, sustainable and safe way*" (Volvo Car Group, 2020). Therefore, it is of upmost importance that the perception that the customer has of the car, matches this goal.

The Perceived Quality (PQ) department at Volvo Cars is responsible for assuring that the cars express high quality and a premium feel, something that will affect the perception of the brand overall. They do this by creating requirements related to how the customer perceives the quality and then verify the car and its components against these requirements.

The PQ department consists of four sub attributes, all with their specific expertise and tasks: Illumination, Geometry, Material, and Surface Finish.

- **PQ Illumination** works with the experience of lights in relation to the car, for example colour, intensity, harmony, and light behaviour.
- **PQ Geometry** is tasked with creating requirements and verifying geometric aspects of the vehicle, for example for gaps and flushness, and to make sure nothing unintended is visible such as cables and screws.
- **PQ Material** works with how different materials in the car is perceived by the customer, for example through colour, surface grain, and harmony between surfaces.
- **PQ Surface Finish** works with the surface structure on the outside of the car to make sure it is consistent and of excellent quality.

The sub attributes work with the verification process in different ways, but when evaluating a car or its components, issues may appear that have a risk of affecting the perceived quality of the complete vehicle. Issues could include anything from mismatched materials to faulty lighting. What solutions that can be put forward to solve these issues is limited by for example financials, time, and other resources (Stylidis et al., 2020). Therefore, it is important to be able to prioritise potential issues in an efficient way to know what should be solved first, and this indicates the importance of performing a project like this one.

1.1.2. Car types

Figure 1: Illustration of car types (from left: SUV, sedan, convertible, pickup truck, station wagon, crossover

Cars come in many different types, each with their own characteristics. Some of these will be mentioned throughout the report and therefore a few examples of car types can be seen in figure 1 and are described below:

- **SUV (Sport Utility Vehicle):** This is a bigger car type that has a high ground clearance and seating position (Nationalencyklopedin, n.d.a). It usually comes with either five or seven seats.
- **Sedan:** This car type has a trunk that is separate from the rest of the car and that is opened below the rear window (Cambridge University Press, n.d.a.).
- **Convertible:** The roof of this car type can be retracted, meaning the car can be driven either with or without a roof (Cambridge University Press, n.d.b).
- **Pickup truck:** This type of car has an open space for luggage in the back (Cambridge University Press, n.d.c).
- **Station Wagon:** There is much space for luggage in this car type and the trunk is connected to the sitting area of the car (Cambridge University Press, n.d.d).
- **Crossover:** This is a combination between a SUV and another car type (Merriam-Webster, n.d.). An example of a crossover is a combination between a SUV and a sedan.

The cars can also have the following different types of engines:

- **Electric:** The car is solely driven by electricity (Nationalencyklopedin, n.d.b).
- **Plug-in hybrid:** The car can be driven both by electricity and fuel (Cambridge University Press, n.d.e).
- **Mild hybrid:** The car is mainly driven by fuel, but there is an electric engine that supports the drive (Nationalencyklopeding, n.d.c). The electric engine in a mild hybrid cannot be charged.
- **Combustion:** The car is solely driven by fuel (Nationalencyklopedin, n.d.d).

Volvo Cars' current product range includes the following car types: SUV (XC models), sedan (S models), station wagon (V models), and crossover (C model). The number at the end of the model-name indicates its size, e.g., XC40 and XC60 are two SUVs where the 60 is larger than the 40 (Volvo Car Group, n.d.).

1.1.3. Use cases of the car

Today, there is a wide range of different cars and how they are used may depend both on the type of user and the type of car. This means that there is a large variety of activities occurring that differ in frequency of occurrence and importance for different users. These activities can be defined as use cases. For example, most cars have a trunk but depending on the type of car and user it might be used in a diverse way. Since cars are used in different ways, users can have different perceptions of the cars and value certain aspects higher than others.

To accurately evaluate the perceived quality of cars, the teams within the PQ department want to gain further knowledge about different use cases of cars and which ones are the most important to prioritise. The prioritisation processes used today are not based on research and this thesis project will therefore be conducted to create a research-based prioritisation method and facilitate decision making.

1.2. Aim

The aim of the thesis is to map use cases that are relevant when evaluating the perceived quality of a car and to develop a method where the use cases are prioritised to support the decision making of the Perceived Quality department.

1.2.1. Research questions

The following research questions were formulated to be used throughout the project in order to fulfil the aim:

1. What use cases exist in the lifecycle of a Volvo car when considering the interaction between the car and current or potential users?
2. Which of these use cases are relevant when evaluating the perceived quality of a car?
3. What aspects affect how important the use cases are to consider when evaluating the perceived quality of a car?
4. Taking these aspects into account, how can the relevant use cases be prioritised to support decision making related to the perceived quality of a car?

1.2.2. Objectives

Below is a list of the main objectives of the master thesis project, they are based on the research questions in the previous section.

- Investigate what use cases that are established within Volvo Cars today and why they are considered relevant for the departments' work.
- Investigate if there are any use cases that can be relevant to take into consideration that are not part of the knowledge base at Volvo Cars today.
- Map the use cases that are relevant when evaluating the perceived quality of a car.
- Map and create a framework of aspects that affect the relevancy of the use cases in relation to the perceived quality of a car.
- Develop a method for use case prioritisation that assists in improving the decision-making process in perceived quality evaluations.
- Test and evaluate the developed method with perceived quality experts.

1.3. Delimitations

The project has the following delimitations:

- Use cases that will be in focus for this project are ones related to current and potential customers of Volvo Cars, and the usage of Volvo cars that are currently sold on the market.
- The study will focus on customers owning, leasing, or subscribing to their own personal car (excluding usage related to renting, taxi, or similar services).
- The studies that are being held with customers will be conducted in Sweden. Therefore, the customer base that is being consulted is mainly Swedish.
- The project team consists of 2 master students working with this project for 20 weeks during the spring of 2022.

2

Theory

This chapter includes theory that is of importance for this project. It is in part theory that the design process is built upon, but also theory regarding the themes of the thesis that are of importance for understanding the basis of this project.

2.1. Pyramid of knowledge

When working with user studies, an understanding of the concept of knowledge is key in order to decide a plan for the research. Knowledge is defined by Sanders and Stappers (2012, p.52) as information that has been experienced and stored in the mind through ideas and thoughts and can be divided into four different categories: explicit, observable, tacit, and latent. See figure 2 for a visual representation of the pyramid, the different categories are described in more detail below.

- **Explicit**: Knowledge that the person is aware of and can describe themselves.
- **Observable**: Knowledge that can be obtained by observing the person in question. The person might not always be aware of what they are doing.
- **Tacit**: Knowledge that the person has but that they cannot easily describe or communicate through words.
- **Latent**: Knowledge that is connected to things the person may not have experienced yet but that they can form opinions regarding due to other knowledge that they have.

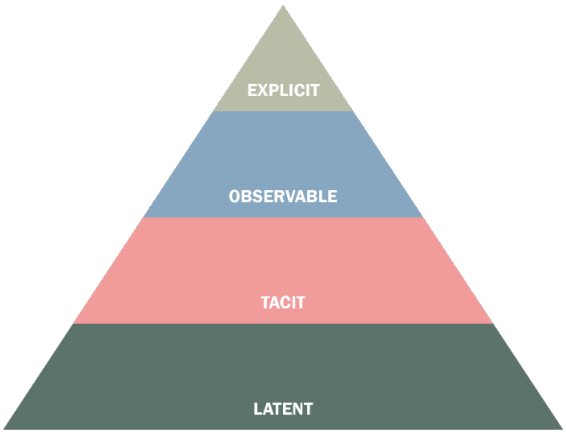


Figure 2: Illustration of pyramid of knowledge (Image inspired by Sanders & Stappers, 2012)

(Sanders & Stappers, 2012, p.52).

2.2. Design thinking

Design thinking is according to Luchs (2015) a useful approach for projects with problems that are not very well defined. He further explains that the approach is suitable for markets that are prone to rapid change and that has uncertain user needs, as well as for more stable markets where it can be used to discover new user needs that previously have not been apparent.

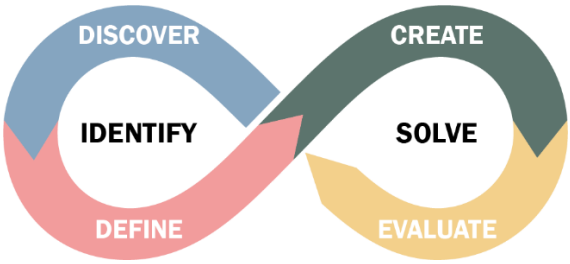


Figure 3: Illustration of design thinking process (Image inspired by Luchs, 2015)

The design thinking framework focuses on identifying problems and solving them, and these focal areas can be considered to be the two main phases of the approach. Within these two phases are several so-called modes: discover, define, create,

and evaluate. See figure 3 for a visual model of design thinking.

2.2.1. Discover

The first mode is the discover mode and here the goal is to gain more knowledge about user needs and insights. Therefore, it is important to empathise with the users to gain an understanding of their experiences and behaviours, which is usually done using different qualitative methods. Throughout the process of gathering data the project team must iteratively work with synthesising it, which

depending on the type of data, can be done by for example coding transcripts, creating personas, empathy maps and journey maps (Luchs, 2015).

2.2.2. Define

The second mode is the define mode, in which the collected and synthesised data from the previous mode is used to identify which needs and insights are most important to focus on and work further with in the project. Usually, short problem statements including the user type, the user need, and an insight clarifying why it is important to handle this need, are written down to be used in the next mode of the design thinking framework. Since it might not be possible to focus on all problem statements that are created, the team must decide which ones are of most significance (Luchs, 2015).

2.2.3. Create

After having concluded which problem statements to address, the project can enter the create mode, where the aim is to develop several concepts. Since these concepts are later meant to be evaluated with the target market and potential users, it is suggested to also create prototypes that they can interact with. The create mode can therefore be considered to consist of two parts: generating ideas and prototyping them. When a quantity of ideas has been generated, the project team must choose which ones to move forward with, and some aspects that can be important to consider when making this decision is the desirability, the feasibility, and the viability. The prototypes that are then created can be very simple, low-resolution prototypes, and they do not have to be fully functional. The purpose of the prototypes are to use them for tests and evaluations in the evaluate mode. Moreover, the concept can be further explored and developed during prototyping and several variations of the concept might be created during this step (Luchs, 2015).

2.2.4. Evaluate

Evaluate is the last mode within the framework and the goal here is to receive feedback on the developed concepts to be able to continue developing and improving the concepts during the coming iterations. During this mode, potential users will first provide feedback on the concepts. It is suggested to let them interact with the prototypes in a similar way that they would do in a real use situation, rather than simply showing the prototype. Thereafter, the feedback should be synthesised and based on the conclusions from the synthesis, it can be decided how to move forward in the project (Luchs, 2015).

2.2.5. The process

It is important to consider that design thinking is an iterative and non-linear process, although the first iteration might be rather linear. The number of iterations that should be performed can vary for different projects and this might not be something that can be decided entirely before starting the project. Instead, it is something that will be decided throughout the process, depending on for instance the objectives, constraints as well as how the project progresses (Luchs, 2015).

The design thinking process can be described in more than one way, and according to the description by Dam (2021) it consists of the five stages: empathise, define, ideate, prototype and test. The description and content of each of these stages is very similar to the description and content of the modes by Luchs (2015), the main difference is the names of the stages.

2.3. Perceived quality

Perceived quality is something that comes up within several different fields such as philosophy, marketing, science, engineering, and manufacturing, and the definition of perceived quality differs depending on the field (Stylidis et al., 2020). According to Lieb et al. (2008), when it comes to perceived quality of a product it includes all impressions that are visual, tactile, acoustic, gustatory, and olfactory.

However, Volvo Cars' definition of perceived quality is limited to the visual and tactile aspects, which will therefore be the focus in this project.

Earlier, the technical quality of products has had a significant impact on the success for a company, but nowadays it is very easy to find products of great technical quality. To stay or become successful it is therefore important for companies to focus on other aspects as well, such as the perceived quality. Perceived quality has a considerable impact on potential users' opinions and thus affects their decision to either buy a product or not. Moreover, it also has an impact on customer satisfaction; if a product has great perceived quality, it likely leads to a higher level of customer satisfaction (Lieb et al., 2008). Perceived quality can also be helpful in foreseeing how successful either a product or a company will be (Braun et al., 2020).

In the automotive industry, perceived quality attributes are often included in the requirements for the vehicle or its components. As it is of importance to fulfil and in best case exceed the expectations that the consumers have for the product, it is crucial to create accurate perceived quality requirements and to implement them in the work as early on as possible. Consumers' perception of a product's design and quality is based on both how it looks and how it is to interact with, i.e., how functional the product seems to be (Braun et al., 2020).

The process of perceiving the quality of a product is subjective and it can occur both consciously and subconsciously (Lieb et al., 2008). How the quality of something is perceived usually stems from physical and cognitive inputs, which in turn usually result from signals taken in by the senses. To simplify, it can be said that the experience of a product is based around information that the different senses take in. Sensory processing is something that happens subconsciously and therefore perceived quality attributes can be communicated through different sensory experiences. Braun et al. (2020) define perceived quality with a framework called the Perceived Quality Framework (PQF) which consists of two parts;

- **Technical perceived quality** which includes everything that is part of the product.
- **Value based perceived quality** which includes attributes like brand image, social values and marketing promotion techniques.

The PQF can also be divided into different levels of perceived quality attributes and the first level consist of quality aspects related to the senses, there is visual quality, tactile quality, auditory quality and olfactory quality. Thereafter, on the second level there are product attributes such as illumination quality and material quality (Braun et al., 2020).

Since it nowadays is difficult for users to compare products based on technical aspects, perceived quality will become increasingly important for companies to work with (Lieb et al., 2008).

2.4. Customer journey

A customer journey is a tool that can support businesses and researchers in gaining an understanding of customers and their preferred experiences. Customers interact with brands and their products in multiple ways, and it can be crucial for the success of a company to focus more on the customer experience (Lemon & Verhoef, 2016).

A customer journey can be described as the process where someone transforms from not being a customer to being one (Nenonen et al., 2008). Lemon & Verhoef (2016, p.74) furthermore describes it as a way to "conceptualize customer experience […]" where the steps that the customer goes through from the purchase is described. They further explain that the customer journey consists of three distinct phases: prepurchase, purchase, and postpurchase, all with their own activities and

customer goals. There are several ways to gain an understanding of what occurs in a customer journey, but traditional user study methods such as interviews and observations are often a good approach (Nenonen et al., 2008).

When a customer is going through the stages of a customer journey, their thoughts and values are subject to change depending on which phase they are in. It can therefore be beneficial to use a customer journey to track the customer's mental model as well as the interactions (or touchpoints) they have with the brand or product (Nenonen et al., 2008). There is a method that is widely used in user experience design called Customer Journey Mapping that takes these aspects into account. According to the Interaction Design Foundation (n.d.a) this mapping should consist of a timescale for the journey, scenarios that the customer goes through, touchpoints, channels, as well as the thoughts and feelings of the customer.

2.5. Use cases

Use cases are used in several different types of work, such as product management, product development, and product testing. They can be part of both the problem space and the solution space of a project. Product management can create use cases describing the users and their goals to define the problem space and hand these over to the product development that work more on the solution space and might also add technical and design details to the use cases to prepare for their development work (Steinhardt, 2021). There are several different reasons for working with use cases, such as managing the scope of a project, creating requirements, making an overview of how a user interacts with the system in focus, and to facilitate communication of technical requirements to business stakeholders (Daly, 2021).

There are several ways to define the term use cases and even if there are similarities, the way the definition is phrased shows that there is a difference in interpretation between sources. One way of seeing it is that use cases describe how a user interacts with either a system or a product, and they can be either in written or visual form. The level of detail in a written use case can vary depending both on who is supposed to read it and which system it is about (Daly, 2021). Steinhardt (2021) defines use cases in a bit more rigid terms when they say that a use case statement includes:

- Who does something? (Persona)
- What do they do? (Interaction)
- What are the circumstances? (Specific instances of usage)
- What is the purpose? (Goal)

Use cases can be described as all the ways of using something in order for it to fulfil a user's goals, or as Jacobson et al. (2011, p.14) states "The smallest unit of activity that provides a meaningful result to the user". This statement speaks for an understanding of a use case as a more strictly defined activity than the ones presented above, and the source discusses this definition in the context of agile software development. The authors continue by describing how the use cases are all a part of a bigger story that describes the entire interaction between the system and the user (Jacobson et al., 2011).

What all of these definitions have in common is that they describe a use case as being where something (a goal) is fulfilled for someone (a user), often in a specific context.

3

Methodology

This chapter contains descriptions of theory regarding the methodology used throughout this project. The information is categorised into user studies, analysis and definition, and ideation.

3.1. User studies

This section will cover a description of the methodology that was used to collect data from users and experts throughout the project. In user studies, there are both qualitative and quantitative ways of gathering and analysing information. Quantitative methods often focus on a larger amount of data and statistical analysis while qualitative methods are used to get a deeper understanding of the users or a concept (Wikberg Nilsson et al., 2015, p.59-60).

3.1.1. Interviews

Interviewing is a common, qualitative method for data collection during user studies (Qu & Dumay, 2011). It can be used in the early stages to provide the researchers with knowledge of the users and their needs, among other things, and in later stages to provide feedback or evaluations. In an interview, a researcher asks the participant questions on the subject in focus. The questions are often based on a previously defined interview guide and the interview should be documented either through note taking or recording (Wikberg Nilsson et al., 2015, p.83).

Interviews can be categorised as structured, semi-structured, or unstructured. What this entails in practice is a difference in the level of detail when it comes to the interview guide that the researcher uses during the interview (Wikberg Nilsson et al., 2015, p.83). Following is a short description of each type:

- **Structured:** Structured interviews are based on an interview guide that is highly organised and that consists of questions with limited space for answers. The questions are not adjusted to the response of the participant.
- **Unstructured:** Unstructured interviews are often deemed more informal and if an interview guide is used, it is very limited. The idea is that the researcher does not know what questions are needed before the interview starts and adapts the discussion based on the replies of the participant.
- **Semi-structured:** Semi-structured interviews are the middle ground between the two extremes. An interview guide is used with questions, but the researchers also use probes to dig out more information between the predetermined questions when needed.

(Qu & Dumay, 2011).

Different types of people can participate in interviews. For example, there are stakeholder interviews, where the participants are people with certain roles or with an interest in a certain subject. There are also key informant interviews, where the interviewees are specialised within the area or have expert knowledge. Furthermore, the participants can be interviewed either individually or in group and while the conversation likely flows more naturally when interviewed in group, it should be considered that the participants might also affect each other's answers (Hanington & Martin, p.138). There is not a correct number to specify how many interviews one should conduct, but when dealing with qualitative interviews and analysis, a rule of thumb is that more interviews do not automatically equal a better study. It is only worth it to conduct the number of interviews that the researchers can actually analyse in a thorough way, any more than that and the interviews will not be fruitful (Brinkmann, 2013, p.58-59).

When conducting interviews in person, it is possible for the interviewer to not only capture what the interviewee says, but also their body language and expression, therefore this is often the optimal way of performing interviews. However, it is also possible to perform phone interviews or interviews through different types of video platforms (Hanington & Martin, p.138).

3.1.1. Focus groups

Focus groups is a qualitative method where a group of participants discuss and share for example experiences, memories, and needs related to a certain topic. It is common to use this method in order to capture feelings, opinions, and attitudes towards a certain product or service (Hanington & Martin, p.118).

In a focus group, the researcher often acts as a mediator, they are there to ensure that the group maintains focus on discussing the topic of interest. They can be more or less direct with this task depending on how freely they want the conversation to run (Kamberelis & Dimitriadis, 2013, p.8).

One benefit of working with focus groups rather than individual interviews is that the participants can listen to each other and develop their ideas and thoughts further based on what has been said before. However, individual interviews tend to reach a deeper level of understanding (Wikberg Nilsson et al., 2015, p.87). Additionally, using focus groups as a method for data collection can be more convenient since it is less time consuming, and sometimes it can reduce the bias of the researcher since they are less involved in the discussion (Qu & Dumay, 2011).

3.1.2. Diary study

A diary study is a method used to gain knowledge about the participants' behaviours, thoughts, and feelings during a specified period of time, which can be anything from a day to months. This method is beneficial to use when working with exploratory research, but it can be used in generative research as well (Hanington & Martin, p.88).

When planning a diary study, it is important to consider that it should be easy for the participant to use and there should be clear instructions on how and when it should be filled out. The time point when the diary should be filled out can differ between different studies, for example it can be at specific times, when certain behaviours occur, when they are in certain situations or encounter certain products. To facilitate for the participant when filling out the entries, there should be some question or other prompt for each entry. The diary entries do not necessarily have to consist of text, but it can also be sketches, symbols and photographs for instance (Hanington & Martin, p.88).

3.1.3. Probes

When conducting user studies, probes can be used to elicit responses and reflections from the participants. Probes can be a variety of things and they are selected based on the aim of the study in question. For example, it can be an object used to represent a future solution that the participant can interact with, or something that supports the participant in gathering information for a study. Probes are therefore a form of contextual analysis that aids the researchers in understanding the users' goals, actions, and interactions (Wikberg Nilsson et al., 2015, p.91).

3.1.4. Card sorting

Card sorting is a process where the participant is asked to sort, group, and categorise a group of cards for the researcher to gain information regarding the participant's preferences, beliefs, and understanding of concepts. Card sorting can either be open, where the participant chooses the categories, or be fixed, where the researcher sets the categories beforehand. One example could be to categorise how they believe that information should be sorted on a website. The cards each hold a bit of information and the participant is free to move the cards around (Conrad & Tucker, 2018). The method can be conducted both in person with physical cards, and online with the help of different digital tools.

3.1.5. Observations

Observations can be divided into semi-structured and structured, where the main difference between them is the level of preparation and structure regarding the execution of the observation (Hanington & Martin, p.158).

A semi-structured observation, also called casual observation, is usually performed in the exploratory phase of a project, especially to learn about a subject that the observer does not have much knowledge about. Before the observation some questions can be prepared, however, the observer does not have to follow them strictly, but should be openminded and adjust as the observation goes along. Throughout the observation it is important to document for example by taking notes, photos, or record (Hanington & Martin, p.158).

A structured observation, also called systematic observation, is mainly used when the environmental or behavioural aspects that should be observed are clearly defined. What is observed is often coded using for example worksheets or checklists. This type of observation has a higher level of preparation and structure, which could mean that different types of interactions or categories for behaviours have been prepared in advance to be used for coding the observations. It could also be that the observer counts the correct actions and errors when the participant interacts with a product, interface, or a prototype (Hanington & Martin, p.158).

When planning out an observation it is also important to decide what the participant should know about the observation. They can both be completed with a participant that is aware that they are a subject for observation or with participants that do not know that someone is watching them. The former instance is called overt and the latter covert (Duke University Libraries, 2022).

3.1.6. Pilot testing

When working with user studies, both as a beginner but also as a professional in an unfamiliar territory, pilot testing can be used to test out the planned activities. A pilot test can support the researchers in multiple aspects, for example: the time needed to complete the tasks, if everything is understood correctly, and how the overall activity should be laid out and presented. If the pilot test is well developed, the feedback gained can increase the likelihood that the real studies will be fruitful (Sanders & Stappers, 2012, p.166).

3.2. Analysis and definition

After performing user studies, the findings need to be analysed. Therefore, this section will describe the methods used for analysis and definition in this project.

3.2.1. KJ analysis

When analysing user studies, user needs can often appear to build off each other. It can therefore be beneficial to display them in a way that visualises this hierarchy. Affinity diagrams, also called a KJ analysis, is a popular method used for grouping and categorising the results from a user study. During this analysis, each insight is placed one by one on a surface. Similar insights are then placed together and if no similarities are found a new pile is created. The groupings are named according to the theme of their categorisation (Takai & Ishii, 2010). KJ analysis can be done both with pen and paper and with the help of digital tools.

3.2.2. Design specification

After collecting and analysing larger amounts of data from a user study, it is important to gather important insights that specify what can and should be done in the project going forward. This can for example be requirements, guidelines, laws and regulations, and preferences that have been expressed

and highlighted throughout the project. By creating a compilation of specifications, the researchers are supported by having a clearer direction going forward, as well as having a clear tool for evaluation of concepts and the end result (Wikberg Nilsson et al., 2015, p.80-81).

3.3. Ideation and prototyping

In this section of the report, the methodology used to generate ideas regarding the customer journey, use cases, and methods for prioritisation are presented.

3.3.1. How might we

How might we is a method that can be used to prepare for ideation by framing the problems that should be solved and make sure that the team maintains focus on these problems. Working with this method can also be beneficial in order to come up with several creative ideas or solutions. In this method, insights and problems that have been identified during research in the earlier phases of the project should be used as a starting point. The insights or problem statements should be rephrased as questions starting with the words “how might we”. When formulating these questions, it is important to make sure that no types of solutions are suggested in the questions since this limits the solution space, leading to less ideas being generated. Moreover, it is important to find a balance when it comes to how broad the questions should be. Questions that are very open can facilitate for generating more ideas, however, if they are too broad there is a risk that they no longer focus on the specific problem to be solved. Lastly, it is good to phrase the questions in a positive way since that encourages creativity and can result in a larger quantity of ideas. This can be done by using positive verbs such as increase, enhance, and promote rather than negative verbs like reduce, remove, and prevent (Rosala, 2021).

3.3.2. Brainstorming

The goal of a brainstorming session is to quickly generate a quantity of ideas, both by expressing own ideas and building on others’ ideas. While brainstorming it is important to avoid being critical and judging whether the ideas that come up will work, and instead be open and not limit the ideas based on for instance current technology and materials. It is encouraged to work visually during brainstorming, for example by drawing or writing on post-its and the quality of the drawing does not matter (IDEO, n.d.).

3.3.3. Crazy 8s

Crazy 8s is a method for quickly generating many and broad ideas to solve a problem. On a paper with eight squares, the team members should individually sketch eight different ideas in eight minutes. This means that the ideas should be generated quickly and therefore do not have to be perfect. To then conclude on which ideas could work and which to move forward with, the participants can then present their ideas to each other, and the others can vote on the ideas they think are the best. Another alternative is to let all participants choose their three best ideas and work further on those for six minutes and then present them and let the others vote. After voting, the group should pick out two or three ideas to work further with (Levey, 2016).

3.3.4. Brainwriting 6-3-5

Brainwriting 6-3-5 is an ideation method with the goal to generate many ideas and build on each other’s ideas. Before beginning with the ideation, the theme of the session should be defined and this can be done by formulating a question to ideate around. In the brainwriting 6-3-5 session, six participants should individually write three ideas in five minutes. Thereafter, the participants will pass their ideas over to the participant next to them, and another round of ideation will begin. This time the goal is to build on and further develop the ideas that are already written down on the paper. This should be repeated for 30 minutes, i.e., six times, until all papers have been passed around to all

participants. After the ideation is finished, the participants can go through the ideas and categorise them (Wikberg Nilsson et al., 2015, p.127).

3.3.5. Prototyping

A prototype is defined as “the first example of something, such as a machine or other industrial product, from which all later forms are developed” in the Cambridge Dictionary (Cambridge University Press, n.d.f). Within design, prototyping includes the activities that are done to transform ideas to more tangible concepts, often with the aim of testing it with users. The benefits of using prototypes are many but some that are worth mentioning are:

- Prototyping allows for faults and mistakes to be found early, which makes them easier to resolve quickly.
- Prototypes can support discussion with stakeholders regarding project status, benefits, and risks with the solution.
- The usage of prototypes can make discussions with users more streamlined since they have a common object to discuss.

(Interaction Design Foundation, n.d.b).

Prototypes can be created on varying levels, everything from a sketch to a fully interactive digital mock-up of an app can be considered one – as long as they serve the purpose of being able to test out ideas. Depending on the industry and project in question, the type of prototype that is created can differ as well since what is needed from the prototype is not the same. For example, prototypes can be used to study the form and design of a product, or to test out its functionality (McElroy, 2016).

4

Implementation

This chapter will present a detailed description of the execution of the project. First, on an overall level by describing and visualising the project framework, followed by an in-depth description of each phase.

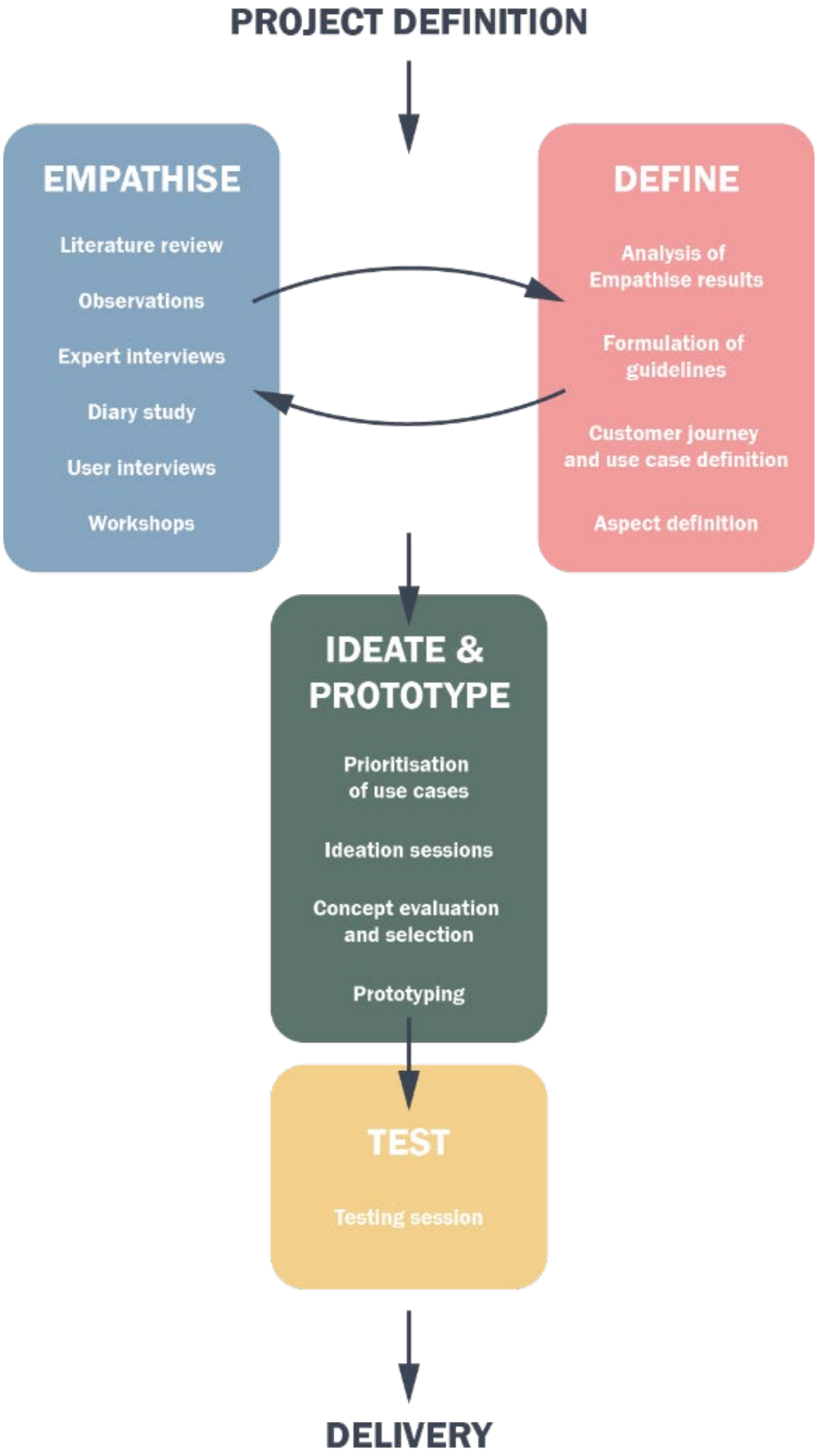


Figure 4: Illustration of project process

4.1. Project approach

In this project, design thinking was used as an overarching framework. It was selected in part for its iterative format as well as for the fact that it is suited for solving problems that are not well defined to begin with (Luchs, 2015). However, to suit the particularities of this project, adaptations to the framework were made, see figure 4. The project started with iterations between *Empathise* and *Define* to investigate and map the use cases and aspects that affect their relevance when it comes to the perceived quality. After that, the phase *Ideation and Prototyping* was initiated to develop the first concept of a method that prioritises the use cases and supports the work for perceived quality experts. This method was then tested, and adjustments were made to mitigate potential faults and to perfect the method.

4.2. Empathise

In the *Empathise* phase, the main goal was to learn more about the user and what their interaction with their car looked like. However, the project team also found it important to learn more about the processes used today for evaluating perceived quality in order to be able to develop a method for this specific purpose. In this chapter, the implementations of the methods used to investigate these questions are described in further detail. As previously mentioned, this phase overlapped and iterated on multiple occasions with the define phase that is described in chapter 4.3.

4.2.1. Literature review

One important aspect in order to understand the scope and possibilities of the project was to perform a literature review. This was something that occurred in parallel with other tasks throughout the entire project. The topics that were researched included how people process knowledge, what perceived quality is, and how use cases can be defined. Different methods that were being used in the project were also researched. By using appropriate keywords for the theme of literature needed, databases such as Chalmers Library and Google Scholar were used to find appropriate articles.

4.2.2. Observations

In order to understand how benchmarking and evaluation of cars is done today, the project team conducted semi-structured observations of a benchmark performed at Volvo Cars by experts from the PQ department. Two longer observations were performed with PQ Illumination and two shorter with PQ Geometry. In addition, a discussion was held with a representative from PQ Material regarding their work processes. To prepare for the observations, a few questions were formulated. During the observations, questions were sporadically asked regarding the approach and documentation used, but the team members for the most part stepped back and observed the work. After the observations, the team members discussed and reflected on the experience to conclude what would be of value for the project going forward.

4.2.3. Expert interviews

During the *Empathise* phase one goal was to gain knowledge about if and how use cases are implemented in car development processes today. Experts within the field of car development and customer retainment were selected for interviews due to their experience working close to the car and the customer. All experts were employees at Volvo Cars. During the interviews the experts were also asked if they had any recommendations of other departments that could be relevant for the

project team to interview. This led to an expansion of the list and 12 expert interviews were conducted in total, see table 1.

Table 1: Participants in expert interviews

EXPERT INTERVIEWS	
ID	**DEPARTMENT**
E1	Strategy & Business Ownership
E2	Product Validation
E3	NVH
E4	Innovation Arena
E5	UX Illumination
E6	Consumer Data
E7	Ergonomics
E8	UX Design
E9	Consumer Experience
E10	Market Intelligence and Strategy & Business Ownership
E11	Functional Architecture & Simulation
E12	Consumer Experience

A basic interview guide, see appendix 1, was created to be used as support during the interviews. However, due to this phase being very explorative, the project team did not know all questions that would be suitable to ask in advance and therefore had to adapt the interview based on what the interviewee said. For example, some of the interviewees had brought prepared material and held a presentation, in which many of the team members' questions were answered, but new ones were also prompted. The interviews should therefore be described as unstructured. All interviews were recorded and thereafter transcribed to facilitate the analysis of the information. Some of the interviewees also shared documentation with the project team, that they thought could be relevant for the project. After the interviews, this material was analysed and the parts that were of interest for the project were summarised.

4.2.4. Diary study

A diary study was planned to get a deeper understanding of car usage, confirm the information gathered through the expert interviews, and potentially fill in any knowledge gaps. In the diary study, the participants were instructed to fill out a short survey after every time they used their car during one week. This would show the project team what a week of car usage could look like. A more detailed overview of the diary study process can be seen in figure 5 below.

Figure 5: Illustration of diary study process

Pilot study

In order to make sure that the process, as well as the prepared questions, were suitable for the study and understandable for the participants, a pilot study was executed. In this, two participants were instructed to answer the diary prompts for two days and to send their answers to the project team. They also participated in a pilot version of the interview and lastly gave their input on the study. This gave the project team a greater understanding of what worked and what did not so that the questions could be adapted accordingly.

Table 2: Participants in diary study (those in cursive are those who dropped out)

DIARY PARTICIPANTS			
ID	**CAR MODEL**	**NUMBER OF PEOPLE USING CAR**	**OWN MORE THAN ONE CAR**
TP1	C40 Electric	4	Yes
TP2	*C40 Electric*	*2*	*Yes*
TP3	XC90 Plug-in hybrid	5+	No
TP4	XC40 Plug-in hybrid	1	No
TP5	S60	2	No
TP6	XC40 Electric	3	Yes
TP7	V60	4	No
TP8	XC90 Plug-in hybrid	4	Yes
TP9	*S60 Plug-in hybrid*	*3*	*No*
TP10	C40 Electric	3	Yes
TP11	XC40	3	No
TP12	V90 Plug-in hybrid	2	Yes
TP13	*XC40 Electric*	*2*	*No*
TP14	XC60 Plug-in hybrid	2	No
TP15	S60 Plug-in hybrid	3	No
TP16	XC60	3	Yes
TP17	*XC90 Plug-in hybrid*	*5+*	*No*
TP18	*V90 Plug-in hybrid*	*1*	*No*
TP19	XC90 Plug-in hybrid	4	No
TP20	Polestar 2	3	Yes
TP21	XC40	4	Yes
TP22	XC40	4	Yes
TP23	XC60	1	No
TP24	S60 Plug-in hybrid	2	Yes
TP25	XC40 Electric	4	Yes
TP26	XC60 Plug-in hybrid	2	No
TP27	V90 Plug-in hybrid	4	No
TP28	C40 Electric	2	Yes
TP29	XC60 Plug-in hybrid	4	Yes
TP30	XC60 Plug-in hybrid	4	Yes
TP31	V60	4	Yes
TP32	V90 Plug-in hybrid	1	No

Selection of participants

After the pilot study, it was time to recruit participants for the main study. In this case, people who drove Volvo cars were the main group of interest. The primary way to contact this group was through a fleet of cars of Volvo employees. The participants from this fleet were segmented by selecting people living in the Gothenburg area and that had cars that were maximum 3 years old. The time limit was set to make the results more applicable for designing a method for cars being developed now and in the future, older cars may not be as relevant for this purpose. A survey was sent out to the segment of interest asking them for some initial background information, such as their car model and the number of people using the car, as well as asking if they were interested in partaking in the study, see appendix 2. 903 people responded and 211 expressed an interest in participating. Based on the results, 50 people were selected. The people selected owned cars from an as wide range of car models as possible, seen to the Volvo cars currently being sold on the market. It also varied on aspects such as how many people regularly used the car and if they owned more than one car or not. The proportions of car models were selected to reflect the proportion of the whole database of replies. The final number of participants that expressed an interest was 32, see table 2, but due to some people dropping out later the project team was able to collect replies from 27 people.

Preparations

The material needed for the diary study was prepared beforehand and can be found in appendix 3. When the appropriate participants had been selected for the study, they were sent all the material they needed for completing the diary study. This included:

- **A welcome letter** describing the study in more detail as well as the questions they were going to answer throughout the week. They were also provided with contact information to the team members so that they could send any questions that came up during the study.
- **A schedule** that they could print and use as a reminder of their tasks.
- **A reminder note** for them to print and put in their car. Since the diary entries were preferably going to be filled in right after a drive, having something working as a reminder in that situation could be beneficial.

The participants were also invited to a digital kick-off meeting. The purpose of the kick-off was to present the instructions again as well as allow the participants to ask any questions that they had to the project team. The participants that could not attend, were instead sent all the instructions via email.

Execution

During the actual study, the participants could answer the questions directly in an app that they already had in their phones since that was included when becoming part of the Volvo fleet. This approach was selected due to it being accessible to all participants regardless of their location and it was also easy to implement. The questions that they were asked were mainly regarding the purpose of the drive, passengers, and luggage. A full list of questions can be found in appendix 4. The questions were designed to be easy to answer quickly in order to not disrupt the daily life of the participants. Most of the questions were multiple choice and the open-ended ones only demanded a short and concise answer. The project team also made sure to check in with the participants once throughout the week to answer any potential questions and remind everyone to continue to fill out the diary. The responses from the diary were collected in an Excel sheet that was later used for analysis.

4.2.5. User interviews

After performing the diary study, some of the participants were selected for an in-depth one-on-one interview. The purpose of this interview was to discuss their experience of performing the study, both to evaluate it and to potentially catch activities that were not recorded by the entries. Additionally, the interviews were used to gain a deeper understanding of the relationship between the customer and their car, how they use it, and what is important for them. It would put the diary week into a bigger picture and compare it to the whole year.

The interviewees were selected to as accurately as possible represent the variety in the total group of participants from the diary study. In total, eight people were interviewed, and the interviews lasted about 30 minutes. The interview was semi-structured, and the guide can be found in appendix 5. The first part of the interview was more general and concerned their thoughts of the diary study, followed by questions about their car usage. The latter part of the interview was designed differently and used mediating tools to drive the discussion and prompt the user to reflect about their experiences and values. The digital tools Miro (an online collaborative whiteboard tool) and PowerPoint were used in order to make this section interactive for the participants. The mediating tools and the associated tasks are described below and they are shown in more detail in appendix 5.

- **A year in usage:** An image representation of the year was presented for the user for them to imagine their driving behaviours and patterns over a whole year, making it easier to discuss things that did not happen during the duration of the study. They were asked to write specific things they do with their car throughout the year.
- **Top view of car:** To reflect on how they use their car in detail, a top view of a car was shown to the participants where they were asked to explain where people sit and where they store things in the car regularly.
- **Car models:** A collection of images of different types of cars as well as some basic information about them was shown one at a time to the participant. When presented, the user was prompted to answer some questions regarding if this car would work for them and their needs, as well as tell the interviewer what they thought about it.
- **Card sorting:** Lastly the participants were shown a list of use cases that had been defined based on previous user studies by the project team. They were asked to rate these use cases depending on how important they found that use case, what use cases they would prioritise as meaningful to them and their car usage. This activity consisted of two parts, the first one including use cases more related to using the car and the second one focusing more on the process of learning about a car.

The interviews were recorded and later transcribed to support the analysis.

4.2.6. Workshops

The final part of the *Empathise* phase was to further learn about the prioritisation of the use cases in order to be able to develop a method where they are prioritised. Since the method is to be used for evaluating the perceived quality of the car, experts in this field from the PQ department were consulted. This was done through a series of workshops, one with each specialisation within the field: illumination, geometry, material, and surface finish. The workshops lasted for about 30-60 minutes and were conducted in person. Following is a list of the participants:

- Workshop 1 – PQ Material: 4 participants
- Workshop 2 – PQ Illumination: 3 participants
- Workshop 3 – PQ Surface Finish: 2 participants

- Workshop 4 – PQ Geometry: 4 participants

During the workshops, the participants were further introduced to the background of the project as well as the purpose of the workshop. The agenda was presented, and they were encouraged to ask questions at any time they wanted. Overall, the structure of the workshop consisted of some individual work as well as discussions between the participants, similar to that of a focus group. The mediator was one of the members of the project team and they were responsible for describing the tasks and answering any questions. During the discussions, it was important that the mediator did not interact with the participants more than necessary as to not affect their responses. The agenda was as following:

- **Warm up**: The project team asked the participant an ice breaker questions in order to get everyone talking and ready for later discussions. The question was: "What was the last TV-show you watched and if you were in it, would you have survived?".
- **Customer journey discussion**: The participants were presented with a customer journey that the project team had developed. They got the opportunity to discuss their thoughts around the journey as well as deciding what phases are of importance when it comes to evaluating perceived quality in their specific sub attribute. The journey used can be found in appendix 6.
- **Card sorting**: The participants were shown a list of use cases that had been developed by the project team. They were asked to rate these use cases depending on how important it was for their sub attribute within PQ (similar process as for participants in the interviews described in chapter 4.2.5). This was firstly done individually and after presenting their results to each other, they created a common prioritisation.

4.3. Define

In this section, the execution of the *Define* phase will be described. The KJ analysis and the use case definition in particular are two methods that were not only executed at one time and then seen as completed. Instead, the *Define* phase was revisited at multiple times throughout the project. When more information was gathered, both through empathising and through testing, this knowledge was integrated into the previously made definitions.

4.3.1. Expert interview analysis

The information from the transcribed expert interviews was analysed using the method KJ analysis. What was considered relevant for the project was sorted out from the transcripts and transferred into a Miro board. The notes of information were colour-coded to be able to trace them back to the interviews and they were then presented one at a time within the team and then placed in appropriate groups. When all notes had been primarily sorted, a secondary sorting occurred to further categorise and connect relating themes. The results were thereafter summarised to accommodate for upcoming steps in the process such as definition of guidelines.

4.3.2. Formulation of guidelines

Based on the conclusions from the KJ analysis, the project team discussed how the insights connected to the development of use cases and the method of prioritisation. Aspects that could be important to consider when developing the method were summarised and resulted in a list of guidelines that would serve as a basis while ideating later in the project.

4.3.3. Initial customer journey and use case definition

The insights from the initial interviews with experts resulted in a list of use cases. This list was categorised and sorted to see if a use case was mentioned multiple times or not, and to group any use cases that were similar. Based on this list, a customer journey was created. The main method for

developing this was brainstorming with the insights as the knowledgebase. Each use case in the customer journey was then further analysed and the project team discussed what made it important or not important from a perceived quality perspective.

4.3.4. Diary study analysis

All diary entries from the app were placed in an Excel sheet, and they were analysed both using qualitative and quantitative tools such as KJ analysis and statistical calculations in Excel. The part of the entries that explained the purpose of the drives, was transferred to Miro and analysed by KJ analysis. The entries were sorted into different categories to conclude on what different purposes of drives there were, as well as which ones occurred more often. The other answers from the diary entries were analysed in Excel and comparisons were made on how and if the result differed between different car types and engine types.

4.3.5. User interview analysis

Since the interviews consisted of both questions and interactive activities, the results of the different parts had to be analysed in different ways, depending on what was considered the most suitable way of reaching insights.

The task “a year in usage” was analysed by compiling all interviewees’ notes into one larger image to get an overview of what is done with the cars throughout the year. Since the interviewees were also asked about their car usage in other parts of the interview, relevant comments from the transcripts were also selected. Together, these two parts were used to reach insights about what the car can be used for throughout a year.

When it comes to the tasks “top view of car” and “car models”, these two were analysed using the KJ analysis method. The transcripts were read through and comments concerning storing luggage, usage of seats, and what aspects attracts or does not attract the interviewees to a car, were selected and transferred to Miro. The comments were colour coded to keep track of which interviewee said what, and lastly the insights were summarized.

During the interviews, the interviewees were also asked about their opinions about, and experience of participating in the diary study and this part was also analysed by KJ analysis.

The card sorting part of the interview was analysed by creating a scale from 0-3 on the board where the interviewees had prioritised the different use cases, this way each use case was given a score based on their position on the board. The scale was chosen due to the structure of the card sorting board used, that had three distinct levels. All scores were put into an Excel sheet, where the average score for each use case was calculated to conclude on which ones were considered the most and least important for the interviewees.

4.3.6. Workshop analysis

The result from the customer journey discussion part of the workshops was analysed by summarising what each sub attribute had written on the sheet and what was said about each of the phases of the customer journey. Like the card sorting that was done during the interviews, the card sorting result from these workshops was also analysed using a scale from 0-3. The average of the individual card sorting was calculated for each sub attribute and compared to the result of the card sorting that was done by the whole sub attribute together. Moreover, it was also compared how the result of the common card sorting differed between the different sub attributes.

4.3.7. Final customer journey and use case definition

By using the initial customer journey as a starting point and taking new insights into consideration, a final customer journey could be defined. With the results from the diary study, interviews and workshops in mind, the team members discussed whether something was missing or was irrelevant seen to the complete customer journey. Thereafter, the phases of the customer journey were defined in more detail by describing each of them with:

- A name
- User goals
- User activities, i.e., a description of what the phase includes

Each phase was broken down into use cases and these were then defined with:

- A name
- A description of what the user does in the use case

The team members then went through the results and insights from the workshops performed with experts within perceived quality, and discussed which phases were considered more and less important when evaluating the perceived quality of a car. Thereafter they also discussed and made a selection of which use cases were most relevant to include for evaluation of the perceived quality.

4.3.8. Aspect definition

To identify which aspects affect the importance of each use case, the project team performed an initial brainstorming session, using the knowledge and insights gained from the expert interviews. The brainstorming session was based around what affects how important a use case is for the customer, for Volvo Cars and for the different attributes of perceived quality and it was therefore divided into three smaller parts. For five minutes both team members brainstormed individually around one of the questions and thereafter the result was discussed. This was then repeated until the team members had ideated around all three questions. Thereafter the team members went through the result of the brainstorming and explained their thoughts to each other. Moreover, there was a discussion about how the aspects that came up could be studied and measured, as well as positive and negative factors of the different aspects. The results of the brainstorming were also compared against the KJ analysis of the expert interviews to make sure that no important aspects had been overlooked. Thereafter, an initial list of aspects was created.

Later on in the project, after having gained more insights through the diary study, interviews and workshops with perceived quality experts, the list of aspects was revisited. The team members concluded that some aspects included in the list could be discarded since the new insights showed that they did impact the importance of the use cases when evaluating perceived quality. Moreover, the insights also contributed to new aspects being added to the list and a final framework of aspects was created.

4.4. Ideate & Prototype

This section will describe the execution of the *Ideate & Prototype* phase. In this phase, the goal was to compile the use cases and aspects that were defined in the previous phase into a method that could be applied when evaluating perceived quality. In accordance with the objectives presented in chapter 1, the method should prioritise use cases to assist perceived quality experts with decision making. Therefore, it is determined that the method should consist of a use case prioritisation and a concept of a process for how to work with the use cases. Chapter 4.4.1 below discusses the former and 4.4.2-4.4.5 the latter.

4.4.1. Prioritisation of use cases

When prioritising the use cases, Excel was used as the main tool due to its flexibility and capability to streamline the usage of calculations. The use cases were listed in a table and the determined aspects were input as columns. For each of the aspects, the insights from the diary entries, interviews, and workshops were used as a starting point to prioritise the use cases. The use cases were each given a number to represent their importance concerning that specific aspect. The rankings from the separate aspects were then combined to give each use case a final combined score.

4.4.2. Initial ideation session

In order to stimulate creativity in the project team as well as to explore the possible design space for a process to apply when evaluating perceived quality, an ideation session was held. In this the project team decided to first discuss through the problem statement to have a direction for the ideation. When the problem statement had been formulated, different aspects, concerns, and possibilities regarding this problem was noted down on digital post-its. These were rephrased as questions starting with the phrase “How might we…”. These questions were the source of inspiration for the project team when the brainstorming method Crazy 8s was implemented. Here, both members of the team were provided with a paper folded in eight equal parts. During eight minutes, they had to come up with eight ideas answering one, or a combination, of the earlier formulated questions. At this stage, it was encouraged to not limit the ideas by how realistic or implementable they were to keep the design space wide. Afterwards, the ideas were discussed between the team members. Miro, pen, and paper were the main tools used during this session.

4.4.3. Final ideation

Later on in the project, another ideation session was carried out, where the method Brainwriting 6-3-5 was used. However, since the team only consisted of two team members, the method was adapted to suit that by decreasing the number of iterations. The team members had the question “How can the perceived quality experts evaluate perceived quality of a car with use cases in mind?” as a starting point and then had five minutes to individually sketch or write three ideas using pen and paper. Thereafter the papers were switched, and the team members had five minutes to further develop the other’s ideas, and this was repeated three times. Lastly, the team members went through and explained their ideas to each other.

4.4.4. Concept evaluation and selection

Thereafter, the team members grouped ideas that had similarities and had a discussion regarding which elements of the different groups that they thought were best and if these elements could possibly be combined to create new solutions. As the last part of the ideation session, the project team ideated and discussed the previous ideas using three different mindsets. At first, they were very open-minded and did not criticise any ideas. Then, they had a more realistic perspective and discussed how the ideas could actually be implemented. Lastly the team members thought in a critical manner and reflected on which problems could occur with the different ideas. For this part of the ideation, Miro was used.

Based on the ideation sessions and the discussions that followed, a concept was selected to be worked on further and prototyped.

4.4.5. Prototyping the concept

When developing the concept, a prototype was made in Figma. This was done to make it possible for the experts within perceived quality to gain an understanding of the suggested process and also for them to have something to interact with while later testing out the use cases.

4.5. Test

To evaluate the method and prioritisation of use cases that had been developed a testing session was conducted with three experts within perceived quality of illumination. During the test a car was used as a mediating object. In the beginning of the session some of the prior work leading up to the concept was presented to the participants, before the resulting concept and prioritisation was introduced. The team members then performed a demo, showing the participants how the concept and prioritisation were intended to be used. Thereafter, the experts were asked to try the concept by imagining that they were performing an evaluation of the car in front of them. Due to time limitations the experts were only asked to try evaluating one use case in the concept rather than all of them. Moreover, the goal of the testing session was not to evaluate all use cases for the car, but to evaluate how the concept presented the use cases and what they thought of the use case prioritisation. Lastly, after having tried the method, the experts were given a few questions for discussion. They were for instance asked to discuss what worked well, what could be improved and what their thoughts about the prioritisation aspects were.

5

Analysis & Results

This chapter will present the analysis and results from the user studies that were performed in the *Empathise* phase. These results will lay the groundwork for the final definitions and the concept that is presented later on in chapter 6.

5.1. Observations

The observations provided the project team with a deeper understanding of the processes that are established for evaluating the cars in development and performing benchmarks today. Following is a summary of the learnings from observing the PQ department benchmarks:

- The sub attributes within the PQ department were at different stages of their journey for developing a method for evaluation that considered use cases.
    - Even if use cases were not implemented for a sub attribute in the evaluation, some of the discussions between participants made it clear that they tried to see the identified issue from the customer or users' point of view.
- When use cases were implemented today, they lacked a detailed description of what the use case actually incorporated. This led to several discussion between the experts to clear out these uncertainties which takes time from the already time sensitive analysis. Furthermore, the uncertainty makes it hard to assume that two separate evaluations are comparable since the participants may have interpreted the use case differently each time.
- There was not much synergy between the different sub attributes in how they worked. The methods were seemingly developed separately, and they had varying approaches.

5.2. Insights from expert interviews

The information from the interviews with experts at different departments was in the KJ analysis divided into different categories and subcategories, an overview of the KJ analysis can be seen in figure 6. The main findings from the KJ analysis are described below.

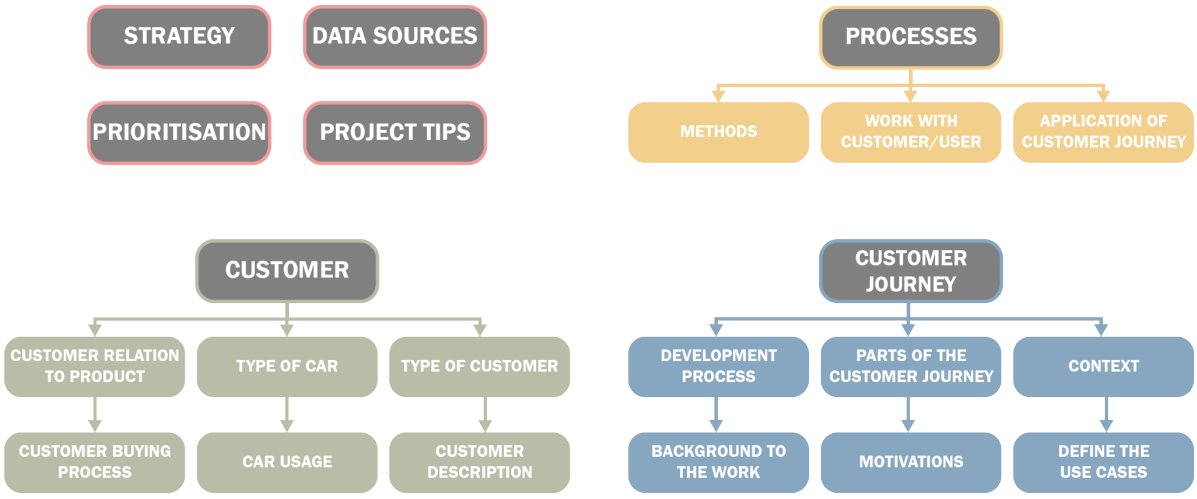


Figure 6: Structure of insights from KJ analysis

5.2.1. Strategy and data sources

The expert interviews taught the project team about how the strategy plans that are established within a company can flow throughout the entire corporation and the importance of working towards a common goal. Potential synergies should be utilised, and the customer and their needs should be the centre of focus. Large organisations must utilise several sources of customer information in order to discover these needs, and both qualitative and quantitative data is needed for a full understanding.

5.2.2. Customer understanding

By working with defining the customer and learning about them it is possible to gain much knowledge that is of value when developing new cars, in order for the people involved to know who to aim their development towards. The customer and the product are not two isolated entities, instead they are

intertwined in several complex ways. This includes, but is not limited to, what the customer values in the product, how and where they decide to attain the product, what the product can deliver to the customer – not only when it comes to functionality but also emotionally, who the customer is, and how they interact with their product when they have attained it. This relationship is also affected by other products in its proximity. An example is that the usage of one car may be affected if the person owns another car.

Customer segmentation is an effective tool to categorise knowledge about the customer so that it is easy to refer to in the development processes. When segmenting, it is important to discuss what parameters should be used to do the segmentation. For example, things like age, gender, interests, living situation, or number of people in household may be more or less important depending on the project.

There are also different ways that people come in contact with products. For cars, some common examples are: owning a car, leasing, subscribing, using car sharing services such as M, renting cars, or by using fleet or company cars.

5.2.3. Working with use cases and customer journeys

To translate the customer understanding that was mentioned in the previous section, into a tool to be implemented in the development process, the experts mentioned that use cases and customer journeys can be used. One benefit of customer journeys is that they provide an overview of the entire process while still providing information about specific steps of the journey. People or departments that are more interested or focused on one thing can zoom in on that part of the journey and have that as their focus point.

Additionally, it was found that what is here described as customer journey and use cases can be named a variety of things. Even though it at first sounded like people discussed different things, in reality the things in discussion were very similar. One example of this is that customer journeys were often referred to as user journeys. It is therefore important to have clear definitions regarding what a customer journey and use cases are so that the people working with it have the same understanding. Relating to this, it is important to consider how the use case is meant to be used in development and discussion. By doing this it is clearer what framework needs to be established.

When developing and defining a customer journey or use cases, different aspects were considered to describe them relating to the customers' behaviour and mental processes. Context was also highlighted as an aspect that greatly can affect the users' needs and their experience of a product.

5.2.4. Prioritisation

Throughout the interviews, there were also discussions regarding what made a use case more or less important to the customer and to the company selling the car. When prioritising use cases different aspects can be considered, the following are some of those that were mentioned:

- Usability, desirability, and feasibility
- Frequency of occurrence
- Importance to the customer
- What is done while driving
- Criticality of task
- Car type
- Customer segment

However, the weight of these aspects was also discussed. For example, what is done most frequently is not always what is the most important or what the customers are most emotionally attached to. There needs to be a deeper understanding as to what the customer actually needs, values, and reflects upon.

5.2.5. Processes

Experts at different departments implement use cases and customer journeys in their work to a varying degree and in a way that suits their specific tasks. The frameworks help the experts understand what the customer appreciates, what their pain points are, and what should be prioritised in the projects going forward. For many, customer journeys or use cases work as a tool for visualisation and communication – a straightforward way of making sure two people of different backgrounds and expertise are discussing the same thing.

5.2.6. Project tips

In addition to the conclusions mentioned above, the project team also obtained the following learnings to implement in the project going forward:

- Remember that the customer journey of a car owner is more than only the usage. Look at the entire customer journey to identify if there are any potential use cases of interest when evaluating the perceived quality of the car.
- It is important to clearly define what a use case and a user/customer journey is in order to facilitate discussions.
- Since the method that is going to be developed in this project is supposed to be used on cars developed for the future, it is important to reflect over potential developments of tech and/or regulations that may affect the outcome.
- Aim for synergies between departments when possible.
- Keep in mind who the user or customer of interest is, not only current ones but also those who may have a car in the future.

5.3. Guidelines

The guidelines are based on information received from the expert interviews and can be seen below. They were divided based on if they relate to use cases or method for prioritisation, and their purpose was to serve as directions for the project team in the following parts of the project: defining the use cases and developing the method.

Guidelines related to use cases

- Make a clear definition of what a use case and customer journey is and follow that definition throughout for all use cases.
    - Each use case should have a clearly defined start and end.
- The driver is not the only user of a car, consider use cases of others that are interacting with the car as well.
    - Do not only consider current user, but also potential future user.
- Consider interactions with the car that are not strictly considered “in use” that affect the perceived quality (in other words, not only the use case of driving or riding the car).
- Use cases that the customer is experiencing rarely can still be of importance when it comes to perceived quality.
- For the use cases that are to be defined, strive to have synergies with other departments within Volvo to facilitate communication and discussion.

Guidelines related to the method for prioritisation

- The method should help decide what needs to be prioritised in a development project when evaluating the perceived quality of a car.
- When developing the method, it is important that the method considers both positive and negative aspects, as well as goes through all use cases of interest in a strategic way.
- The method and prioritisation should have an aspect that reflects the needs and wants of the customer. Consider different customer values, both emotional and functional.
- Consider development in tech and regulations – the method that is to be applied should be applicable for designing future cars on the market.
- Consider how the context, e.g., the weather may affect the prioritisation and how it should be included in the method.

5.4. Initial customer journey

The expert interviews also provided the project team with a high number of use cases that were considered throughout the organisation. Some use cases were only mentioned once or twice, while others were mentioned by almost all participants. The goal at this point was to create a preliminary customer journey and define the accompanying use cases that could be used in the upcoming *Empathise* activities and developed further when new information had been gathered.

Figure 7: Initial Customer Journey Categories

Looking into the list of use cases, 7 different categories could be identified, and these were used as the phases of the initial customer journey, see figure 7. The phases are: *Learn, Sales, Delivery & first use, Away from car, Using car, Daily maintenance,* and *Service*. It should also be emphasised that the customer journey is not linear, but there are several loops between the different experiences and all use cases are not necessarily performed by all users.

As described, each of the phases consisted of a number of use cases, a full list can be found in appendix 7. An initial screening was done based on knowledge about perceived quality to select a number of use cases that should be prioritised and evaluated by users and experts. The screening was based on if the customer interacted directly with the car during the use case or not, as well as it being an activity that holds value to the user. Some use cases were not selected due to the fact that it would test the same activity as another use case. The project team decided to focus on use cases related to learning about the car, using the car, and daily maintenance since they had been expressed as important in the expert interviews.

Following is a list of the selected use cases:

- **Learn**
  - Test drive
  - Looking at the car in a showroom
  - Viewing the car while sitting in another car
  - Viewing the car from the outside, e.g., walking past it
  - Looking for a new car online
  - Moment of purchase

- **Usage**
  - Drive car - Drive the car in different situations
  - Ride car - Ride in the car as a passenger
  - Approach car - Move towards car and unlock it
  - Leave car - Lock the car and walk away from it
  - Load car - Load the trunk, the frunk, on seats, or in any other places
  - Unload car - Unload the trunk, the frunk, on seats, or in any other places
  - Ingress - Open the door, enter the car and place belongings. Settle in
  - Egress - Take belongings, open the car door and exit the car
  - Sitting in car - Sit in the car while it is not currently being driven
  - Arrive - Park the car and finish up the driving
- **Daily maintenance**
  - Charge or refuel - Charge or refuel the car

These, and the preliminary model of the customer journey, were prioritised and evaluated in the upcoming *Empathise* activities.

5.5. Diary study & interviews

When analysing the diary study and the input from the interviews that followed, the project team was able to identify six distinct areas of insights. These were: feedback on study, what the car is used for, usage of seats, luggage, the determining customer values, and prioritisation of use cases. The insights from each area are described in more detail below and consists of information from both qualitative and quantitative sources. However, first some general statistics from the study will be presented. When working with the analysis, the data was also sorted based on car type, i.e., SUV, sedan, station wagon or crossover, and on engine type, i.e., combustion, plug-in hybrid or electric (mild hybrid and combustion engines are grouped together as combustion due to their similar characteristics). This was done to make it possible to compare whether the result differed depending on these factors. The use cases that are discussed in this chapter are the initial ones presented in chapter 5.4.

5.5.1. Diary study statistics

The diary study conducted in this project lasted for one week. During this week, 318 entries were recorded in total – this number averages out to about 45 drives per day. Some participants drove more than others during the week. Seeing to the whole week, the greatest number of drives that any one participant did was 23, and the least was 1. When it comes to the distribution of the drivers in car type and engine type, see figure 8 below. Around 50% drove a plug-in hybrid and the rest were evenly distributed between electric and combustion. Most of the participants drove and SUV (56%), followed by station wagon (19%).

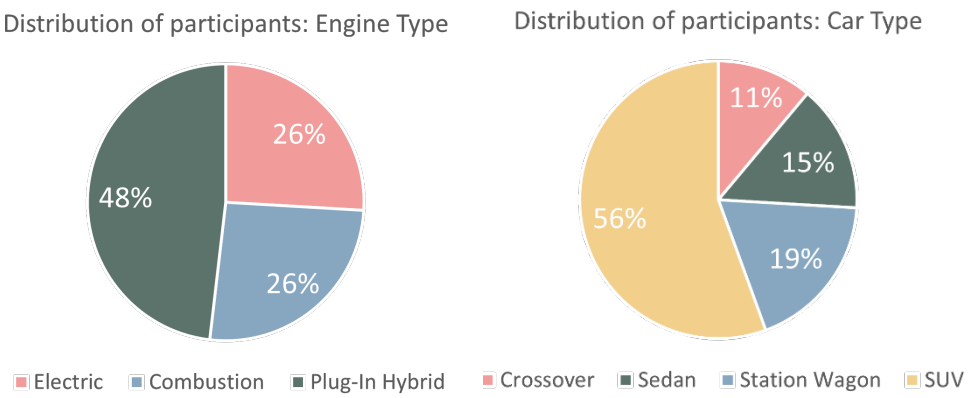


Figure 8: Distribution of participants in diary study (engine type left, car type right)

5.5.2. Feedback on study

The majority of the feedback about the study was very positive and when the interviewees were asked what they thought about participating they said they had enjoyed it and that it was interesting. Many of them also mentioned that participating in the diary study made them reflect more on how they use their car and on why they e.g., place their luggage where they place it. When it comes to filling out the diary entries a few participants had experienced technical issues with the app, but other than that most of them found that it worked well, and that the questions were clear and easy to answer. What was mentioned to be the most difficult was to remember to fill out the questions after each drive and some participants found it easier to set a reminder to fill out all their drives at the end of each day instead.

> *"Very interesting and fun [...] to see what you do during a drive and especially how long it takes and where you put your things. Some more awareness about it."*

5.5.3. What the car is used for

The diary entries and the activity "a year in usage" from the interviews showed what the car is used for both during a regular week and more rarely on a few occasions throughout the year. The clearly most common type of drive during a regular week for the participants was the commute to and from work. A few participants also mentioned that they used their car in their work for going on business trips. Another common drive was to go shopping and run errands and this was often done in connection to other drives, e.g., driving to the grocery store on the way home from work. During a regular week, many of the participants also drove to and from their hobby activities such as workouts and sports. Moreover, it often occurred that they gave others a ride, mostly it was that they drove their children to their sports activities or school. Some of the participants also drove to visit friends or relatives during the week. Activities such as changing the tires or getting a car inspection occurred during the week, but it did not happen often or for many of the participants.

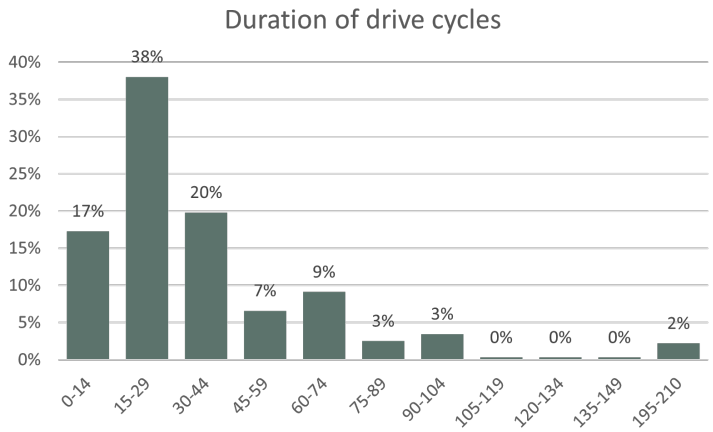


Figure 9: Duration of drive cycles in minutes

A couple of the participants did some longer trips, e.g., to other cities or to their summer houses. Vacations or longer road trips was also something that was highlighted in the "a year in usage" activity. Most common was to go on longer trips during the summer months and going skiing in the beginning of the year, but it was also mentioned that these types of trips occur every now and then throughout the year as well, e.g., to visit family and friends.

When it comes to the length of the drives, the majority were rather short, more than 50% of the registered drives were shorter than 30 minutes and the median car ride was about 25 minutes long, see figure 9. Comparing the median duration of drives between different car types it could be concluded that SUVs, station wagons and crossovers were driven for slightly longer periods of time than sedans.

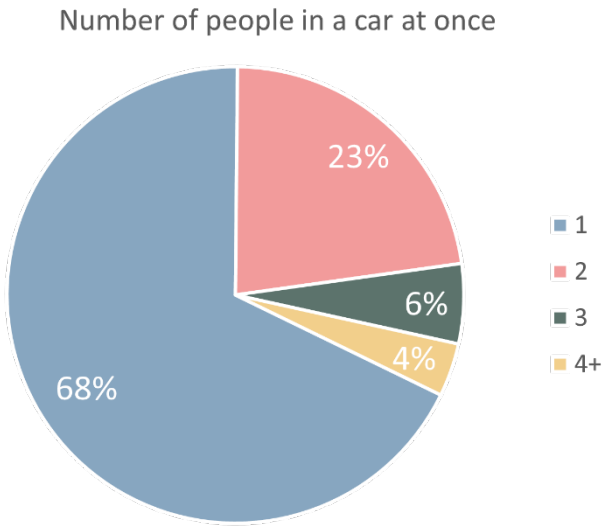


Figure 10: Number of people in car

5.5.4. Usage of seats

In 68% of the drives that occurred during the week of the study, the driver was alone in the car, without any other passengers, see figure 10. This result was very similar for the different car types and engine types. When it comes to the average number of passengers in the car, it was the highest for station wagons and for the other car types it was rather even. Comparing the average number of passengers for the different engine types it could be seen that it was lowest for electric cars, and for the combustion engine and plug-in hybrids it was more even.

Regarding the use of the different seats of the car, the driver's seat was obviously the most used one and the front passenger seat was the second most used, when considering all cars that were in the diary study. However, when analysing the usage of seats for different car types, it was found that the rear window seats were the second most used seats for station wagons, and not the front passenger seat, see figure 11. One interviewee mentioned that for him the back seat was the second most used since his children always sit there, no matter if anyone sits at the front passenger seat or not, and it can be considered that this might be a reason why the back seat is used more than the front passenger seat for station wagons. Though, most interviewees explained that the front passenger seat is the second most used seat, matching the result of the diary entries. Moreover, when asked in which situations the front and back passenger seats are used respectively, most interviewees explained that the back seat is only used when there are more than two people in the car. The diary entries showed that in general, the rear window seats were the third most used seats, while no participant in the study used the middle seat during the entire week. However, it should be considered that the number of participants in the study was limited and the fact that none of them used the middle back seat does not mean that the seat is not used at all.

5.5.5. Luggage

The diary entries provided insights about where the participants chose to store their luggage if they had any. In 86% of the drives that were registered in the study there was some type of luggage, and the most common placement of the luggage was in the back seat or on the floor in front of it. The trunk was the second most used and thereafter the front passenger seat. When comparing the result between the different car types and engine types, it could be concluded that the result was quite similar no matter which car or engine they had, see figure 12. However, one result that differed significantly, was that for station wagons it was much more common to store the luggage in the trunk than in the back seat.

The interviews helped gain a deeper understanding for in which situations the different storage solutions were used as well as why the users store their luggage where they do. Like in the diary entries, the interviewees mentioned that they often store luggage on the floor in the back seat, both when it comes to smaller luggage such as a computer bag and for larger things like grocery bags unless there are too many to fit. They explained that when they have many grocery bags they are placed in the trunk and that is also where other large luggage such as a suitcase is placed. Luggage such as handbags is usually placed in the front passenger seat or on the floor in front of it. The interviewees that had a frunk never used it for anything else than their charging cables.

When asked why they choose to store their luggage the way they do, many of the interviewees explained that they primarily store luggage in the back seat because they find it easier and more accessible than storing it in the trunk. One interviewee also mentioned having a dog cage in the trunk and therefore they were unable to use the trunk for luggage and must use the back seat instead.

> *"If I have one bag of groceries I choose the floor behind the driver's seat and if I have several bags it will be the trunk."*

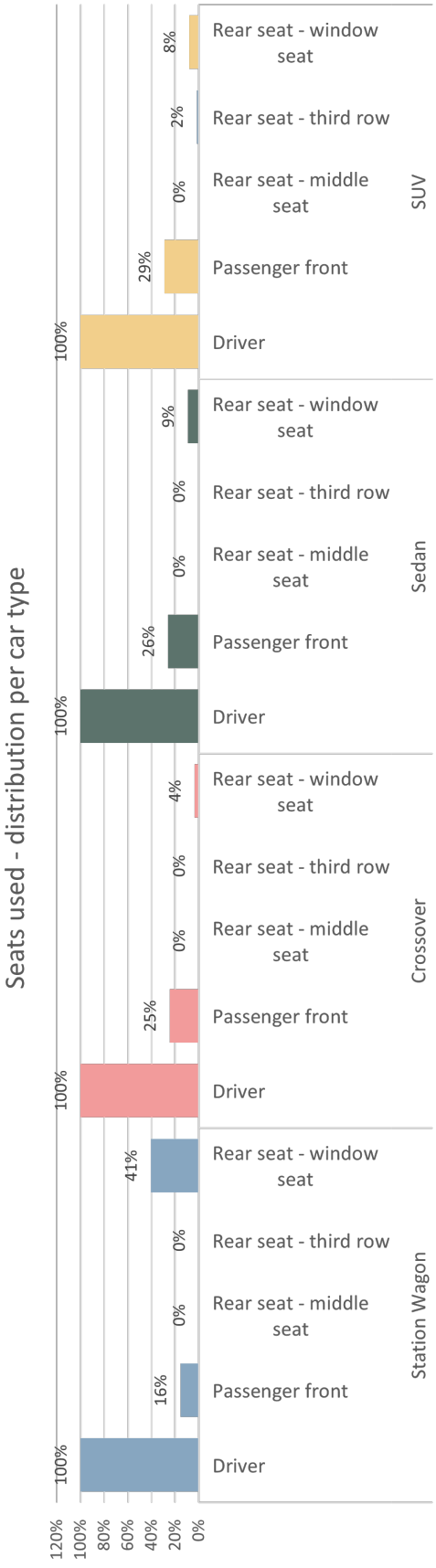


Figure 11: Seats used in the car

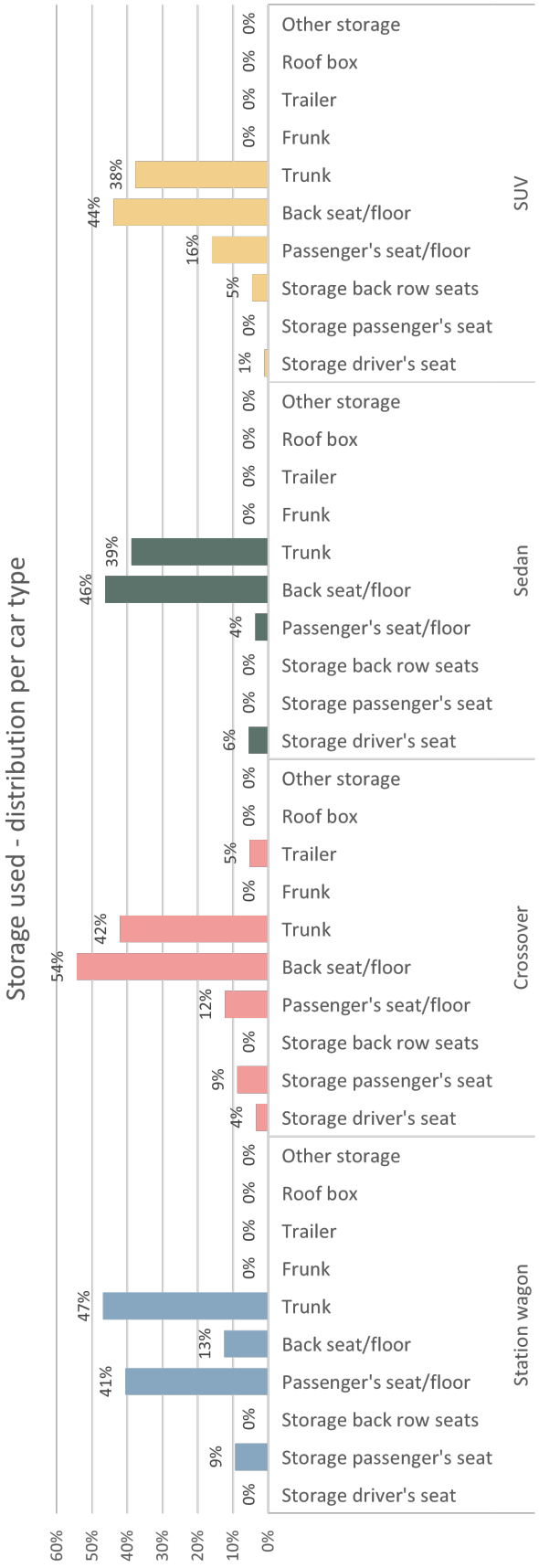


Figure 12: Storage used in the car

5.5.6. The determining customer values

The "car models" activity from the interviews combined with the interviewees' answers when asked about their opinions about their own car was useful to gain an understanding about which aspects that attract or do not attract people to a certain car. The size of a car appeared to be a very important aspect for many of the interviewees, both in terms of luggage space, room for passengers and the size of the entire car. Depending on the interviewees' personal needs, the size of a car could be a determining factor both in the way that they think a car is too big and too small. For example, some interviewees often drove with many passengers and therefore wanted a big car with many seats, while others did not and thought more about that a big car is more difficult to park and therefore did not want a big car.

> *"It fulfils my needs considering size. What needs I have to drive with passengers and luggage and also with trailer."*

Another important aspect for the interviewees was the design and looks of the car. If they thought a car looked bad, they did not want it and vice versa. However, which cars look good depend on the individual's opinions and preferences.

The type of engine was also something that affected the interviewees' opinions about a car, especially when it comes to whether a car has an electric or combustion engine. Some interviewees explained that it was really important to them that the car was electric, e.g., due to high fuel prices or because it is better for the environment. However, others really did not want an electrical car because they found that the infrastructure is not expanded enough and that they would therefore be more limited.

> *"And I do not think that the infrastructure is expanded enough, it limits my freedom since I have to plan so much."*

5.5.7. Prioritisation of use cases

The last activity in the interviews, card sorting, gave the project team an understanding of what activities the interviewees deemed the most important when it comes to interacting with the car, see figure 13. Everyone that performed the activity found *Driving* as the most important, but the results were more divided when it came to the rest of the use cases. *Charge/Refuel, Load* and *Unload* were often found in the middle, accompanied with the motivation that it is an activity that happens often. *Sitting in car* was prioritised as the least important use case and some interviewees explained their reasoning as if the use case of driving is done well, this will be fulfilled automatically. The results were also compared between different car models and engine types to see if there were any trends. However, due to the low number of participants this would yield in each category, no final conclusions were made from this comparison. As mentioned in section 4.2.5, the participants also sorted cards relating to the process of learning about the car. However, the result of the second part of the card sorting was not considered representative, since the participants in the user interviews all obtained their cars through the fleet and not the same way as regular customers would do. Therefore, there are no analysis and results based on this card sorting.

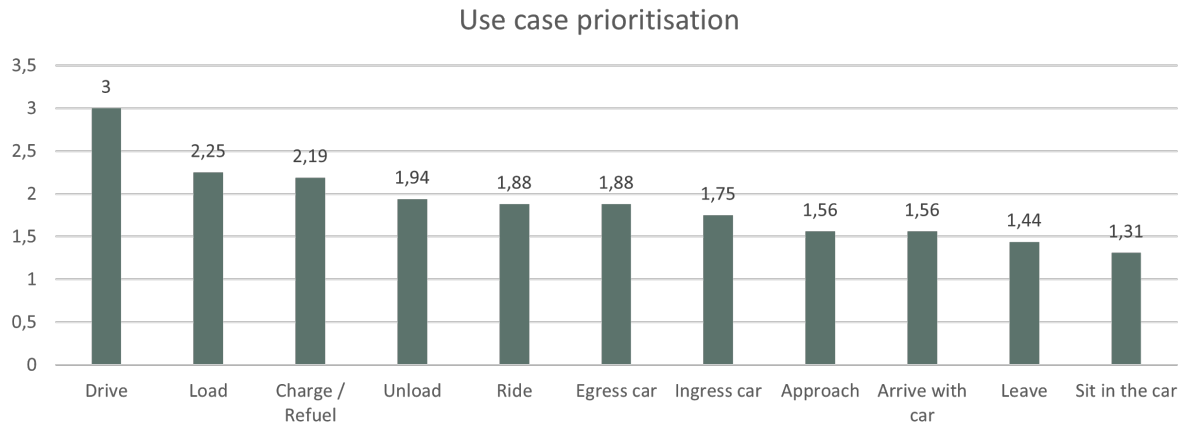


Figure 13: Prioritisation of use cases by users

5.6. Insights from workshops

In the following section, the insights from the workshops with experts at the PQ department will be presented. The customer journey and the use cases that are discussed in this chapter are the initial ones presented in chapter 5.4.

5.6.1. Discussion regarding customer journey

From the discussions about the customer journey, insights were gained concerning what made the different phases important for the sub attributes. Overall, it was discussed that the entire customer journey was of importance when developing cars, but the experts agreed that certain phases might be more central than others for the evaluation of perceived quality.

It was discussed that during the *Learn* phase, new customers can be attracted and that during this phase potential customers gain knowledge about the car. The impression they get of the car here likely affects their decision about whether to get it or not. This phase was therefore deemed to be of importance to the perceived quality experts. When it comes to *Delivery & first use* the experts mentioned that during this phase the users interact with their own car for the first time and for instance explore settings and functionality. It was also discussed that the users' expectations of the car can either be fulfilled or not, leading to the user feeling either satisfied or disappointed. The experts further discussed that the phase *Using car* is important since the users can then learn more about what aspects of their car that they like and dislike. Regarding the *Daily maintenance*, it was discussed that users might notice things that they have not noticed before, since they might interact with the car in a different way, e.g., when opening lids and seeing the car from different angles.

5.6.2. Prioritisation of use cases

The card sorting was helpful to gain an understanding of how each sub attribute prioritised the different use cases and the reasons behind that. Arguments for the ratings included, for example, discussions regarding if the customer comes in contact with the sub attribute during the use case, and what the user is focused on in the instance. The fact that the sub attributes' use case ratings were not identical further indicated the importance of considering this as an aspect when developing the method including a prioritised list of use cases.

6

Use cases, Prioritisation & Process

The aim of this project was to create a method to support decision making when evaluating the perceived quality of a car or its components. This chapter will introduce the final version of the complete customer journey and use cases, as well as the selection of use cases that are recommended for perceived quality experts in their work and evaluations. Thereafter, the method will be presented in its two parts. First the framework for how the use cases can be prioritised will be described, followed by the concept for how this could be implemented into the work processes of a perceived quality team. After that, the results from when the created framework, prioritisation, and concept were tested and evaluated with experts will be presented.

6.1. Definitions

In this project and report, the terms customer journey and use cases have been used many times. It has been clear that different sources, experts, and workers in the field use the term differently and that there does not seem to be one clear way to define them. Therefore, it is of upmost importance to define the terms in regards to the final concepts and results of this project.

- **Customer journey:** The collection of all phases and activities that a user goes through in their entire relationship with a product. Each phase is called an experience and consists of several use cases.
- **Use case:** A description of an activity that a user does with a product to fulfil a goal for them. A use case is a part of a larger customer journey.

The definition is based on the overall insights from the *Empathise* phase in combination with the theory discussed in chapter 2.4 and 2.5. It is recommended to use the definitions above in order to gain a full understanding of the following results.

6.2. Complete customer journey and use cases

Throughout the project, the customer journey and use cases relevant for this project have been iteratively developed. The initial journey and use cases (presented in chapter 5.4) were evaluated and prioritised with the help of both experts and users. In this chapter, the result of these iterations will be presented.

6.2.1. The experiences of a customer journey

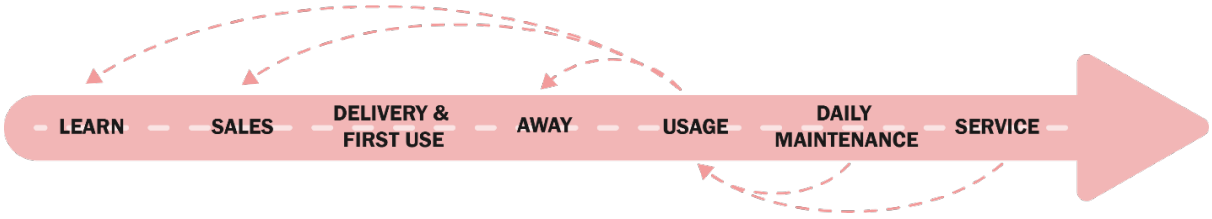
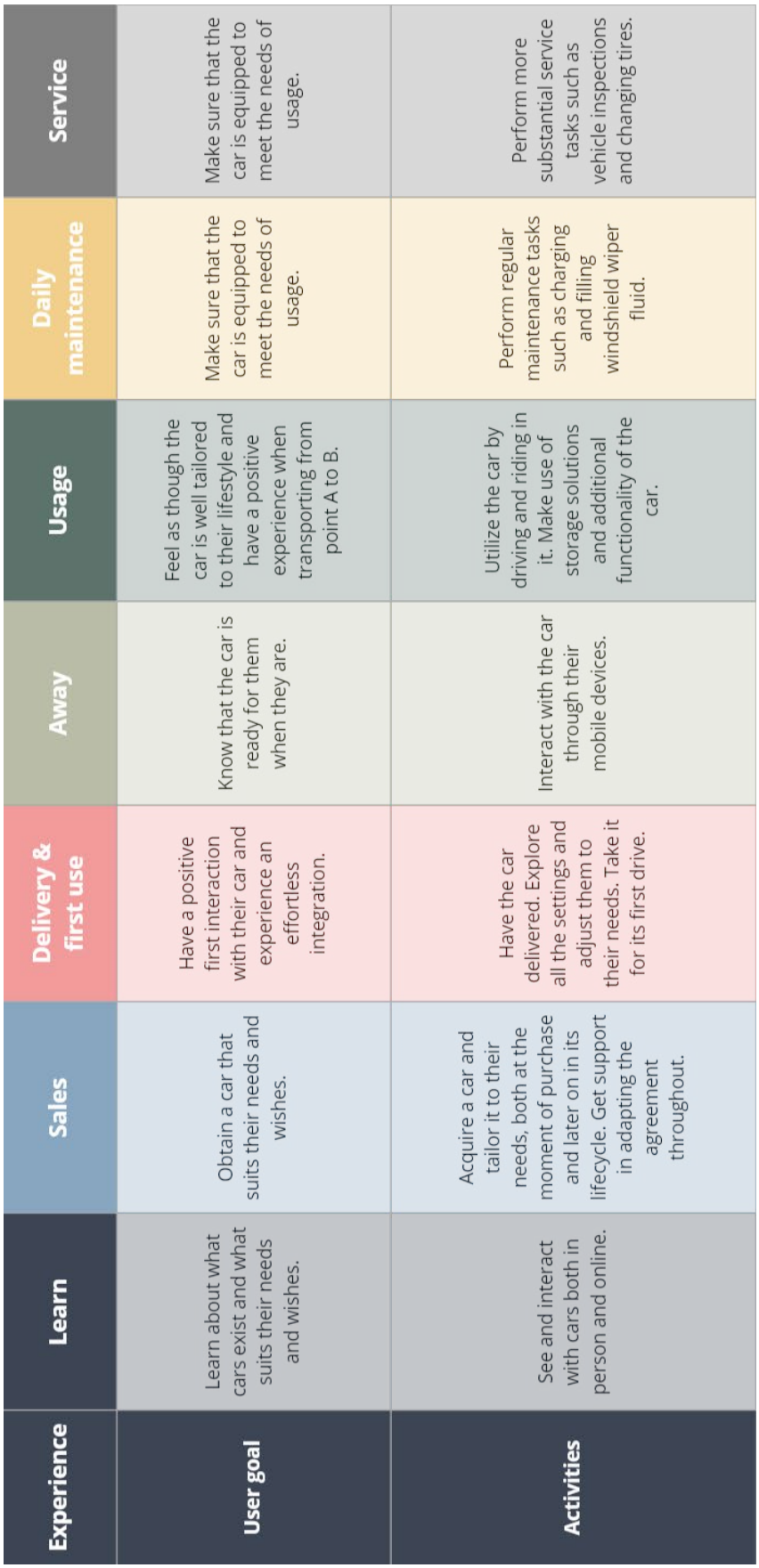


Figure 14: The final Customer Journey

The complete customer journey of interacting with, attaining, and owning a car can be summarized in seven phases that are called experiences, see figure 14. Each experience is described by a title, a user goal, and the activities that are taking place during the experience. In table 3, a detailed description of the experiences can be found. They are presented in a successive order, but it is important to note that the user might circle through these activities in different ways and with irregular intervals. For example, a user will most likely circle between *Away* and *Usage* very often and spend much time there, but they may only turn in the car for *Service* once per year. The goal with this customer journey is that it should facilitate discussion and help experts gain an understanding of the overall relationship between the car and the customer. It should be possible to use as a tool during evaluation and development of cars.

Table 3: The Experiences of a Customer Journey



6.2.2. Mapping of use cases

Each of the experiences in the customer journey consists of several use cases. These are the activities a customer, or potential customer, may go through in order to fulfil the user goal of that particular experience. They sometimes occur in the designated order, but they can in many cases be isolated activities as well. Below, the use cases are presented and discussed briefly, the full description for the use cases can be found in appendix 8. The use cases are divided according to the experience they belong to.

Learn

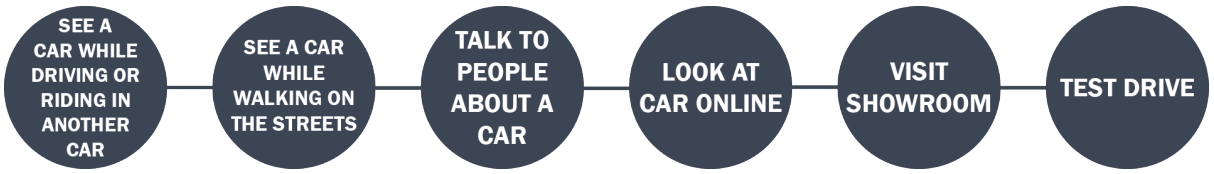


Figure 15: Use Cases of the *Learn* Experience

Figure 15 presents the use cases related to the experience *Learn* and the user in these use cases is a potential customer of a car. In this phase, the activities that the user may perform are all related to information gathering and decision making regarding a potential car purchase. Different people may value these use cases differently and some of the use cases, such as seeing other cars on the streets, may be done more or less subconsciously. These use cases, as well as the ones relating to *Sales* and *Delivery & first use*, are mainly gathered from the expert interviews and the document review that followed.

Sales

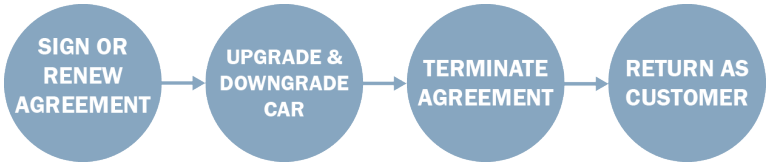


Figure 16: Use Cases of the *Sales* Experience

For the *Sales* experience, this is the point where the user goes from being a potential customer to becoming an actual customer, see figure 16. Within *Sales*, activities such as signing and renewing the agreement for obtaining the car are found. But the *Sales* experience does not stop there, it is an ongoing relationship with the company that sells the cars, and the customer may for example choose to upgrade their car at a later stage, e.g., by purchasing products such as a roof box.

Delivery & first use

After becoming a customer, the car is delivered and the customer interacts with it for the first time. This entails both the first drive of the car as well as the process of choosing the settings of the car. All the use cases can be found in figure 17.

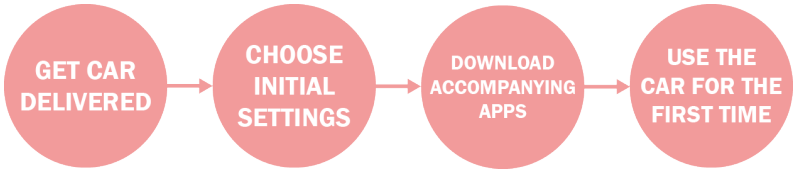


Figure 17: Use Cases of the *Delivery & first use* Experience

Away

The customer may interact with the car indirectly even when they are not in the near vicinity of it, see figure 18. This experience is one that is constantly expanding with new technological advancements and developments. Most of these use cases are carried out through the car's mobile application which can, among other things, tell the customer about the charging levels and location of the car.

Figure 18: Use Cases of the *Away* Experience

Usage

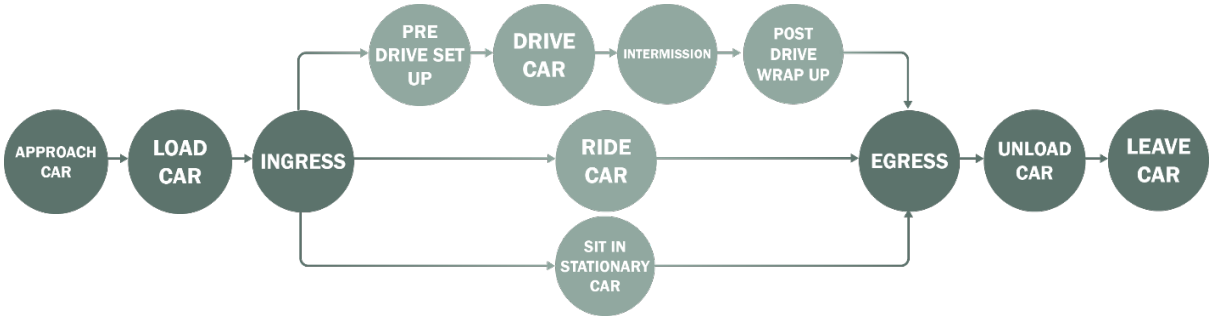


Figure 19: Use Cases of the *Usage* Experience

The biggest and in many ways most significant experience is the *Usage* of the car, see figure 19. Noteworthy here is, compared to many of the other experiences, that the customer no longer is the only main user – there are also passengers to consider. The use cases in this experience are executed successively however some activities may not be executed during every drive. When performing use cases from other experiences, such as *Test drive* and *Using the car for the first time*, the user will in practice go through the use cases of this experience as well.

Daily maintenance

When having a car, the customer is required to regularly maintain it to a certain level, in order for it to work and fulfil their needs. That is what this experience entails and in figure 20 the use cases are presented. The most regularly performed activity is charging or refuelling the car (depending on engine type). These are displayed as two separate use cases since the customer experiences them as two rather different activities. Other car care such as washing the car is also a part of this experience.

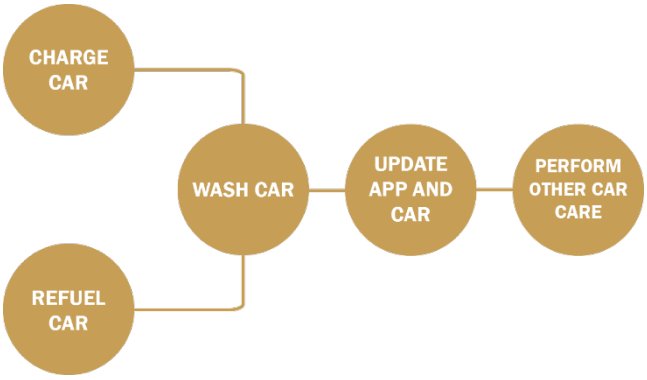


Figure 20: Use Cases of the *Daily maintenance* Experience

Service

The last experience of the customer journey is *Service*, see figure 21. Included here are use cases related to service tasks that the customer seldom performs themselves. These use cases, e.g., vehicle inspections required for the car to be allowed to be driven, occur less regularly than those within *Daily maintenance*.

Figure 21: Use Cases of the *Service* Experience

6.3. Perceived quality relevancy screening

In the previous section, the complete customer journey and all the use cases were presented. However, not all use cases are equally important when it comes to perceived quality of a car or its parts. Therefore, a screening was done based on insights from the workshops conducted with perceived quality experts (see chapter 5.6). Another aspect that was considered when doing the screening was the applicability for the experts that are supposed to carry out the evaluation of the car based on the use cases. Their time and resources are limited, and they will not have the possibility to consider the entire customer journey in every evaluation. Some of the use cases were therefore not selected due to the fact that in an evaluation, they would yield similar results as when evaluating another use case. An example of this is *Using the car for the first time* and *Drive car*, where only *Drive car* was selected during the screening. See appendix 9 for the motivations behind the selections. The experts would in practice evaluate the same activities in both these use cases even if they are in fact different use cases.

It was found that most of the relevant use cases either related to the *Usage* experience or the *Learn* experience, the selected ones can be found in the two diagrams in figures 22 and 23 below. This result was based much on insights from the workshops with perceived quality experts, where it was emphasised that these two experiences were of high importance. As can be seen in figure 22, the use cases *Charge car* and *Refuel car* from the experience *Daily maintenance* were also selected during the screening, since the result from the user interviews showed that the users considered these two use cases to be very important.

The use cases from *Learn*, *Usage,* and *Daily maintenance* are divided into two separate flows, this is in part due to the discussion above that one focuses more on the potential customer and the other on actual customers and other users. They are therefore not possible to combine into one flow at this point. It is recommended that both phases are considered when evaluating perceived quality of a car. As discussed previously in the report, the selection of participants for this project meant that more insights were collected regarding the *Usage* phase than the *Learn* phase. Therefore, the flow with use cases related to *Usage* will be prioritised and discussed further in this report.

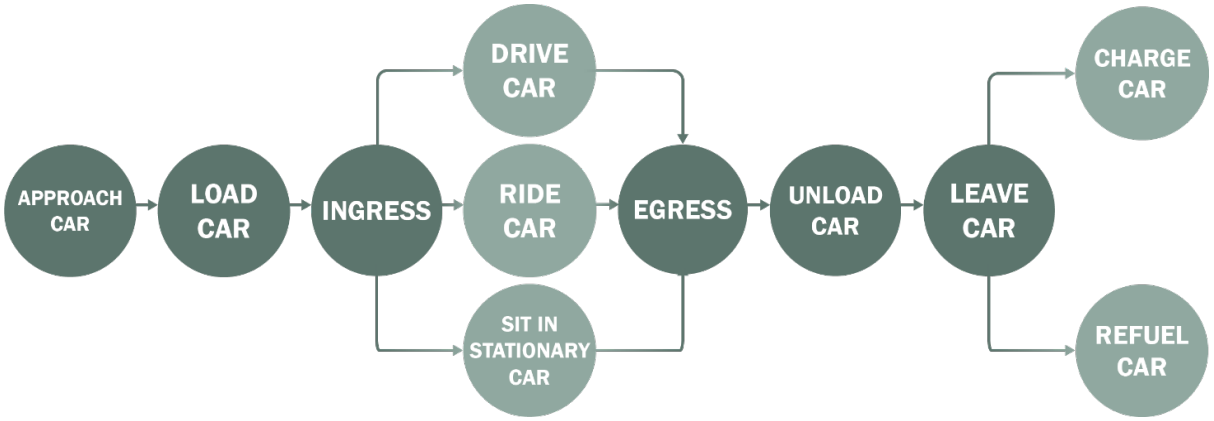


Figure 22: Selected use cases relating to *Usage* and *Daily maintenance*

Figure 23: Selected use cases relating to *Learn*

6.4. Framework of aspects for prioritisation

When the use cases that were relevant for perceived quality had been defined, they also needed to be prioritised in order for them to be applicable for the experts evaluating perceived quality. This began by determining what aspects that were important to consider for the prioritisation of the use cases and creating a framework of how these aspects relate to each other. Since this framework was the result of an iterative process, below both the initial ideas and the final framework of aspects are presented.

6.4.1. Initial ideas

Early on in the project, a first ideation session was conducted by the project team with the goal of establishing a primary understanding of aspects that affect how the use cases should be prioritised. The results were the following aspects:

- How much the customer values the use case
- Duration of the use case
- Frequency of the use case
- What car that is being evaluated or developed
- The relevant customer segment for the car
- Strategic importance of the project to the car developer
- Perceived quality area of expertise

These first drafts of aspects were only defined in loose terms and were grouped into three groups: Customer understanding (How much the customer values the use case, Duration, and Frequency), Car project (Car project, Customer segment), and Car producer (Strategic importance and PQ sub attribute).

6.4.2. Final framework

Based on the summative insights from the *Empathise* phase and the initial ideas presented above, there were four reoccurring aspects that were concluded to describe the importance of the use case in the *Usage* phase. They can be seen in figure 24 below and are there described in more detail. *User's voice* and the *Perceived quality specialisation* are deemed to be the two most defining aspects; however, the experience is also affected by the car type and engine type in question. Most of the aspects have alternatives (e.g. Car type having SUV, station wagon, crossover, and sedan) meaning that the prioritisation will differ depending on which of these alternatives are selected.

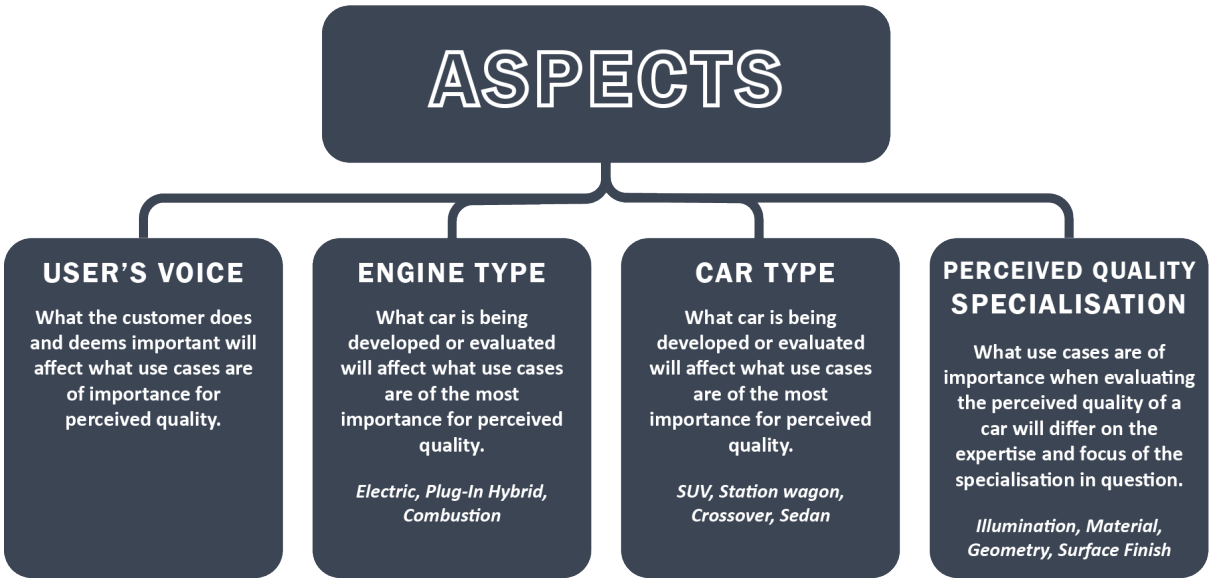


Figure 24: Framework of aspects that affect prioritisation of use cases

6.4.3. Prioritisation based on framework

When prioritising use cases with the framework presented above, insights from the *Empathise* phase were utilised to give each use case a rating. A scale of 0-10 (0=not important, 10=most important) was used for rating the use cases for the aspects *User's voice* and *Perceived quality specification*. The reason behind the selection of the 0-10 scale was that it offered enough steps to differentiate the levels of priority without bringing too much complexity to the list which a higher number of steps could have done. The aspects *Car type* and *Engine type* are incorporated as adjustment factors, adjusting the ranking by plus or minus 20% depending on the use case's importance to the car project in question. 20% was deemed an appropriate adjustment factor since it makes a considerable difference for the final score without affecting the score as much as for example *User's Voice*.

In the equation below the final prioritisation calculation that was implemented for each use case can be seen.

$$USE\ CASE\ RANKING = \frac{USER'S\ VOICE + SPECIALISATION}{2} * CAR\ TYPE * ENGINE\ TYPE$$

Below follows a more detailed explanation of sources used to rate the use cases on that aspect:

- **User's voice:** The main source used for this ranking was the insights from the card sorting exercises in the user interviews where the participants had prioritised the use cases according to their preferences. Some adjustments were however done with consideration to qualitative data that was gathered. For example, the ranking for *Load car* was increased since it (in combination with overall space in the car) was the number one reason expressed for wanting

or needing a specific car. Therefore, it was concluded that it is an activity that brings much value to the user.

- **Perceived quality specialisation:** Similarly to the aspect *User's voice*, the ranking for this aspect was mainly based on the results from the card sorting done during the workshops with experts. Some adjustments were however made to take valuable comments and insights into consideration.
- **Car type:** The ratings for the different car types came from the insights collected from the diary entries and the user interviews that followed. The project team could for example conclude that for some of the car types the driving experience was more central than for others.
- **Engine type:** As for the car model, the ratings for the different engine types came from the insights collected from the diary entries and the user interviews that followed. For example, the activity of charging the car was deemed more important for electric cars than refuelling was for combustion engine cars.

The prioritisations and calculations are all done in Excel and in figure 25, an example is shown regarding how the prioritisation could look with the settings Illumination for *Perceived quality specialisation,* Station wagon for *Car type*, and Electric for *Engine type.* Important to note that the numbers presented in the images are only a placeholder and not the actual prioritisation. In this instance it can be seen that *Egress* and *Unload car* are the two most important use cases to consider. When selecting another car type for example, the final prioritisation would be adjusted accordingly.

	PRIORITISATION					
			Specialisation	*Car type*	*Engine*	
Use Case	**Use Case Description**	**User's Voice**	**Illumination**	**SUV**	**Plug-In Hybrid**	**RANK**
Approach car	Walk towards the car and	7	7	1	1	**7**
Load car	Open the trunk and imagin	2	7	1	1,2	**5**
Ingress	Open the door and step in	10	3	0,8	1,2	**6**
Drive car	Sit in the driver's seat and	9	5	1	1	**7**
Ride car	Sit in the front passenger s	6	1	0,8	1	**3**
Sit in stationary car	Sit in one of the front row	10	2	1	1	**6**
Egress	Imagine grabbing belongin	5	10	1,2	1	**9**
Unload car	Open the trunk and imagin	6	10	1	1	**8**
Leave car	Lock the car and walk awa	4	8	1	1	**6**
Charge car	Open the lid and attach th	6	1	1,2	1	**4**
Refuel car	Open the lid and imagine r	7	3	1	1	**5**

Figure 25: Example of how a prioritisation could look in Excel

6.5. Process guide concept

To package all of the information presented above in a way that is more applicable in a real-life work situation, some digital material has been created. This was the result of the ideation sessions presented in chapter 4.4. This material is called a process guide and is built like a presentation that can be used on a phone or on a computer during a perceived quality evaluation session by experts in the field. The idea is that the guide walks the expert through the relevant use cases step-by-step and explains what they should do to test out the use cases. Each page of the presentation consists of an image representing the use case as well as a detailed description of what it entails. See figure 26 for an example, the full guide can be found in appendix 10.

To accompany this guide, there is a prioritisation work document where the prioritisation can be found, and this document also allows the experts to fill out comments regarding any pain points or delights that they encounter when performing the evaluation. The reason for this is to encourage them to consider both positive and negative aspects of the experience, since perceived quality is a quite complex subject to evaluate. Moreover, it is also possible for the experts to write notes that describe what happens during the use case. Lastly, there is a column where the experts should enter a rating they give the car for each use case. The prioritisation work document can be seen in appendix 11.

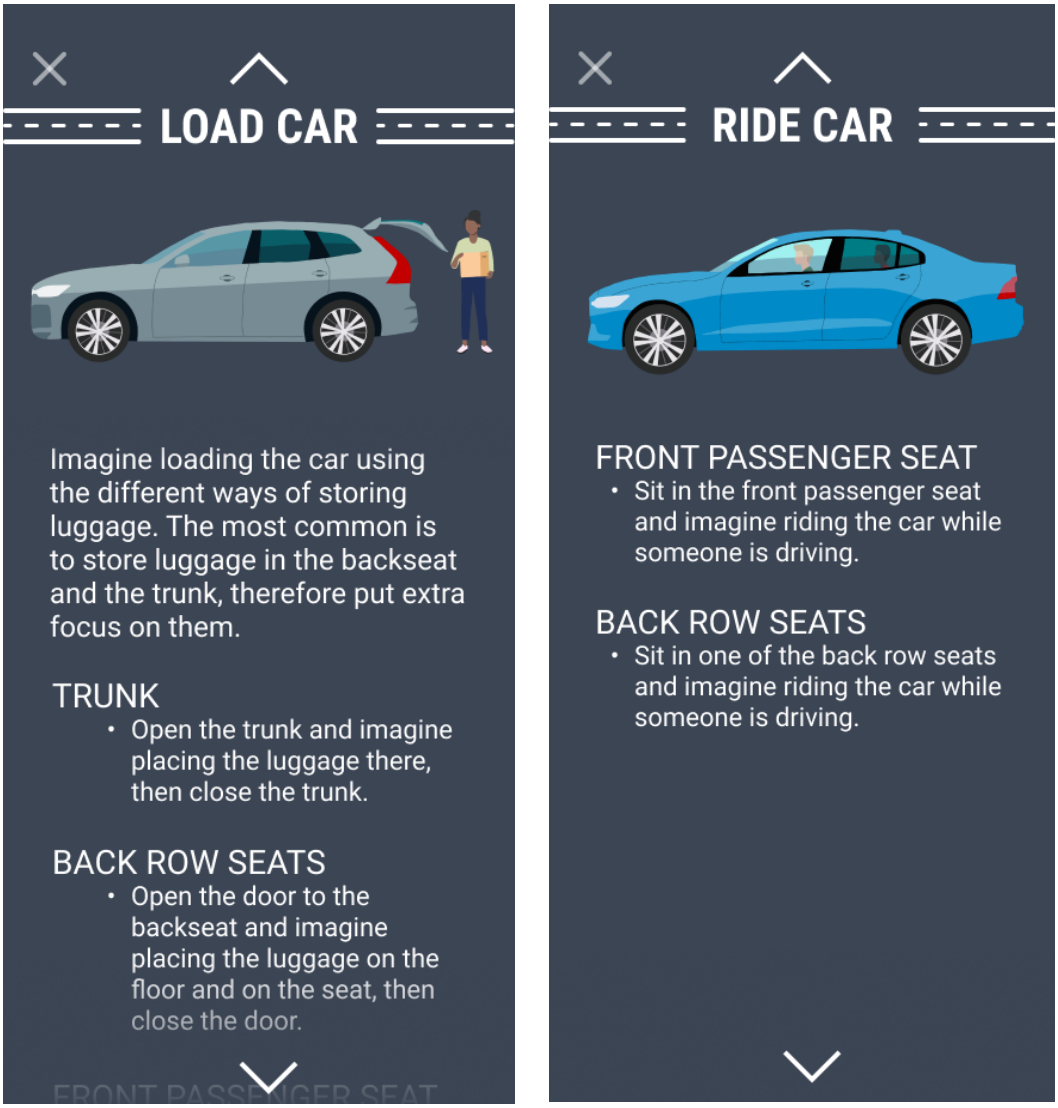


Figure 26: Example of pages from process guide concept

6.6. Scenario

To describe how the developed method is supposed to be used and implemented when evaluating the perceived quality of a car, a scenario is described below and an accompanying illustration can be seen in figure 27.

Anna works as an expert within perceived quality related to illumination, at a company that develops and produces cars. Together with her three closest colleagues who are also experts within the same field, she is going to evaluate a new car that is being developed. To make the evaluation process run

as smoothly as possible, they are using a method consisting of a process guide and a prioritisation work document with a prioritisation of use cases.

Before beginning the actual evaluation, they must make some preparations in the work document to make sure that the use cases are accurately prioritised for the specific evaluation they are performing today. Anna opens the work document and on specialisation she selects Illumination, since that is what they are working within. The car that they are evaluating today is an electric crossover, and that is therefore what she selects as *Car type* and *Engine type* in the work document. Then the rankings of the use cases are automatically adjusted according to that, and Anna and her colleagues are ready to begin the evaluation.

They all open up the process guide on their phones or computers and since they are evaluating the whole car today, they decide to follow the suggested order of the use cases and therefore click on the first one, *Approach car.* When they have all read through the description of the use case, they start acting it out by walking towards the car from different directions and unlocking it.

In the work document they start by writing notes describing what happens when approaching and unlocking the car. They start discussing what they think is good and bad about the car in this use case and write down their thoughts under delights and pain points. Lastly, it is time to give the car an overall rating for this use case and after discussing their thoughts they make a mutual decision and write down their rating. In the same way they then continue evaluating the rest of the use cases.

Figure 27: Illustration of perceived quality experts performing evaluation

6.7. Evaluation of prioritisation and method

While developing the final process guide that is presented above, the concept was evaluated through a testing session to make sure it fulfilled the needs of the target group that was going to use it. During the testing session, the participants (experts within perceived quality) expressed their opinions about the process guide concept as well as the underlying work that had been done to create it. The participants were all familiar with the process of integrating use cases into their daily work but in a less defined way than the concept offered.

Overall, they appreciated the guide for how it provided them with a common ground to base discussions on. It allowed them to not spend as much time defining the use cases each time, something

that they have had problems with at other instances. Instead, the activity that the user goes through is presented clearly for them and they would have all the information available to reference back to at any time; the guide works as a mediating object. The participants did express that it is important to avoid misunderstandings about what a use case entails between the experts performing the evaluation. Therefore, it was discussed if more details should be added in order to create even clearer definitions of the start and end, than those that were included in the guide at the time of the testing session.

The possibility to take notes of pain points and delights about each use case was something the participants in the testing session appreciated and found useful, especially since they after an evaluation of a car usually make a summary of the pros and cons of the experience.

Some of the use cases consisted of several different steps, e.g., *Load car* included both loading the trunk and loading the back seat, and in the process guide it was described that both should be evaluated, however since they were considered to be part of the same use case they were going to be given one common rating. During the evaluation the participants discussed that they would have wanted the possibility to give these different steps separate ratings and comments, since the perceived quality of them could vary. However, it was also discussed that since they belong to the same use case, they could all have the same initial ranking.

Based on the feedback received during the testing session, some adjustments of the process guide and Excel sheet were made. More details were included in the use case descriptions in the process guide, and in the Excel sheet the steps were written on their own rows, making it possible to give each of them their own ratings.

7

Discussion

In this chapter the approach and results of the project will be discussed. This chapter will also provide some recommendations for future work that can be done to further develop the results of this project.

7.1. Project approach

The approach used to plan and carry out the project is something that was of big importance since it had an impact on the entire project. Since the problems to be solved in this project were not completely straightforward in the beginning, the design thinking framework was deemed appropriate to implement. An initial plan for the project was made based on the phases of design thinking and some iterations were included, for example the *Test* phase was planned to be iterated. However, while working with the project, the team members realised that the *Empathise* phase would be more extensive and time consuming than initially estimated. This was in part due to the lack of clarity that existed regarding the work with use cases which meant several groups of people had to be consulted in different ways. Therefore, the plan had to be adjusted according to that, and the second iteration of *Test* was removed while *Empathise* was extended. When making this decision, the project team reasoned that it would be more fruitful to do thorough work with the *Empathise* phase to gain a deeper understanding of what use cases exist, what affects how the use cases should be prioritised, as well as what needs there are when it comes to the method, and to instead suggest further development and tests as future work. Moreover, as mentioned in chapter 2.2.5, when working with design thinking the number of iterations between the phases cannot always be planned in the beginning of a project but that must be adapted throughout.

The fact that the design thinking framework is not linear but iterative made it very suitable for this project since that made it possible for the team members to iterate between the phases *Empathise* and *Define.* In this way studies could be performed and analysed, and based on the result and insights it could be concluded what needed to be researched further, leading additional studies being planned and performed.

Due to the openness of the project as a whole, the objectives and research questions presented in the introductory chapter were regularly referenced to and discussed. They provided the project team with a sense of direction and clarity to make sure that the activities that were done moved the project in the right direction. In the end, the final research questions did not have to be adjusted from their initial format and they worked well for the project approach.

Based on the discussion above, it was determined that the design thinking framework is appropriate to use in projects similar to this one and that it provides researchers with the support needed to structure a project.

Use of digital tools

Most of the activities that have been carried out throughout this project have been done digitally, using different digital tools, such as Miro, Figma, and Excel. During the project, the team members reflected on that this was a very good decision, since that made all the material easy to access from anywhere and at any time. Moreover, when working digitally it is generally easier to make adjustments, e.g., when prototyping in Figma.

7.2. Methodology and implementation

In this section of the discussion, the methodology and implementation of the project will be discussed in greater detail. The discussion is divided according to the different phases of the project: *Empathise*, *Define*, *Ideate & prototype*, and *Test*.

7.2.1. Empathise

In this section, mainly the selection of participants as well as the execution of user studies will be in focus. A goal in the *Empathise* phase was to reach a deep level of understanding about the customer,

both observable and tacit knowledge was desired, as described in chapter 2.1 regarding the pyramid of knowledge. The structure of this phase was successful in doing this for the project team.

Selection of participants

The participants in the studies that were carried out during the project contributed much to the insights and conclusions made by the team members. Therefore, it can be discussed how they were selected and why, as well as how that might have affected the results. All of the participants in the expert interviews, the diary study and the following interviews were Volvo Cars employees. The reason why they were chosen as participants was that it was a very accessible way for the team members to reach them. When it comes to the diary study, all participants had cars that were part of a fleet at the company, and they were selected as participants since it was a good way for the team members to find a large number of users with relatively new Volvo cars. When deciding to contact people with cars that were part of the fleet, the team members reflected on whether the fact that they were employees at Volvo Cars would affect the results. The conclusion was that they are still users and the way that they use their cars likely does not differ much from how people that are not employees at the company use their cars, and therefore the result would be representative. However, something that does differ between employees at Volvo Cars and other customers is the process of obtaining the car, since the employees do it through the fleet while other customers go through different steps such as test driving, looking at the car in showrooms etc. When performing the second part of the card sorting during the user interviews as described in chapter 4.2.5, the team members quickly realised that the result would not be representative. To obtain a valid result about what customers find most important when learning about and obtaining a car, an additional study with customers that are not Volvo Cars employees would therefore need to be done.

The studies performed in this project focused on Swedish customers, and therefore the results reflect their car usage and priorities. However, Volvo Cars also has markets in other parts of the world, for example they have large markets in China and USA. If customers from these markets would have been included in the studies as well, the results might have been different since they might use their cars in other ways and value other things than the Swedish customers. Therefore, other use cases might would have been identified and selected for evaluation, and their prioritisation order might would have been different than the one made in this project.

Ethical considerations

When working with user studies and including participants in research, it is important to consider the ethical implication of the work that is done. In this project, participants were inquired about their driving habits and routines, something that may feel personal to share. It was therefore important that the project team informed them about the purpose of the study and what the information would be used for. The participants should not feel as though they are tested in any way.

Throughout the studies that were completed, the participants always had the opportunity to end their participation at any time without giving a reason for doing so. The project team also made sure to ask if they agreed to be recorded and if so, they were informed about how the recordings were to be used and for how long they would be stored in agreement with GDPR. When interviews were performed during regular working hours, the team made sure to be considerate of the time to not disrupt the participant's workday more than necessary.

Execution of diary study

A large part of the *Empathise* phase was the diary study. Overall, the activity worked out really well, much likely due to the extensive planning and preparational work that was done beforehand. The decision to provide all participants with both written instructions as well as a quick kick-off meeting was very appreciated since it allowed the participants to read everything through thoroughly as well as give them a space to voice any questions or concerns. By also placing the survey in an app that they all already had downloaded on their phone made it very accessible and the threshold for them to be willing to participate was lowered. However, there were still some people dropping out of the study which is something researchers always need to keep in mind. Looking back, it would have been beneficial to allow even more people to be a part of the study from the beginning, both to account for those who changed their mind and to make the result even more statistically accurate. Since all results from the study were collected in an Excel sheet and the manual labour required to analyse it was not affected greatly by the number of entries, it would have been possible to do.

Regarding the execution of the diary study, it can be discussed that the participants were themselves responsible to fill out the diary entries after each drive. The team members had prepared both a schedule and a note to have in the car to remind them to register their drives, however, it cannot be guaranteed that all participants in the study actually filled out the diary every time they had used their car. If they did not register all their drives, the team members would not be aware of it and that might have affected the results. Something that could have been done to limit this risk is to remind the participants more about filling out the diary, e.g., by sending out more reminder emails throughout the week.

Interviews

When performing interviews in this project, the team mainly decided to work in an unstructured and semi-structured way. The risk when going into an unstructured interview is that some information may be missed due to not having the predefined questions ready. On the other hand, if the prepared questions are too rigid, it becomes harder to be as explorative. When it comes to the expert interviews in this project, the unstructured interview guide worked out well and it provided the team with a broad spectrum of insights. The reason it worked well was because of the explorative mindset of that part of the project. The team members did not have much prior knowledge in the area and therefore needed to learn more general information about the topic at hand. It also allowed the experts to bring up presentations and other material that they had to guide the discussion more. Later on, when interviewing the participants after the diary study, it was suitable to have a semi-structured interview guide instead because the theme of discussion was more limited, and the project team knew what needed to be inquired.

During the interviews, the project team chose to include some mediating tools in order to facilitate the discussion and engage participants. When looking through the results, it was concluded that they fulfilled their purpose and the project team believes it helped them to collect more data than they could have done without the mediating tools. When discussing the images in the “car model” task, the participants would point out aspects that would have been more difficult to elicit without the image, such as aesthetic preferences. The project team also felt as though it was important to describe the tools in a similar way for each participant and therefore had a script to use as a starting point. This made sure that the data collected from the discussion was comparable and useful for the analysis.

7.2.2. Define

The *Define* phase was a section of the project that was in focus more or less during the entire project, it is an example of how the results of this project were iterated. The activities that were conducted here were designed to be accessible in the sense that they were always used as a reference point and

something that may had to be adjusted as the project progressed. One clear example of this was the customer journey and use case definitions. A preliminary iteration of these were created early on to capture the insights of the project at that point. By doing that, the project team had something to test out and discuss around when it came to the later user studies. When the later user studies had been completed, the customer journey and use cases were revisited and adjusted based on the new insights and feedback, making sure that the new definitions were more accurate to reality.

One challenge of the *Define* phase in this project was the fact that the project was defined quite loosely in the beginning. It meant that the project team did not know for certain what they were going to create as an end result. The fact that the definitions that were created early on were subject to change as the project progressed was therefore very useful. For example, in the KJ analysis that was done, the project team decided to reorder many of the insights as more interviews were conducted and their knowledge in the area increased. The final categorisation had therefore gone throughout several stages and was therefore considered reliable.

7.2.3. Ideate & Prototype

When it comes to the phase *Ideate & Prototype* the project team got the opportunity to test out design methodology that is created more for traditional design projects on something that is not just that. The problem statement of this project was more focused on creating a method for prioritisation and a process for implementation than on designing a product or interface. However, the methods that were implemented were deemed to be very useful in this context as well and only needed minor adjustments at times to be appropriate. Overall, the project team found value in implementing methods such as brainwriting 6-3-5 but adjusting them as needed. It provided the team with a structure to start with, without being limited to not using a method only because certain criteria could not be met. For example, the mentioned ideation method is designed for a larger project group but by adjusting the iterations, it worked well for a team of two as well.

7.2.4. Test

The test that was conducted was deemed successful, much due to the fact that it in many ways resembled a real car evaluation session. By bringing in an actual car to the test, the participants had a mediating object to discuss around and to use as a starting point. The project team could observe that this made the participants more comfortable in the role and it allowed them to quickly implement the method into their work.

The method that was developed was tested with experts within perceived quality related to illumination, but not with the other experts within geometry, material, and surface finish. This might have affected the result, since not all experts could express their opinions about the method. Therefore, the adjustments that were made after the testing session were only based on the feedback provided by experts within illumination perceived quality. However, the reason why the team members decided to not test the method with all experts was that the illumination experts already had incorporated use cases in their work since before and were therefore used to the approach. Since the goal of the testing session was to evaluate the concept that had been developed and not the approach of working with use cases, it was deemed most fruitful to perform the test with experts that were familiar with working with use cases. This was due to that the other experts might would have needed a deeper introduction to the approach of evaluating a car through use cases. However, in the future it would be beneficial to perform a similar test with the experts within the other perceived quality fields as well.

7.3. Results

This section will briefly discuss the results that were produced and the impact they might be able to have on the work processes in the field.

Customer focus

The studies performed during this project have provided many insights about customers' general opinions and what they value regarding cars in general. However, the team members have not gained an as deep understanding of how it differs between different types of customers, but more of how it differs depending on the car type. Since customer types were not the main aspect of consideration in the studies and due to limited time for the project, all types of customers were not included in the studies. For instance, journalists or reviewers were not included although it could be suggested to perform studies with them in the future, since they might impact customers' opinions and attitudes towards cars.

Implementing the method

The method that was developed during the project was constructed to be possible to implement in the work of the different sub attributes within perceived quality, for instance by making the prioritisation adaptable for each of the attributes. However, it can be discussed that the different sub attributes are not equally familiar with working with use cases, some have already incorporated it into their work while others have not. This might affect how quickly the method can be implemented in their work. Those who already work based on use cases might be able to implement the method straight away since the way of working likely does not differ too much from how they work today. The others might not be able to directly implement the method, instead they might need to get more familiar with working with use cases at first. Moreover, the method might need to be adapted further and be combined with other parts of the sub attributes' evaluation processes.

Societal, environmental, and economical impact

Implementing this method into the work likely leads to that the evaluation of cars becomes more representative of real situations, since the use cases included in the method are based on studies about what users actually do. It might also lead to identifying potential issues that may be critical for the users, at an early stage when solving them is easier and has less impact on the environment than at a later stage. Furthermore, it is more economical to make changes and solve issues early on in a project. Since the use cases are prioritised and reflect what is most and least important for the users, implementing the method can help identifying which issues that are most crucial to solve. For example, if two issues are found, one related to a highly prioritised use case and one related to a lower prioritised use case, it might be more important to focus on solving the first one. Focusing on solving the issues that are of most importance to the users might also lead to higher customer satisfaction which might have a positive economic impact for the company. These positive changes for the economy and environment can in the long run also benefit society overall by setting a good example for the industry.

Defining use cases

When defining the use cases that have been presented in this report, the project team found that it was very beneficial to have defined what a use cases should entail beforehand, just as the early studies indicated it would be. It gave the team members a clear approach and direction in the discussion, as well as something to fall back on if misunderstandings occurred. Despite this, the project team experienced that some of the use cases that were identified were difficult to define on an equal level.

For example, the use cases related to the usage of the car were often divided into smaller more detailed use cases such as *Load car* and *Ingress*, while use cases in other experiences such as *Learning about the car* were larger and not as detailed, for example *Test drive.* It was discussed whether the less detailed use cases should have been divided into smaller parts as well but it was determined that this could be solved by the project team giving all the use cases more detailed descriptions that clarified its boundaries.

Qualitative and quantitative data

For this project, qualitative data has been very important since that makes it possible to gain a deeper understanding of behaviours and values. However, when qualitative data should be used to create a quantitative result, in this case the rankings for the prioritisation of use cases, some difficulties can be encountered. For example, the project team found it difficult determining how much a factor in the prioritisation should be adjusted to reflect the findings and qualitative data.

Moreover, since the focus for many of the studies in this project was to gather qualitative data, the number of selected participants was not always high enough to reach stable and statistical results. However, what has been done during this project can be viewed as a starting point, and to develop it further in the future, more studies with the goal of obtaining a statistic result can be performed.

7.4. Future work

This project has resulted in a concept for prioritisation as well as a process guide, and these could both be further developed after this project is finished. The way that the results are combined makes sure that it is easy to insert new use cases in the future if there are others of interest. For example, new technical innovations may allow for a way of using the car that is not possible today. If that occurs, it is possible to add use cases related to this and to rank it among the others.

Since the studies performed in this project included participants whose cars were part of a fleet at Volvo Cars, it could be of interest to perform studies with customers with cars that are not part of that fleet and who attain their car in a more representative way. By performing studies with that type of customer, it would be possible to gain an understanding of what they value the most in the process of learning about and choosing a car. The second part of the card sorting that was included in the user interviews, as described in chapter 4.2.5, is one suggestion of a method that could be used. By analysing the result of these studies, a similar prioritisation as the one created in this project, could be made for the use cases related to the learning about and attaining a car. Related to this topic as well is that it would be interesting to combine the use case prioritisation of this project with a deeper customer knowledge and segmentation. As discussed above, this project has not allowed (in time and resources) for a deep dive in customer characteristics which means that this aspect has not been explored to its full potential. By consulting experts in market research together with conducting research with customers outside the organisation, this aspect could be fulfilled in the future.

In this project, cars that are either owned or leased were the focus. However, there are many other ways of using a car, such as through taxi, rental cars, and car sharing services like M. There is a difference in how the customer uses the car in these instances that may affect how the use cases should be prioritised, e.g., in a taxi vehicle, the back seat may be more important if that is mainly used by passengers. To further develop the method, it could be suggested to perform similar studies as in this project but with those types of users as well.

8

Conclusion

This project had four research questions which served as a guide throughout the project. Each of these have been answered with the activities that have been conducted and the conclusion for each question is presented in this chapter.

What use cases exist in the lifecycle of a Volvo car when considering the interaction between the car and current or potential users?

It has been concluded that the use cases that exist in the relationship between the car and the customer can be summarised in a customer journey consisting of the following phases: *Learn, Sales, Delivery & first use, Away, Usage, Daily maintenance* and *Service*. The customer moves through this journey and may move back and forth between phases at different intervals. *Visit showroom*, *Locate car*, *Egress*, and *Charge car* are all examples of use cases that can be found in these phases.

Which of these use cases are relevant when evaluating the perceived quality of a car?

When evaluating the perceived quality of a car, it has been concluded that not all phases from the customer journey are of interest. Instead, use cases from the phases *Learn*, *Usage* and *Daily maintenance* were selected to represent the most important activities. In total 16 use cases were selected, these included *Load car*, *Drive*, and *Leave car* among others.

What aspects affect how important the use cases are to consider when evaluating the perceived quality of a car?

A framework has been created of the most important aspects to consider, these are: User's Voice, the Perceived Quality Specialisation, the car type, and the engine type. The two former were deemed the most central for deciding the importance of a use case while car and engine type will adapt the score to take into consideration what car is being developed and evaluated.

Taking these aspects into account, how can the relevant use cases be prioritised to support decision making related to the perceived quality of a car?

The use cases were prioritised according to the aspects presented above, based on qualitative and quantitative insights from the user studies that were conducted. By interacting with the prioritisation work document, it can be adjusted based on for example what car type is being evaluated. To support decision making, a process guide was also created which guides the expert performing the evaluation through the relevant use cases and provides them with a description of each use case.

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APPENDIX

APPENDIX 1. Expert Interview Guide

Vi är läser mastern Industrial Design Engineering på Chalmers och håller nu på med vårt exjobb på Perceived Quality här på Volvo Cars. Som vi nämnde i vårt mail ska vi skapa en metod som ska hjälpa dem på PQ att prioritera olika use cases, det vill säga olika användningssituationer t.ex. att packa bagaget eller att sätta sig i bilen. För att kunna skapa denna metod måste vi ta reda på vilka olika use cases som finns och även vilka olika aspekter som kan påverka hur viktiga dem är. Så nu i våra första studier försöker vi därför lära oss mer om hur olika avdelningar här på Volvo använder sig av/tar hänsyn till olika use cases/bilanvändningssituationer.

Är det okej att vi spelar in det vi säger här idag? Det är endast för användning av oss för att vi inte ska missa något viktigt.

Kan du berätta lite mer om dig och din roll?

Vad gör ni på er avdelning?

Involverar ni på något sätt information kring kundens bilanvändande i ert arbete?

Varför? / Varför inte?

Skulle du kunna ge oss ett exempel på hur det kan se ut/fungera när ni gör detta?

Har ni något i er arbetsprocess som liknar det som vi förut presenterade som use cases?

Hur kommer det sig att det är just dessa situationer/use cases/xxx som ni använder er utav?

Hur kom ni fram till dessa use cases?

Är de baserade på faktisk användardata/undersökningar? I sådana fall, är det något som vi kan ta del av?

Använder ni olika use cases i olika typer av projekt?

Varför? / Varför inte?

Hur avgör ni i sådana fall vilka use cases ni ska använda/fokusera på?

På vilket sätt involverar ni use cases i ert arbete?

Har ni någon strukturerad metod?

Varför känner ni att det är viktigt att arbeta på det här sättet? / Hur kommer det sig att ni inte involverar det?

Har du något material/dokumentation relaterat till denna typ av arbete som du skulle kunna dela med oss så att vi kan lära oss mer?

Vi kanske hör av oss längre fram igen för en ytterligare intervju när vi har haft möjlighet att gå igenom materialet från denna, skulle det vara något du kan tänka dig att ställa upp på?

Tror du att det är någon annan på din avdelning som vi skulle ha nytta av att prata med också?

APPENDIX 2. Diary Study: Sign-Up Survey

Hi,

Would you like to help Sanna and Lina from Chalmers with their master thesis here at Volvo Cars? They are working on a study to understand how people use their cars and are now looking for participants.

Please complete this survey regardless if you want to participate in the study or not.

About the study

The study will be composed of 2 parts, a diary study where you participate during week 12 and an interview sometime during week 13. The diary will consist of a set of questions that you answer directly in your app after each time you used your car, so it's more like a very short questionnaire that is quick and simple. The interview will be set-up at a time that suits you and your schedule best during week 13.

"*We are super grateful for everyone who wants to help us in our project, so please answer the questions below and we will shortly contact those who want to participate!*" - Sanna & Lina

The survey will take around 5-10 minutes to complete, depending on your answers.
Please send in your answers no later than 2022-03-07.

Your contribution is valuable for us!

Questions:

What model is your car?

- C40 Recharge (100% electric)
- XC40 Recharge (100% electric)
- XC40 Recharge (Plug-In Hybrid)
- XC60 Recharge (Plug-In Hybrid)
- XC90 Recharge (Plug-In Hybrid)
- S60 Recharge (Plug-In Hybrid)
- S90 Recharge (Plug-In Hybrid)
- V60 Recharge (Plug-In Hybrid)
- V90 Recharge (Plug-In Hybrid)
- XC40
- XC60
- XC90
- S60
- S90
- V60
- V90
- V60 Crosscountry
- V90 Crosscountry

Why did you choose this particular car model? (Open text answer)

How many people use your car on a regular basis (as both drivers and passengers)?

- It's just me
- Me and 1 more person
- Me and 2 more people
- Me and 3 more people
- Me and 4 or more people

How many of the people who use the car on a regular basis have a driver's license?

- Only me
- Me and 1 more person
- Me and 2 more people
- Me and 3 more people
- Me and 4 or more people

Does your household have other cars than your Volvo fleet car?

- Yes
- No

If yes, what car model is your other car/cars? (Open text answer)

Do you have different purposes for your cars?

- Yes
- No

If yes, please describe in a few words the different purposes of your cars. (Open text answer)

Would you like to participate in the diary study conducted by Sanna and Lina?

- Yes, absolutely!
- No
- Maybe, but I would like to know more

APPENDIX 3. Diary Study: Preparational Material

HELLO!

Thank you for your interest in participating in our study! Your participation makes it possible for us to carry out our master thesis together with Volvo Cars and we are convinced that your contribution will be very useful for us. The result of our master thesis will be used in Volvo Cars' daily work to develop new cars and to make it possible to do that in the best way, we need input from you: the drivers of the cars!

Description of study

To prepare for the week and to make sure this diary study works well we have sent you some material that you can use. If possible, we want you to print both the schedule and the reminder note. We want you to place the schedule somewhere in your home where it is easy for you to see, it will be there so that in the end of the day you can double check and fill out that you have done what you should during the day. The reminder note should be placed somewhere in your car where you can easily see it but where it does not distract or disturb your driving. The purpose with this note is to remind you to answer the diary questions after each drive.

The study starts on Monday week 12 and we want you to answer the questions that you can find in AppGrade after each time you use the car. The diary should be filled out every day during that week, from Monday to Sunday, to help us gain an understanding of how the car is used during a longer period of time. The questions are about the drive that you just did, and they are designed to be as quick and easy as possible to fill out, so that it will not take up too much of your time. In case you would forget to answer the questions right away after a drive, you can do it as soon as you remember it.

These are the questions that you will be answering during the study:

- What was the purpose of your drive?
- For how long did the drive last?
- How many people were in the car at most during the drive?
- Where did they sit?
- If you had any form of luggage with you during the drive, where was this placed?
- Did anything of interest happen during the drive? (alternatives will be given)

We might also contact you to book an interview that will be carried out sometime during week 13. The purpose of this interview is to discuss your car usage a bit more and to learn about your attitude towards cars and car usage. We estimate that the interview will take about 30-45 minutes and it can be done either digitally or in person, depending on what works best for us all. If you are selected to take part in the interview you will get a link where you can sign up for a time.

If you have any questions at all during the study, feel free to reach out to us!
You can find our contact information below.

We hope you'll have a good week!

Lina Ring
lina.ring@volvocars.com

Sanna Göransson
sanna.goransson@volvocars.com

SCHEDULE

This is your schedule for the week of the diary study. If you want to, you can print this and as the week goes on, just cross off the appropriate tasks that you have completed.
(The tasks for day 0 can be completed in the morning of day 1 as well)
Good luck!

DAY 0 SUNDAY
- ○ Read through the welcome document
- ○ Print the reminder note and place it in your car
- ○ Print the schedule and place it in your home, at a place where it is easy to see (e.g. on the fridge)

DAY 1 MONDAY
- ○ I have registered my car rides today
- ○ I have not used the car today

DAY 2 TUESDAY
- ○ I have registered my car rides today
- ○ I have not used the car today

DAY 3 WEDNESDAY
- ○ I have registered my car rides today
- ○ I have not used the car today

DAY 4 THURSDAY
- ○ I have registered my car rides today
- ○ I have not used the car today

DAY 5 FRIDAY
- ○ I have registered my car rides today
- ○ I have not used the car today

DAY 6 SATURDAY
- ○ I have registered my car rides today
- ○ I have not used the car today

DAY 7 SUNDAY
- ○ I have registered my car rides today
- ○ I have not used the car today
- ○ Lina and Sanna will contact you regarding a potential interview during week 13. Book a time for this interview if you are contacted.


Have you answered the questions in AppGrade?

APPENDIX 4. Diary Study: Survey Questions

What was the purpose of your drive? (compulsory) (Open text answer)
For how long did the drive last? (compulsory) (Open text answer)
How many people were in the car at most during the drive? (compulsory)

- It's just me
- Me and 1 more person
- Me and 2 more people
- Me and 3 more people
- Me and 4 or more people

Where did they sit? (compulsory)
Choose all that are true.

- Driver's seat
- Passenger's seat front
- Rear seat row 2 – window seat
- Rear seat row 2 – middle seat
- Rear seat row 3 (if there is one)

If you had any form of luggage with you during the drive, where was this placed? (compulsory)
Choose all that are true. Luggage can be anything from groceries, bags, bags of recycling, etc.

- I did not bring any luggage
- Storage compartments by the driver's seat (e.g., in the door or middle console)
- Storage compartments by the passenger's seat front (e.g., in the door or glove compartment)
- Storage compartments by the back row seats (e.g., in the door or seat pockets)
- In the passenger seat or on the floor in front of it
- In the back seat or the floor in front of it
- In the trunk
- In the frunk
- In a trailer
- In a roof box
- Other

Did any of the following happen during your drive? (compulsory) *Choose all that are true.*

- Passenger was added
- Passenger left
- Changed driver
- Luggage was added
- Luggage was left
- Refuelling/charging (not at home)
- Stopped driving and stayed in the car
- Stopped driving and left the car
- Nothing of this happened

APPENDIX 5. Diary Study: Interview Guide

Hi!

Thank you for participating in our diary study and for wanting to participate in an interview as well. I am XX and I am one of the students doing this master thesis. We are having this interview to summarize some thoughts about the study that you were part of and to complete with some additional thoughts as well. The interview will consist of both questions and more interactive parts, but we will explain everything as we go along.

Firstly, we would like to ask if you are okay with us recording this conversation? The recording will only be used by us two in the project team and the purpose of it is that we should not miss anything important that you say. We will store all the data according to GDPR and we will remove the recording as well as potential personal data this summer when the project is finished. If that is okay with you, we would like you to sign this document.

Then we will get started.

Questions about diary study

What did you think about participating in the diary study?

How was it for you to fill out the survey after each drive?

Is there anything you think did not work well?

Questions about car usage

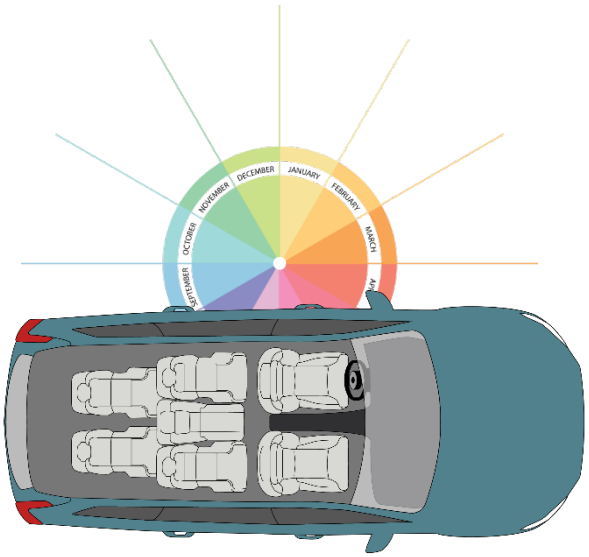
What do you use your car for the most?

The week that you participated in the diary study, would you say that it represents a regular week considering your car usage?

Is there anything that you usually do during a regular week that you did not do this time?

Is there anything you do more rarely with your car?

For example, something that might not happen every week or even every month but that you still use the car for



A year in usage

This is an exercise where you should use this wheel representing the year. The idea is that you should think through your year and car usage and imagine what you use the car for throughout the year. You can choose to take it month by month or place what comes to mind on the appropriate month using the post-its. Think about your car usage throughout the whole year, what do you do with your car? Is there something you do every summer? Is there something that only happens once or a few times a year?

Storage and seats

Assume that this is your car (ignore the back row if you do not have one), while you answer our questions.

Which seats are used the most?

If you compare the usage of the front passenger seat and the back seats, in which situations are they used?

Where do you store things in the car?

Larger items? E.g. suitcases and grocery bags

Smaller items? E.g. backpacks, handbags, pieces of clothing

Why are you using these ways of storage?

If you have an electric car, do you use both the trunk and frunk? In which ways do you use them?

Questions about choice of car

Now we will get into some more questions about your specific car.

Do you like your car?

Why/Why not?

What do you like about it?

What do you dislike about it?

Why did you choose this car?

Did you consider any other cars when you were going to get a new car?

For how long have you had your car?

Are you planning on replacing it any time soon?

Why?/Why not?

Pictures of cars

Now we will show you a picture and short facts about a car and then we will ask you some questions about it. We will repeat this for a couple of different cars. All the cars that we will show you are within a similar price range and in this part of the interview we are mainly focusing on the functionality and characteristics of the cars, therefore we encourage you to not focus on the price of purchase, but more on how the characteristics match what you are looking for in a car and the needs that you have.

Here we have a XX, and you can now take your time to read through the facts about it.

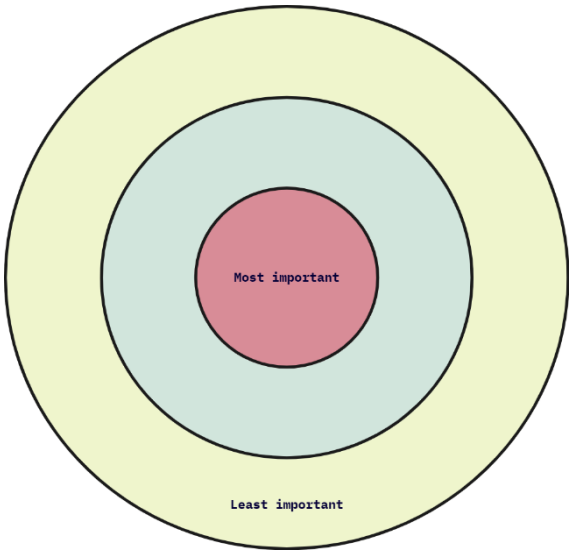
Is this a car you could imagine having?

Why/Why not?

Does it suit your car usage?

Why/Why not?

Card sorting



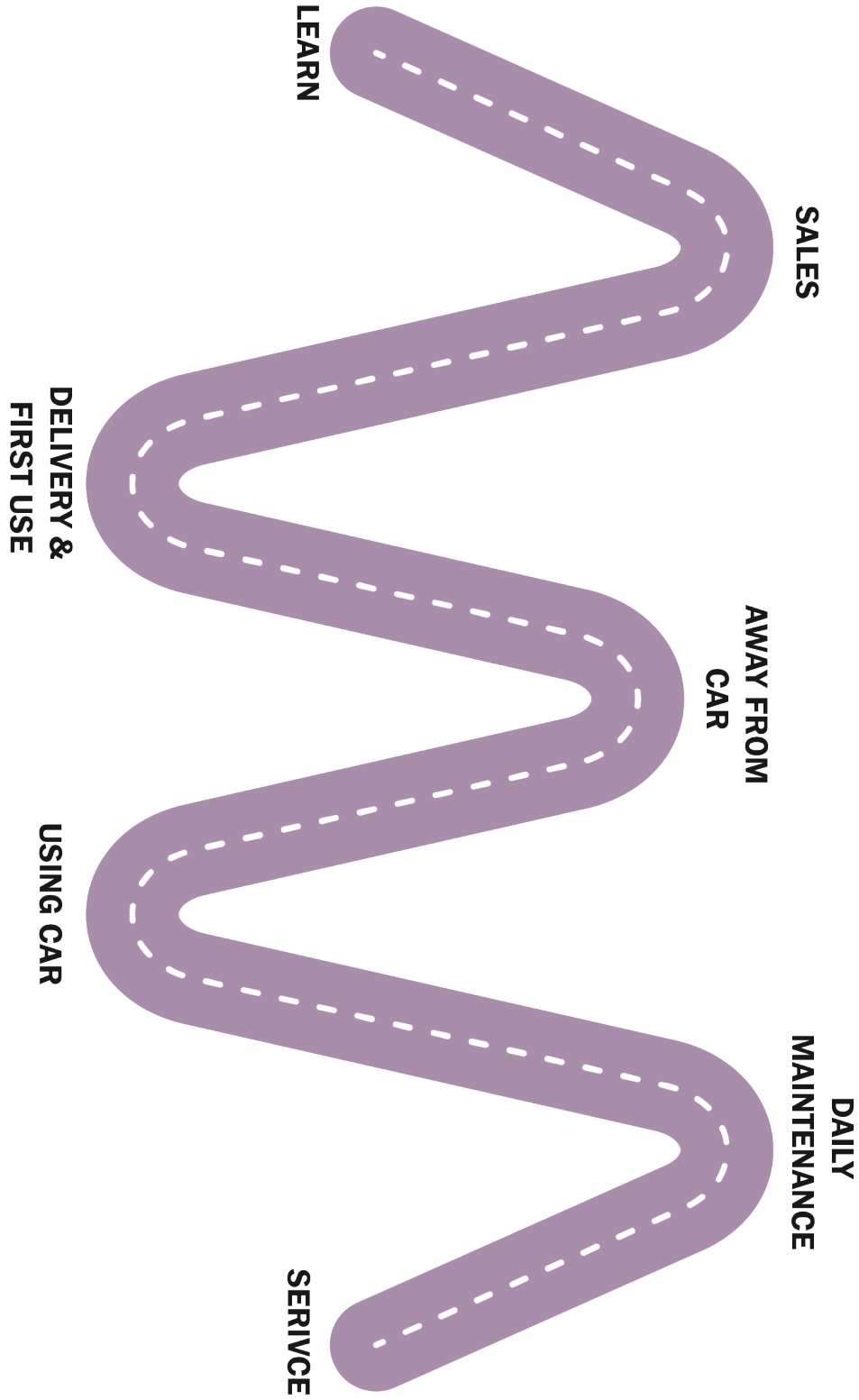
You will now be presented with a couple of activities that can be done with your car. We want you to rank these activities based on what you feel is the most important. What is most important to a person is very personal to them and that is how we want you to think here as well – personally. What is it that you value as the most important activities for you and your car. Which activities is it that makes the car fulfil your goals and what you want to do. Everyone has different priorities and therefore we want to learn more about how you would have prioritised these activities. You can take about 5 minutes to read through and place the activities where you want them and then you can explain your thoughts and decisions afterwards.
And if you have something you want to mention right away you can of course do that as well.

Card sorting part 2

Now we have a part 2 of this task and you are going to do the exact same thing as before but with some other activities. We want you to imagine that you are in the situation where you are planning to get a new car and you are in the process of learning about and deciding which car you are going to get. You can take about 3 minutes to read through and place the activities.

That was all we had for this interview. Thank you so much for taking the time to participate, it will be of great help for us in our project!

APPENDIX 6. Workshop: Customer Journey



APPENDIX 7. Initial Customer Journey and Use Cases

APPENDIX 8. Final List of Use Cases and Descriptions

Experience	Use case	Description
LEARN	See a car while driving or riding in another car	When driving or riding in a car, the potential customer notices other cars in the street. It is a way that they learn about what they like or dislike.
	See a car while walking on the streets	When walking near traffic or parking spaces, the potential customer notices other cars in the street. It is a way that they learn about what they like or dislike.
	Visit showroom	To learn more about a car, the potential customer visits a showroom. Here the car is often studied in greater detail from different angles.
	Look at car online	Through websites and social media, potential customers may see images and information about a car.
	Test drive	The potential customer performs a test drive to see if a car that they are interested in suits their needs.
	Talk to people about a car	The potential customer discuss certain aspects of cars with people in their surroundings.
SALES	Sign or renew agreement	The customer has decided on a car and signs an agreement of how they will attain it.
	Upgrade & downgrade car	To tailor the car to their needs the customer upgrades or downgrades the car, e.g. by buying additional products, such as a roof box.
	Terminate agreement	The customer ends the agreement and stops being a customer.
	Return as customer	After having terminated an agreement and not being a customer for a while, they decide to return and sign an agreement again.
DELIVERY & FIRST USE	Get car delivered	The car is delivered to the customer, e.g. they pick it up at the car dealer.
	Choose initial settings	The user sets up their profile and explores the different settings, e.g. light settings, and decides which ones they want to use to begin with.
	Use car for the first time	The user drives the car for the first time.
	Download accompanying apps	Some functionality can be used remotely through apps, e.g. seeing the charging level, and to be able to utilize this functionality, the user downloads the apps to their mobile device.
AWAY	Know the status of the car	The user uses the car's accompanying mobile app in order to check the status of the car, e.g. checking the charging level.
	Locate car	When the user has the intent of using the car and they need to know where it is located, they may use the car's accompanying mobile app for this.
	Plan upcoming drive	In order to prepare for upcoming drives, the user may, among other things, turn on heating in the car from the mobile app.

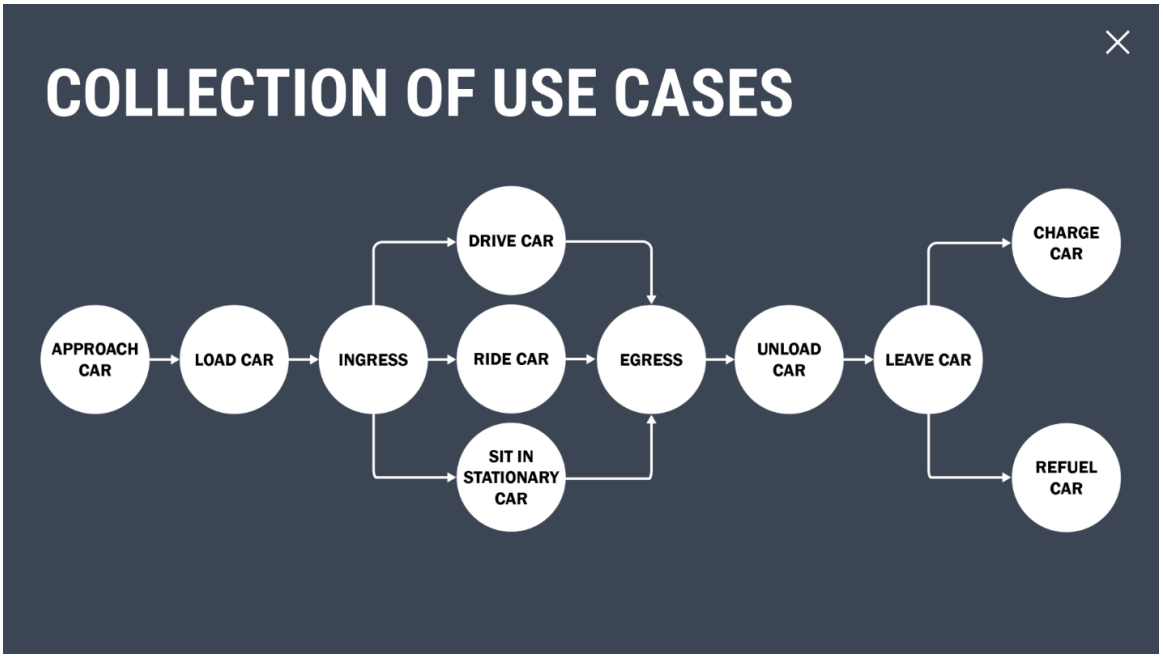
USAGE	**Approach car**	The user moves towards the car and unlocks it.
	Load car	The user loads the car before a drive. This can be done in the trunk or frunk, in seats or on the floor, or in external storage such as a roof box or trailer.
	Ingress	The user opens the door, steps into the car, and places potential belongings somewhere in their proximity.
	Egress	The user grabs any potential belongings that was placed in their proximity, opens the door, and steps out of the car.
	Unload car	The user unloads the car after a drive. This can be done from the trunk or frunk, from seats or from the floor, or from external storage such as a roof box or trailer.
	Pre drive set up	To prepare for the drive the user puts on their seatbelt, turns on the car, and potentially changes some settings.
	Post drive wrap up	After a drive is completed, the user turns off the car, and takes off their seatbelt.
	Drive car	The user drives the car in different situation, e.g. in a city or on a highway. They park the car to finish off the drive.
	Ride car	The user is a passenger in the car and rides it while someone else is driving. They can be seated in the front passenger seat or any of the back row seats.
	Leave car	The user locks the car and walks away from it.
	Intermission	During the drive, a short intermission occurs where the car is temporarily stationary, e.g. to pick up or drop off a passenger.
	Sit in stationary car	The user sits in a stationary car (in any of the seats), e.g. while charging it or while waiting to pick someone up.
DAILY MAINTENANCE	**Charge car**	The user charges their electric car when needed, e.g. at home or at parking lots.
	Refuel car	The user refuels their combustion engine car when needed, at a gas station.
	Wash car	To keep the car clean the user washes it, both the exterior and interior.
	Update app and car	To make sure they have the latest version and upgrades to the software of the app and car, the user updates them.
	Perform other car care	The user performs other car care when needed, e.g. refilling the windshield wiper fluid.
SERVICE	**Change tires**	At least two times a year, the tires need to be changed. This can either be done by the user or by a professional.
	Vehicle inspections	At regular intervals, the car needs to be inspected for it to be allowed on the streets. This is done by a certified professional.
	Service car at mechanics	Sometimes the car will need service at a mechanics shop.

APPENDIX 9. Motivations for Use Case Screening

Experience	Use case	Selected	Motivation
LEARN	See a car while driving or riding in another car	Yes	Important way to attract new customers
	See a car while walking on the streets	Yes	Important way to attract new customers
	Visit showroom	Yes	Important to attract new customers, the customers may see certain details of the car for the first time
	Look at car online	Yes	Important to attract new customers, here the customer learns about the car and can compare it to others
	Test drive	Yes	Important to attract new customers, this is the opportunity where they can try the car for the first time
	Talk to people about a car	No	Not in contact with the actual car
SALES	Sign or renew agreement	No	Customer has already made up their mind, they are not in contact with the actual car
	Upgrade & downgrade car	No	Not in contact with the actual car
	Terminate agreement	No	Not in contact with the actual car
	Return as customer	No	Not in contact with the actual car
DELIVERY & FIRST USE	Get car delivered	No	Not in contact with the actual car
	Choose initial settings	No	The activities performed here are tested in a similar ways as when you would test Sitting in stationary car and Driving car
	Use car for the first time	No	Is tested during other selected use cases, e.g. drive car
	Download accompanying apps	No	Not in contact with the actual car
AWAY	Know the status of the car	No	Not in contact with the actual car
	Locate car	No	Not in contact with the actual car
	Plan upcoming drive	No	Not in contact with the actual car

USAGE	Approach car	Yes	In contact with the car, the user is experiencing the car from the outside
	Load car	Yes	In contact with the car, 86% of rides include some type of luggage
	Ingress	Yes	In contact with the car, the activity is central and leading up to both Drive car and Ride car
	Egress	Yes	In contact with the car, the activity is central and leading up to both Drive car and Ride car
	Unload car	Yes	In contact with the car, 86% of rides include some type of luggage
	Pre drive set up	No	The activities performed here are tested in a similar ways as when you would test Sitting in stationary car and Driving car
	Post drive wrap up	No	The activities performed here are tested in a similar ways as when you would test Sitting in stationary car and Driving car
	Drive car	Yes	Arguably the main activity a user does with their car, ranked most important by users in card sorting
	Ride car	Yes	In direct contact with the car, the user experiences the car from other angles than during Drive car
	Leave car	Yes	In contact with the car, the user is experiencing the car from the outside
	Intermission	No	Similar to Sitting in stationary car and Driving car
	Sit in stationary car	Yes	The customer is sitting in the car and since they do not have to focus on driving, they may experience the car in another way
DAILY MAINTENANCE	Charge car	Yes	Important everyday task needed for the car to function, big part of having an electric vehicle
	Refuel car	Yes	Important regular task needed for the car to function
	Wash car	No	An activity that the user does not put much emphasis on
	Update app and car	No	Often not in contact with the actual car
	Perform other car care	No	An activity that the user does not put much emphasis on
SERVICE	Change tires	No	Often not in contact with the actual car themselves
	Vehicle inspections	No	Often not in contact with the actual car themselves
	Service car at mechanics	No	Often not in contact with the actual car themselves

APPENDIX 10. Process Guide Concept



ABOUT THIS GUIDE...

Glad that you are here! This guide is a supportive guide to assist you and your department in performing evaluations that put the user at the center. You will be introduced to a number of use cases that all are activities that the customer does with their car. The use cases are all part of a bigger customer journey and they are selected due to their importance to the customer expereince as well as how well they represent the customer journey overall.

You can choose to go through this guide and the use cases in their designated order, or you can just focus on the use cases that are relevant for your development at this moment. We do however recommend the designated order for when a full car evaluation is done.

Good luck!

CONTEXT

When evaluating all these use cases, consider that they can occur in different contexts, e.g., in daylight, in darkness and in different weathers. Also keep in mind that these use cases can be carried out those who are first-time users as well as those who have been users for a longer time.

APPROACH CAR

Walk towards the car and unlock it. Keep in mind that it is possible to approach the car from multiple directions and therefore repeat this use case by making this adjustment.

BACK TO MENU

LOAD CAR

LOAD CAR

Imagine loading the car using the different ways of storing luggage. The most common is to store luggage in the backseat and the trunk, therefore put extra focus on them.

TRUNK
- Open the trunk and imagine placing the luggage there, then close the trunk.

BACK ROW SEATS
- Open the door to the backseat and imagine placing the luggage on the floor and on the seat, then close the door.

FRONT PASSENGER SEAT
- Open the door to the front passenger seat and imagine placing the luggage on the floor and on the seat, then close the door.
- Sit in the driver's seat and imagine placing the luggage on the front passenger seat and on the floor in front of it.

FRUNK
- Open the frunk (if there is one) and imagine placing the luggage there, then close the frunk.

APPROACH CAR

INGRESS

INGRESS

Imagine entering the car into its different seats. Depending on the project, a certain seat may be of extra importance.

DRIVER'S SEAT
- Open the door, step into the car, sit down on the seat and close the door.
- Imagine placing belongings in the door pocket and middle console.

FRONT PASSENGER SEAT
- Open the door, step into the car, sit down on the seat and close the door.
- Imagine placing belongings in the door pocket, middle console and glove box.

BACK ROW SEATS
- Open the door, step into the car, sit down on the seat and close the door.
- Imagine placing belongins in the door pocket or nearby seats.

LOAD CAR

DRIVE CAR

DRIVE CAR

- Sit in the driver's seat and imagine driving.
- Interact with the same things as when driving, e.g. the steering wheel and the lever that controls the turn signal.
- Keep in mind that driving occurs in different situations such as in a city or on a highway.
- Imagine arriving to the destination and parking the car.

INGRESS

RIDE CAR

RIDE CAR

Imagine riding the car as a passenger. Depending on the project, a certain seat may be of extra importance.

FRONT PASSENGER SEAT

- Sit in the front passenger seat and imagine riding the car while someone is driving.

BACK ROW SEATS

- Sit in one of the back row seats and imagine riding the car while someone is driving.

DRIVE CAR

SIT IN STATIONARY CAR

SIT IN STATIONARY CAR

Imagine sitting the the car while it is stationary. Try this out for the different seats in the car.

FRONT ROW SEATS

- Sit in one of the front row seats and imagine sitting there while the car is standing still, e.g. while it is charging or while waiting to pick someone up.

BACK ROW SEATS

- Sit in one of the back row seats and imagine sitting there while the car is standing still, e.g. while it is charging or while waiting to pick someone up.

RIDE CAR

EGRESS

EGRESS

Imagine exiting the car from its different seats. Depending on the project, a certain seat may be of extra importance.

DRIVER'S SEAT

- Sit in the driver's seat, imagine grabbing belongings from the door pocket and middle console.
- Open the door and step out of the car, close the door behind you.

FRONT PASSENGER SEAT

- Sit in the front passenger seat, imagine grabbing belongings from the door pocket, middle console and glove box.
- Open the door and step out of the car, close the door behind you.

BACK ROW SEATS

- Sit in the back row seats, imagine grabbing belongins from the door pocket or nearby seats.
- Open the door and step out of the car, close the door behind you.

SIT IN STATIONARY CAR

UNLOAD CAR

UNLOAD CAR

Imagine unloading the car using the different ways of storing luggage. The most common is to store luggage in the backseat and the trunk, therefore put extra focus on them.

TRUNK
- Open the trunk and imagine grabbing the luggage, then close the trunk.

BACK ROW SEATS
- Open the door to the backseat and imagine grabbing the luggage from the floor and the seat, then close the door.

FRONT PASSENGER SEAT
- Open the door to the front passenger seat and imagine grabbing the luggage from the floor and the seat, then close the door.
- Sit in the driver's seat and imagine grabbing the luggage from the front passenger seat and the floor in front of it.

FRUNK
- Open the frunk (if there is one) and imagine grabbing the luggage, then close the frunk.

EGRESS

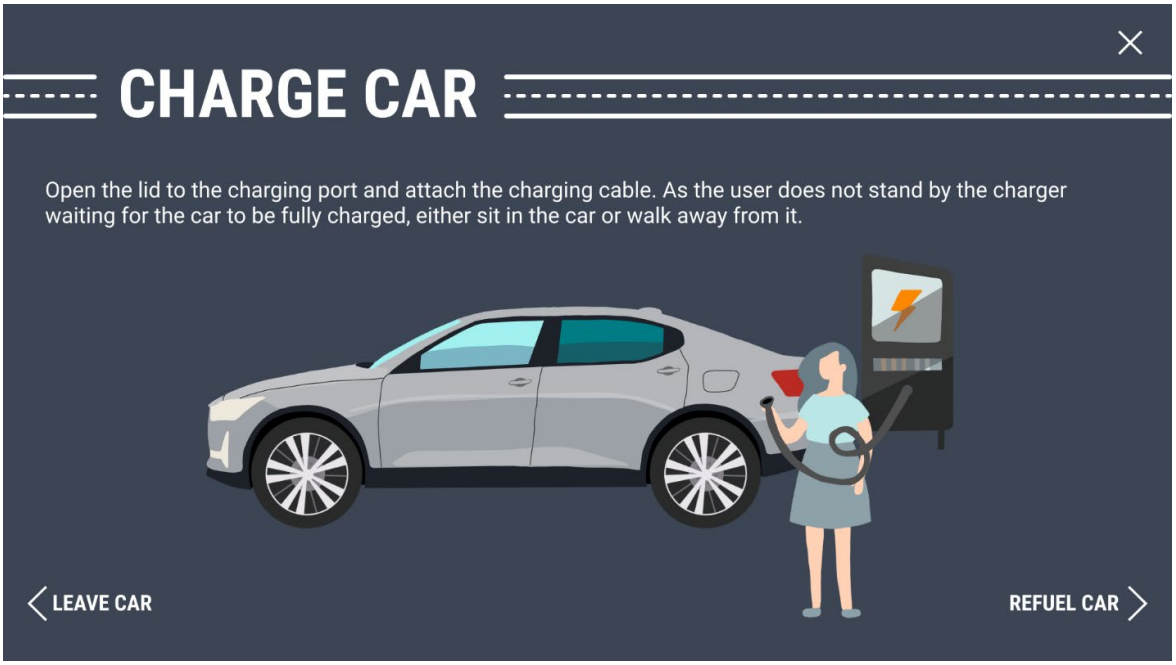
LEAVE CAR

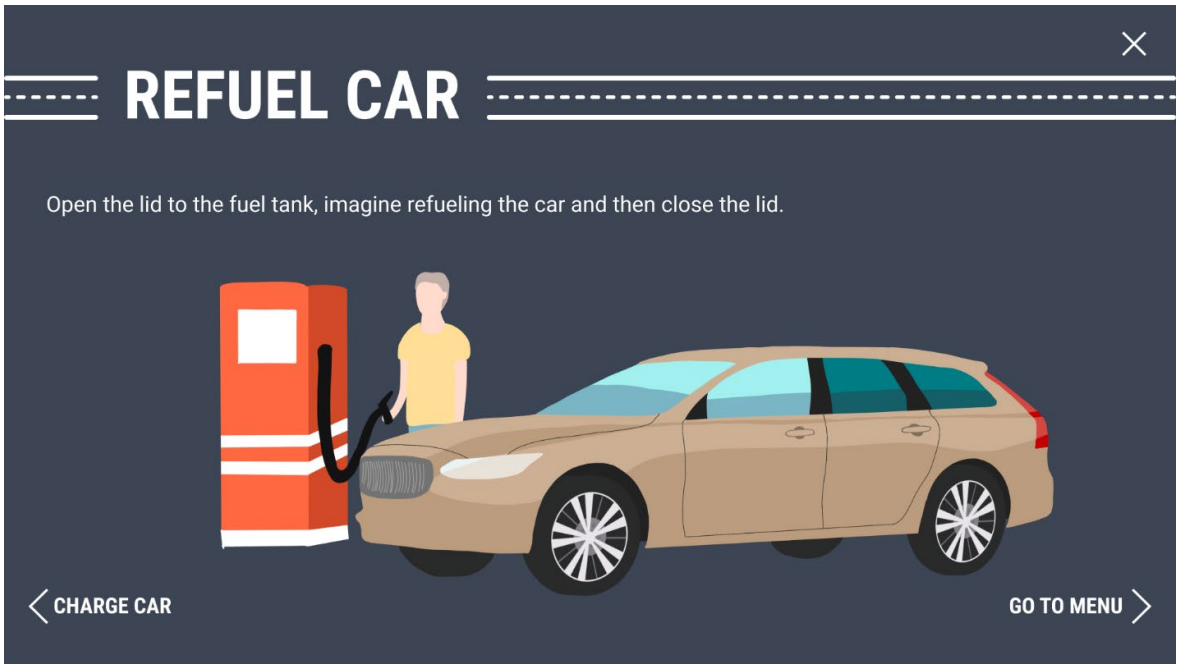
LEAVE CAR

Stand the outside the car as if you have just egressed, lock the car and walk away from it.

UNLOAD CAR

CHARGE CAR


CHARGE CAR
Open the lid to the charging port and attach the charging cable. As the user does not stand by the charger waiting for the car to be fully charged, either sit in the car or walk away from it.
LEAVE CAR
REFUEL CAR


REFUEL CAR
Open the lid to the fuel tank, imagine refueling the car and then close the lid.
CHARGE CAR
GO TO MENU

APPENDIX 11. Prioritisation Work Document

PRIORITISATION			Specialisation	Car type	Engine						
Use Case	Use Case Description	User's Voice	Illumination	Combi	Electric	RANK	Description	Delights	Pain Points	Static rating	Dynamic rating
Approach car	Walk towards the car an	7	7	1	1	7					
Load car	Open the trunk and imag	2	7	1	1,2	5					
Ingress	Open the door and step	10	3	0,8	1,2	6					
Drive car	Sit in the driver's seat ar	9	5	1	1	7					
Ride car	Sit in the front passenge	6	1	0,8	1	3					
Sit in stationary car	Sit in one of the front ro	10	2	1	1	6					
Egress	Imagine grabbing belon	5	10	1,2	1	9					
Unload car	Open the trunk and imag	6	10	1	1	8					
Leave car	Lock the car and walk aw	4	8	1	1	6					
Charge car	Open the lid and attach	6	1	1,2	1	4					
Refuel car	Open the lid and imagin	7	3	1	0	0					

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