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PSS Design in Practice - How a Choice Experiment Can Help Configuring a New Subscription Offer

The Case of Care by Volvo's Used Car Subscription Offer

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Abstract

Background and Purpose

The automotive industry is facing huge challenges as the perception and utilization of cars is changing. As a result, many automotive companies are increasingly moving away from solely selling cars and starting to offer bundles of products and services (PSS) instead. Care by Volvo is one such example as it offers cars via a subscription offer. This thesis aims to support the management of Care by Volvo during the design and configuration of a used car subscription offer. More specifically, it aims to obtain reliable information about customers' preferences and willingness to pay regarding the included services by using an established method in this new PSS design context. The services evaluated where repair & maintenance, tyres, a car pick-up and delivery service, insurance, a replacement car and the car condition.

Methodology

The research was based on an extensive literature review in the fields of PSS, PSS design and methods for measuring customer preferences and WTP. In order to obtain the necessary customer data a survey-based discrete choice analysis was conducted. It was distributed on social media and targeted towards a predefined target group that consists of male inhabitants of Germany who are between 25-45 years old and have a gross-income above 37 500 €. However, the obtained sample could only partly represent this population.

Findings and Conclusions

The researchers found that it is most important to include Repair & Maintenance and Tyres services into a used car subscription offer. *"Winter and summer tyres with mounting and storage included"* was thereby strongly preferred over *"All-weather tyres and mounting included"*. The monthly price resulted to be among the three most important decision factors for a subscription offer. Interestingly, women from the obtained sample have shown to be more price-sensitive than men while no correlation could be detected with the respondents' income. Overall, the specific target group was found to have the highest WTP.

On an academic level, the DCA seems applicable to the researchers for PSS-Design and specifically for the configuration and evaluation of a PSS. Furthermore, the research contributes to the sparse literature about car subscriptions.

The most important limitations of this research concern the data collection, since the use of a convenience sample and a selection bias lead to overall low generalizability. Other significant limitations are the non-inclusion of a no-buy option and further factors that could influence on a respondents' choice for a subscription offer.

Keywords

PSS Design, PSS Configuration, Servitization, Car Subscription, DCA, Discrete Choice Experiment, Choice-Based Conjoint, Customer Preferences, WTP

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Göteborg, 3rd of June 2019 Fabian Perktold & Moritz von Raczeck

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Glossary

AHP = Analytical Hierarchy Process

DCA = Discrete Choice Analysis

EPR = Extended producer responsibility

IIA = Independence of irrelevant alternatives

MNL = Multinomial Logit

PSS = Product Service System

RP = Revealed Preference

RUT = Random Utility Theory

SCM = Stated Choice Methods

SEM = Self-Explicated Methods

SP = Stated Preference

QFD = Quality Function Deployment

WTP = Willingness to Pay

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1. Introduction

For decades the automotive industry was the perfect example for a mature industry with few large companies that had divided the market. Cost reduction, outsourcing and process optimization were the dominant strategies as the technology and business model was commonly agreed on (Proff, 2000).
However, the last decade changed this steady ride into a wild race. Fueled by the digitalization a number of trends has emerged. Due to electric cars, growing smartphone penetration, connected car technology, smart algorithms and a shift in consumer preferences towards access rather than ownership new opportunities emerged. Instead of producing a car and selling it to customers who need to get from A to B, many companies today challenge this existing viewpoint and start from the actual need.

However, such solution-oriented way of thinking had already been existing within many traditional car manufacturers. Car sharing service examples like DriveNow, Car2go or Sunfleet that were established by car manufacturers even before these new trends emerged can be seen as a proof (Tietze, Schiederig & Herstatt, 2013). Nevertheless, the developments fueled by the digitalization radically increased the emphasis of the incumbents to innovate around their business models. Often this requires shifting the viewpoint from products towards services (Godlevskaja et al., 2011). This trend of manufacturers that increasingly include services into their business model is commonly referred to as servitization (Vandermerwe & Rada, 1988). Large companies like Volvo for example announced that they want to shift from a manufacturer to a mobility service provider (Volvo, 2018). Changing the focus of their offering from the product to services, e.g. when offering a car sharing service, usually results in a carefully designed bundle of a product and connected services. In academic literature such bundles are called product-service systems (PSS) (Tukker, 2004).
Thus, developing new PSS in a fast and efficient way so that new entrants cannot capture emerging niches is an important new capability for car manufacturers.

1.1 Car Subscriptions

One example for the development of new PSS are car subscription offers. Such an offer allows a customer to subscribe to a car for a flexible period of time without taking the ownership and all connected responsibilities (e.g. insurance, maintenance, repair, tyres etc.). In exchange for the usage of the car the customer pays a monthly fee that captures all costs except of the fuel. The first time this offer was introduced was in 2014 by an American company called Flexdrive. In 2017, Volvo was one of the first car manufacturers introducing such offer with their “Care by Volvo” deal. Today many companies have followed Volvos example and started to offer similar subscriptions. Some popular examples are Porsche Passport, Access by BMW, Book by Cadillac or new entrants like Cluno, Fair, Carma or Drover.
Even though all the respective offers should be categorized as subscription plans, the characteristics of the offers differ.
Table 1 underneath shows a few examples that are representative for different car subscription types.

Subscription Provider	OEMs		Start-ups		Dealerships/ Suppliers/ Rental companies
Business Model	Car & Service Provider	Car & Service Provider	Car & Service Provider	Platform/ Marketplace Provider	Car & Service Provider
Offer type	Luxury - All inclusive	Affordable - Selective	Budget - Mass market	Budget - Mass market	Various
Examples	Book by Cadillac, Porsche Passport, Access by BMW, Mercedes Benz Collection, AUDI Select	Care by Volvo, Canvas (Ford), Hyundai Ioniq	Cluno, Carma	Drover, Wagonex, Fair, Clutch	Flexdrive, ZipCar (Avis)
Services included	Insurance, Maintenance, Repair, Roadside assistance, Refurbishment and Cleaning, Pick-up and Delivery	Insurance, Maintenance, Repair, Roadside assistance, Pick-up and Delivery	Insurance, Maintenance, Repair, Roadside assistance	Insurance, Maintenance, Repair, Roadside assistance	Insurance, Maintenance, Repair, Roadside assistance
Min. Duration	Between 0 days and 1 month	Up to 24 months, earlier against cancellation fee	Up to 6 months	Selectable between 1 and 24 months	Various
Switching Cars	Unlimited or 12-18 per year	No or against fee	Limited	Differs (unlimited or against fee)	Various
Mileage included	Unlimited	Limited or customizable	Limited or customizable	Limited or customizable	Limited or customizable
Price Range	1000-3000 USD	Starting from 350 USD (Canvas)/ 750 USD (Volvo)	Starting from 300 USD	Starting from 390 USD	Various

Table 1: Own illustration of the types of existing subscription offers

As the subscription market is still in an early stage, different business models and offer types exist. At the same time change of the companies and their offers within the market is high and therefore the table above can only be a capture of the current moment in time.
Many of the above shown offers are still only offered in selected regions or as pilots but first customer feedback shows huge potential. Volvo for example predicts that they will offer half of all cars through a subscription model by 2025 (Volvocars.com, 2019).
While competitors are ramping up, Volvo is already taking the next step and developing its newest form of the Care by Volvo subscription offer. As this thesis is written in collaboration with Care by Volvo, the next section will explain the current and future offer in more detail.

1.2 Care by Volvo

Care by Volvo is a in 2016 established Volvo brand that aims to create a new and convenient Volvo experience. The goal is to give customers "more time to do the things [they] love" (Media.volvocars.com, 2019) instead of having to go to a dealer, negotiate the price and terms or deal with repairs.
By allowing customers to subscribe to a car in only few minutes by using an app or the website, they want to provide an alternative to the traditional car purchase.
The detailed conditions can differ between markets but the offer usually includes besides the car also insurance, service and maintenance, repairs, pick-up and delivery, taxes and tyres. In return the customer pays a monthly fee throughout the subscription period. In most markets there is a minimum subscription period of 24 months with the option to cancel earlier for a small fee. After the period customers can terminate their contract within a month of notice. Customers can also change vehicles during the subscription period if they are in need of a different car type. However, this existing subscription offer only includes new cars.

Volvo does not want to stop at this point but also allow customers to subscribe to previously used cars in the future. These used cars can be returned subscription cars that were previously subscribed by other customers.
The used car subscription offer will have the same building blocks as the existing subscription but the detailed design of the offer is currently part of different tests and pilots.

1.3 Research Topic

However, as Volvo once again is the first mover for a used car subscription offer, there are no comparable offers from other car manufacturers yet. Therefore the design and introduction of this new offer comes with many unknown variables.
One such variable is the difference in customer needs and preferences for new and used cars. As an established car manufacturer Volvo logically has vast knowledge about these differences when it comes to the traditional purchase based business models, but not all of this knowledge is applicable for subscription based models. One consequence is that customers for used car subscriptions might have other preferences regarding the included service features. These preferences and the changed car age will ultimately result in different willingness to pay (WTP) depending on the distinct configurations.
Thus, defining which offer configurations are most preferable by the potential customers and assigning an optimal price are fundamental tasks within Care by Volvos current PSS development.

1.3.1 Research Gap

A common way to tackle these tasks is to use previous experience and build on existing processes. However, as mentioned before the novelty of the offer limits the direct applicability of earlier findings. In such cases an alternative approach is to consult experts within the field or learn from existing research.

Indeed, if one searches for literature on PSS there is an extensive collection with various focus areas (see Beuren, Ferreira & Miguel, 2013 or Qu, Yu, Chen, Chun & Tian, 2016 for an overview). Especially, the strategic and organizational angle covering advantages, drivers, types and challenges of PSS has been popular in previous research. Nevertheless, Beuren and colleagues (2013) also point out that especially literature around methodologies and tools for PSS design and development is very sparse. Generally, one can structure the PSS development process into "Organizational Preparation, Planning, Design, and Post-Processing" (Marques, Cunha, Valente & Leitão, 2013). Care by Volvo's above mentioned tasks fall into the design phase, more specifically the development, iteration and evaluation of the detailed design. Existing literature for these parts mostly suggest methods and tools that were derived from New Product Development (NPD) or New Service Development (NSD) literature. However, when utilizing these methods for PSS development several limitations occur (Beuren et al., 2013). As a result, some researchers have started to develop a number of PSS design methodologies (Qu et al., 2016). Unfortunately, very few of them put the potential customers in the focus and try to actively evaluate their preferences. Especially, as the underlying logic behind PSS is service driven and therefore uses the customers' perspective, suitable methods and tools would be of high value (Baines, Lightfoot, Benedettini & Kay, 2009).
In order to fill this gap one approach is to connect existing methods from the consumer preference literature with the upcoming PSS development stream. To the researchers knowledge there is only limited literature on such an approach yet. Furthermore, the existing literature often misses to offer applicable methods or proposes highly complicated tools.

Another gap in the existing literature is around subscriptions-based PSS in the automotive industry. This is not necessarily surprising as the first applications of the subscription model in the industry are only dating a few years back. The existing literature around PSS in the automotive industry has so far covered various aspects around car sharing, leasing, renting or mobility-as-a-service (Williams, 2006; Bardhi & Eckhardt, 2012; Tietze et al., 2013; Hietanen, 2014; Jittrapirom, Caiati, Feneri, Ebrahimigharehbaghi, Alonso González & Narayan, 2017). Car subscriptions contain selected aspects from some of these PSS types but are with its specific concept a new type of PSS. However, literature that reviews the current development around car subscriptions or describes an established case seems to be extremely sparse.

1.3.2 Research Goal

Thus, the goal of the thesis is twofold. It aims to support Care by Volvo in their PSS development process but also to contribute to the existing PSS and car subscription literature.

On the practical level the researchers' goal is to assist the management of Care by Volvo in their development decisions for the used car subscription offer by providing reliable insights into the preferences of the target customers (which include 25-45 year old men living in Germany with an income of at least 37 500€ per year). Helping them to find the optimal service configuration and price should subsequently increase the success of the service launch and roll-out.
More important, this thesis can help Volvo and other companies in the future when further

servitizing their business. Providing managers with a study that showcases a possible customer-oriented method should benefit their future PSS development. Especially testing a method that allows to measure the customer's preference should contribute to the limited existing guidance within this area. Hopefully, this might increase the focus on customer preferences within future PSS design processes.

On the academic level the thesis aims to add towards the sparse literature around consumer preference driven PSS design. The researchers hope to propose a method that helps to consider the preferences and WTP of potential customers during the configuration and evaluation steps within the PSS design process. By exemplifying the utilization of an established consumer choice method within a practical PSS development case, the thesis could facilitate further research to build upon this. Proving the value of a consumer driven PSS design and testing different methods for this could be of future academic interest (Baines et al., 2009). At the same time, this thesis could add to the sparse literature around car subscriptions and therefore lead to more academic interest in this type of PSS.

1.3.3 Research Questions

In order to reach the academic and practical goals the thesis will answer the following research questions:

1. *What are potential customers' preferences regarding the services included in a used car subscription plan?*

2. *What is the WTP of potential customers regarding the services included in a used car subscription plan?*

1.4 Thesis Disposition

After the introduction the second part of the thesis reviews existing literature on three research areas: Business and product related literature including Servitization, PSS and relevant cases in the automotive industry. The second area is centered around PSS Design and Development in general and around customer preference driven PSS design methods. The third area reviews theoretical concepts and methods within the Consumer Preferences and Willingness to Pay literature.
The third part is describing the researchers' methodological approach. This includes a review of the research strategy, design and data collection process. The conducted method to analyze the collected data and to calculate relevant results will also be presented in this part.
The fourth part is presenting sample characteristics, followed by the obtained results in the fifth part.
Logically, the sixth part will explain the conducted analysis of the data, discuss the findings and thereby answer the research questions.
Finally, the seventh part will conclude the results, highlight the implications for Care by Volvo, discuss the limitations and propose further research topics.

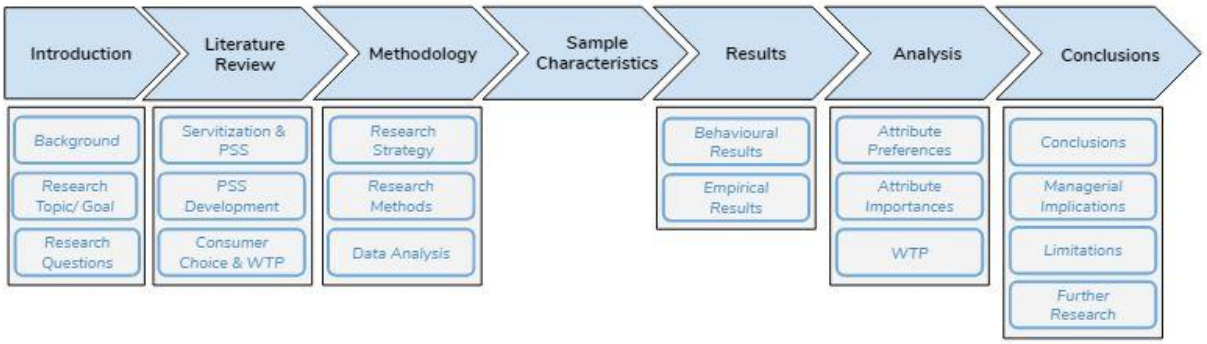


Figure 1: Own illustration, Disposition of Thesis

2. Literature Review

The following literature review shall offer an overview of the existing research within the relevant fields of this thesis. It was constructed to build an understanding of the background around subscriptions, the development of PSS offers, consumer preferences and willingness to pay.

As subscriptions are a means of servitization and a type of PSS, it is necessary to review the literature around servitization and PSS.
Once these concepts are explained the reader has to understand the challenges, processes and methods that exist for companies who develop a PSS like the Care by Volvo's used car subscription.
Similarly, it is necessary to understand the roots of customer preferences and the various methods to measure preferences and willingness to pay in order to suggest a suitable tool for the research questions. Therefore, the literature review will have three sections capturing first Servitization, PSS and Subscriptions; second the PSS development literature; and third the existing research around consumer preference and willingness to pay.

2.1 Servitization, PSS and Subscriptions

This thesis aims to assist Volvo and other companies when innovating around business models and more precisely when adding services to existing products. Vandermerwe and Rada (1988) coined such strategy as "Servitization". Therefore, the first part of the literature review will capture this type of business model innovation in more detail but also review more specific concepts around PSS and subscriptions.

2.1.1 Servitization

Existing literature provides various definitions for servitization but most are somehow in line with the original definition of Vandermerwe and Rada (1988). They defined servitization as the increased "offering of fuller market packages or "bundles" of customer focussed combinations of goods, services, support, self-service and knowledge" (p. 314) in order to add value to core product offerings. Other, broader definitions focus on the strategy to combine products and services into bundled offerings (Robinson, Clark-Hill & Clarkson, 2002). For manufacturing firms this means a shift from competing solely through products to a competition through combinations of products and connected services. Hence, the innovation is to change from a product driven to a service driven and solution-oriented business model (Mitchell & Coles, 2004). Figure 2 illustrates this transformation from offering products through product-service bundles to solutions.

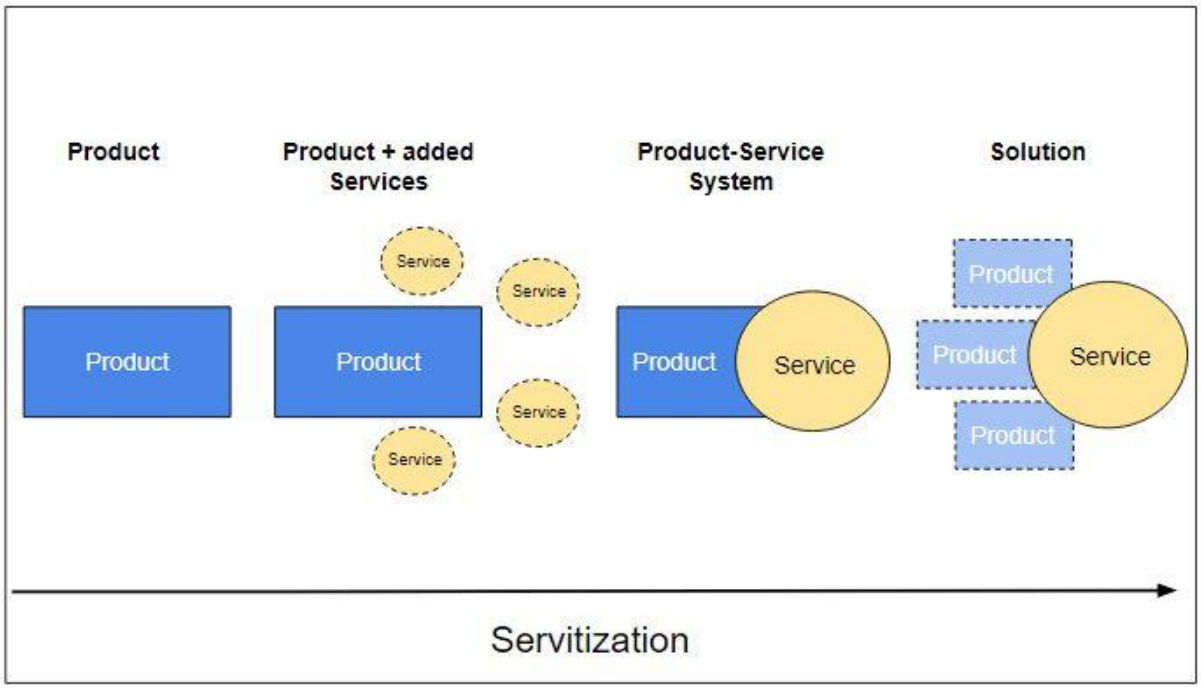


Figure 2: Own illustration of the transition from products to solutions

Servitization was first mentioned in the late 1980s but got increasingly popular in research and practice in the early 2000s.

The servitization literature differentiates between three types of drivers. The first ones are *strategic drivers*, which are related to challenges that arose due to increased globalization, commoditization and competition (Vandermerwe and Rada, 1988; Oliva and Kallenberg, 2003; Baines et al., 2009). The second type of drivers for the increased attention for servitization are of *financial* nature. Wise and Baumgartner (1999) and Ward & Graves (2005) are arguing that service revenues are often more stable, offer higher margins and last longer due to increased product lifetime.
Besides these drivers, Vandermerwe and Rada (1988) argued that servitization is mainly *customer* driven. Other authors refer to this as *marketing* drivers (Baines et al. 2009). Customers are not satisfied anymore by only buying and owning the product, instead they want services that assist them with the buying decision, during the utilization and when they replace the product (Vandermerwe and Rada, 1988). Additionally, newer technologies and the omnipresence of the internet, allows for personalized experiences and the ability to flexibly adjust products (Kryvinska et al., 2014).

As a reaction to this convergence of products and services and the changing customer demands, Vargo & Lusch (2004) questioned the existing dominant market logic that was centered around goods. Instead they developed the "service-centered dominant logic". The service focused logic sees the customer as a partner who co-creates value through the utilization of the product and its connected services and is willing to exchange the resulting value against money (Vargo & Lusch, 2004). Following this logic, it is vital for companies to gain insights about the customer and build a close relationship in order to guarantee a high value through utilization.

Besides these more conceptual and strategic streams of literature, an operational stream has emerged separately. Using the term product-service systems (PSS) a variety of papers have analyzed the same trend towards adding services to products from a slightly different viewpoint. Baines and colleagues (2009) regard both streams as linked and state that "servitization is the innovation of an organization's capabilities and processes to better create mutual value through a shift from selling product to selling PSS" (p. 555). Thus, servitization is the innovation process that aims to result in the development of a PSS. A PSS can therefore be seen as one result in the servitization process. However, in the original concept from Vandermerwe and Rada (1988) servitization does not end with a PSS but with a full transition from manufacturer to service/ solution provider.
As the case of this thesis is a car subscription, a result of Volvos servitization strategy, it is beneficial to provide a more detailed explanation of the PSS concept.

2.1.2 Product-Service Systems

Tukker and Tischner (2006a) defined that a product-service systems (PSS) "consists of a mix of tangible products and intangible services designed and combined so that they jointly are capable of fulfilling final customer needs" (p. 1552). Clearly, this definition leaves room for a range of combinations throughout the whole continuum between products and solutions that could be titled PSS. Consequently, following research has suggested different types of PSS depending on their position on this continuum.

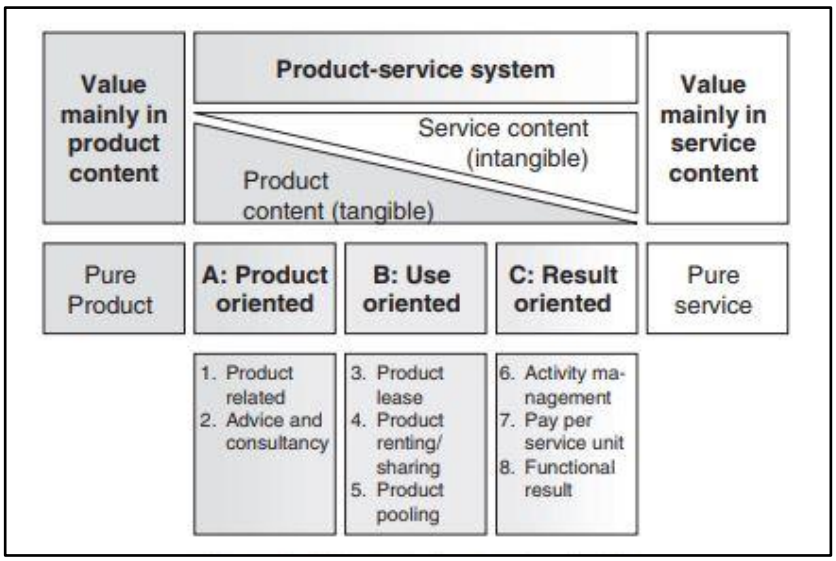


Figure 3: Type of PSS derived from Tukker, A. (2004). Eight types of product–service system: eight ways to sustainability? Experiences from SusProNet. Business strategy and the environment, 13(4), 246-260.

Tukker (2004) for example has come up with eight different types that range from product-oriented PSS to strongly result oriented PSS. Figure 3 above illustrates the eight different types and their position on the product- service continuum.

Product oriented services:
The first main category of PSS is product oriented services. For those PSS the business model is still largely focused on the traditional sales model of products. Services are offered as a supporting add-on (Tukker, 2004). Within this category he differentiates between *Product related services* and *Advice and consultancy services*.

Use oriented services:
The second main category are use oriented services. Here the business model is not designed to sell the product anymore but rather to provide usage in different forms. A specific product is still in the center of the offer but often the ownership remains at the provider (Tukker, 2004). Three sub-categories of PSS can be defined:
Product lease, where the product remains in the ownership of the provider but can solely and unlimitedly be used by the customer. *Product renting or sharing*, which is in most points similar to the product lease (e.g. ownership stays at provider, maintenance and other services are offered). Despite that the customer does not have unlimited and individual access but sequentially shares the product with other customers.
Product pooling, which is again similar to the previous sub-categories with the difference that the product can be simultaneously used by other customers.

Result oriented services:
The third main category according to Tukker (2004) are result oriented services. Here the customer and provider agree on a desired result without pre-specifying a certain product that will be used. This way the underlying logic is closer to the service dominant logic and to provide a solution instead of the utilization of a product. Within this category one can again define three sub-categories:
Activity management includes those cases where a customer outsources parts of an activity to the service provider. This usually does not include any specification on which product the service provider uses but rather an agreement about the result.
Pay per service unit are PSSs where the customer does not buy a product but a specified output that is created by using the product. Instead of paying a time-based fee, the customer pays per agreed output/ service unit.
Functional result describes PSSs that almost completely resemble pure services as they are not bound to any specific product or technology. The customer and provider agree on a result, which is defined with functional characteristics (e.g. a maximum harvest loss for a farmer) and the provider is free to use any kind of product or technology (e.g. pesticides or machines) (Tukker, 2004).

Since Tukker (2004) published these categories of PSS other researchers have added new ones or refined the original ones. For example, Neely (2008) added integration-oriented PSS, which are still very close to pure products as they only add non-integral services that allow the provider to go downstream but do not really change the utilization or experience. Additionally, he added service-oriented PSS which he allocates between product and use oriented services.

For service-oriented PSS the product changes ownership to the customer but services are incorporated into the product and therefore cannot be decoupled.

As a next step the theoretical concepts of servitization and PSS will be connected to practice and a few cases from the automotive industry will be highlighted. Not only shall this clarify the different terms and types but also illustrate the true relevance of servitization in today's business world.

2.1.3 Servitization and PSS in the Automotive Industry

Compared to other industries the automotive industry has a long history of offering services to their customers although their business model was centered around manufacturing (Prettenthaler & Steininger, 1999). Literature around PSS was not existing when automotive manufacturers started offering services. Nevertheless, early combinations of products and services can be included in the PSS concept. The range of services offered by automotive OEMs (Original Equipment Manufacturers) early on included financing, repair, maintenance and warranties. The bulk of those services was conducted by licensed dealers and repair shops as historically OEMs were not downstream integrated towards the customer. However, especially the rise of the internet and increased global competition nurtured the servitization of the industry even further and allowed for new types of PSS (Godlevskaja, van Iwaarden & van der Wiele, 2011). The following section will highlight a number of cases from today's automotive industry and connect them to the above defined types of PSS.

2.1.3.1 Cases

Naturally, the first services that were offered by automotive OEMs were only loosely coupled to the product and designed as additional offers.

Williams (2007) identified a number of such services and categorizes them as *product-oriented PSS*. Classical *product related services* are maintenance and repair services that are commonly included in the warranty period of a car purchase. Recently, some OEMs have also started to offer remote diagnostic systems that allow them to monitor the condition of the car during the usage by using GPS and sensors (Williams, 2007).
Another type of *product related services* offered within the automotive industry allows customers to choose between different finance options. For example, zero-interest financing is a common alternative to a classical purchase. Less examples can be found in the *advice and consultancy services* sub-category. Besides classical brochures that educate about fuel-efficient driving (Williams, 2007), there are more and more OEMs that offer on-demand roadside assistance. A prominent example is Volvo's "On-call" feature that today also includes an App interface.

Use oriented services demand for a greater shift towards the service perspective as the ownership remains at the manufacturer.
A traditional example from the automotive industry is car leasing where the customer pays a monthly fee and in return uses the car for a predefined amount of time, usually around 2-4 years

(Williams, 2007). Repair and maintenance are commonly not included, rather both parties agree on a condition or value that the car has to have when returned after the leasing period. Whereas Williams (2007) could only find first pilots of car sharing and pooling services, these types of PSS are now about to become a natural part of urban mobility.
Car sharing services allow customers to access a car for a short time frame without having to own it. The ownership remains with the service provider (except for peer-to-peer sharing) and customers usually become members of the sharing system (Bardhi & Eckhardt, 2012). Payment is either done solely on a usage basis (per km or minutes) or in combination with a membership fee.
Car-pooling also allows customers to access a car flexibly and without the burdens of ownership but differs in one important aspect. Whereas at a car sharing service customers use the same car sequentially after each other, a car-pooling service allows customers to use the same car at the same time (Williams, 2007).
An even more recently developed *use oriented PSS* are car subscription services. Being solely used by one customer for a specific time and priced with a fixed monthly rate, car subscriptions are somewhat similar to car leasing. But at the same time car subscriptions often also include car related services like repair, tyres, maintenance and insurance that are more typical for car sharing. Additionally, many subscription services allow shorter time frames and flexible cancellation than leasing contracts. Thus, one can position car subscription services somewhere between leasing and sharing services.

Even further on the servitization continuum are *result oriented PSS*. Until recently there were not many examples for such service systems within the automotive industry but recent developments within data analytics and vehicle connectivity started to change this picture. Especially under the term Mobility-as-a-Service (MaaS) one can find first examples of service providers that only focus on the desired result to get from A to B instead of a specific product. Hietanen (2014) defined MaaS as a mobility distribution model that deliver users' transport needs through a single interface of a service provider. In practice this means to allow customers to search, book and use different mobility options to fulfill their transportation need. Jittrapirom and colleagues (2017) list a number of examples and specify the differences in terms of the payment model or included transport modes.

Overall this selected list of cases show that the automotive industry has begun to transform from only offering product related PSS to offering more and more use and result oriented services. Thus, servitization is far away from being just a theoretical concept. The following section will shortly describe the most important reasons for the increased servitization of the automotive industry.

2.1.3.2 Reasons for Servitization in the Automotive Industry

As many of the reasons for the increased servitization of the automotive industry are closely coupled to the earlier presented general drivers of servitization, this overview will focus on automotive industry specific reasons.

Even though new car manufacturers like Tesla or Nio are recently entering the market, the industry has long been in the hands of a few large players. Combining digitalization with fast technology diffusion and adoption the car industry today is an environment where differentiation solely based on products is increasingly unprofitable (Godlevskaja et al., 2011). In practice, only 8-20 percent of the car manufacturers profits stem from vehicle sales with the rest being generated by financial services, after sales and license fees. At the same time, overproduction and high discounts on sales prices are common practice (Godlevskaja et al., 2011). Naturally, this forces car manufacturers to search for new ways to differentiate and increase their profit margins. As mentioned earlier, services are a possible way as they usually offer higher margins and are harder to imitate. Additionally, services and the digitalization create the possibility to overcome the traditional dealership model as Teslas shows. Selling directly to the customer through a website or App will not only allow car manufacturers to further move downstream but also offer services directly to the customer (Nieuwenhuis, 2018). Not only can this create a strong customer lock-in but also take dealers out of the value chain. Eventually this should result in higher shares in car related revenue streams.

Another reason stems from the changing customer perception about ownership. Whereas cars used to be a status symbol and owning a car a symbol of freedom, today this mindset changes increasingly. Especially the younger generation does not see the car as a means to illustrate themselves anymore but rather values access based consumption (Bardhi & Eckhardt, 2012; Moeller & Wittkowski, 2010). The results can already be seen in recently decreasing car sales percentages or the growing number of car sharing users (Godlevskaja et al., 2011). In order to react to these changing customer preferences car manufacturers are forced to develop services that allow access-based consumption instead of the traditional vehicle sales.

Lastly, a vast body of literature has pointed out that PSS can lead to a more environmentally friendly resource consumption (e.g. Manzini & Vezzoli., 2003; Goedkoop, Van Halen, Te Riele & Rommens, 1999; Mont, 2002; Tukker & Tischner, 2006b; Herrmann, Kuntzky, Mennenga, Royer-Torney & Bergmann, 2012). On the other side, many cities today fight with congestion, air pollution and lack of parking spaces that are caused by traditional ways of car utilization. Herrmann and colleagues (2012) state that the average car occupation lies at 1.6 persons per vehicle and cars are parked 94 % of the overall lifetime. At the same time the consequences of the extensive usage of endless resources has led to stricter policies regarding resource consumption and recycling. One result to these trends are extended producer responsibility (EPR) or vehicle bans from the cities (Ceshin & Vezzoli, 2010). Williams (2007) sees the focus on service-based business models as one answer for car manufacturers to these policies. He states that "since, within this model, producers assume responsibility for the physical and financial management of a product throughout its lifecycle, they have an incentive to minimize the associated costs. As a result, they might be motivated to assess or reassess the most efficient means of coordinating product return and reverse logistics systems" (Williams, 2007, p. 1095). This could result in designs that allow easier and cheaper recycling or refurbishment. At the same time the incentive would shift to a maximization of the product lifetime as this would minimize the resources needed while maximizing the revenue generated through usage (Williams, 2007). One example for a strategic shift towards a lifetime

maximizing business model is the case of Riversimple. With the combination of a revolutionary car design and a subscription business model that allows to refurbish the car every three years they want to maximize the resource utilization (Blomsma, Kjær, Pigosso, McAloone & Lloyd, 2018; Wells, 2018). Therefore, the shift towards PSS in the car industry could benefit the environment without harming the profit margins.

In practice these reasons might not be perceived as equally important by car manufacturers, nevertheless they will surely support the servitization trend.
As this thesis is focusing on one specific example of PSS, namely car subscription services, the next section will review the most relevant literature on subscriptions.

2.1.4 The Subscription Business Model

The term subscription has originally been used in connection with newspapers and magazines (Mings & White, 2000). The first literature on this stems back to the 1930s (Clapp, 1931) but the business model was already introduced in England in the 17th century. In the late 1900s other industries like the fitness industry, book clubs, mobile phones or premium television channels adopted the model to allow members flexible access (Taylor, 2003).
Generally, the subscription business model allows customers to flexibly access a product or service in exchange to paying a recurring fee.

With the rise of the digitalization and software-based products and services this business model was re-established by many companies. Today, especially companies that offer software products as a service (SaaS) instead of selling them in a traditional purchase are using subscription-based business models (Suarez, Cusumano & Kahl, 2013; Lehmann & Buxmann, 2009). Even more recently cloud computing services are commonly offered with subscription business models (Chun & Choi, 2014; Samimi & Patel, 2011).

However, literature that looked on subscription models from a business model or PSS perspective is very rare. One reason might be that for many of the above stated use cases the subscription model is rather affecting the pricing strategy without changing the other building blocks of the business model. For example, a software product or gym model does not change fundamentally regardless if a pay-per use or subscription pricing is used. As a result, one can find a larger number of articles that take a pricing strategy angle (Essegaier, Gupta & Zhang, 2002; Fishburn & Odlyzko, 1999; Fruchter & Sigué, 2013; Mesak & Darrat, 2002; Danaher, 2002; Fruchter & Rao, 2001).
For the application of the subscription model in the automotive industry, a focus on a pricing viewpoint will not be sufficient. In the case of a car the differences between a subscription model, like Care by Volvo, and a pay-per use model, like Sunfleet carsharing, are directly affecting various parts of the PSS and the connected business model. Therefore, it will be helpful to take a look into the car related subscription literature.

2.1.5 Subscription in the Automotive Industry

As mentioned earlier in this thesis, there is only very limited literature on car subscriptions. A popular case that has been used by a few studies is Riversimple. The Wales-based company has rethought the current practices in the automotive industry and developed a completely new business logic that aims for a circular system (Blomsma et al., 2018). The business model is a combination of a subscription and a pay-per use model as the customer pay a fixed monthly rate and a flexible fee depending on their miles driven. At the same time, they connect a variety of services from repair and maintenance up to the coverage of fuel costs. They also plan to refurbish and update the vehicles every three years to increase the lifetime (Wells, 2018).
Despite of this example most of the existing literature that refers to subscription models is looking into mobility-as-a-service cases (Li & Voege, 2017; Jittrapirom et al., 2017).
Unfortunately, at the time of this research no publication was found that was describing any of the upcoming car subscription cases. Clearly, this shows an interesting area of future research as the strategies and designs of the existing subscription plans differ throughout the providers.

2.2 PSS Development

The previous section highlighted that PSS are a rather new concept and that some types like car subscriptions are barely captured in the research realm. Therefore, it is of little surprise that both research and practice are highly interested in investigating suitable processes, methods and tools that assist the development of PSS. Before reviewing the existing research on these different areas, it is helpful to understand how this new stream of literature emerged.

2.2.1 Emergence from Product and Service Development

When the first PSSs were developed by product centered firms, they naturally used the development process and tools which they knew from product design. Consequently, a number of PSS methods that were first introduced to the PSS development literature were highly product centered. Some examples are Quality Function Deployment (Shimomura & Arai, 2009), TRIZ (Kim & Yoon, 2012) or Property-Driven Development (Weber, Steinbach, Botta, & Deubel, 2004). Taking the service component within PSSs into account the authors adjusted the original frameworks to PSS development.
A second stream of literature suggested methods from the new service design (NSD) or service engineering literature (Yoon, Kim & Rhee, 2012). Those methods were originally used to design services and had to be adjusted in order to integrate the product engineering within the PSS development. Service Blueprint (Yoon et al., 2012), Service CAD (Arai & Shimomura, 2005) or the Service Explorer (Sakao, Birkhofer et al., 2009) are a few examples.
In practice many companies that servitize their business are nevertheless using traditional product development methodologies as changing the organizational processes and routines is challenging (Beuren et al., 2013). Often this results in less successful PSS because an adequate development process has to consider more factors than the classical product development process. Morelli (2006) argues that a PSS methodology should address the following factors: identification of the involved actors (suppliers, partners, customers, users); an outline of possible PSS use cases including the actors roles and actions; a definition of the requirements

for the PSS containing both the structure and components; and tools to manage, visualize and develop a PSS with all of its components (physical parts, performed services, the links in between and the temporal order).
Thus, PSS designers have to take a system perspective instead of designing separable components or actions (Maussang, Zwolinski & Brissaud, 2009). In order to master this complexity an integrated development process is necessary. The next section will therefore review existing processes that allow to account for this.

2.2.2 PSS Development Process

The PSS literature shows a large collection of different PSSs development process models. A common ground is the aim to link the product and service development into one methodology. However, there is no common step-based model agreed on yet. After an extensive literature review Qu and colleagues (2016) divided the literature into three PSS areas that can represent phases of the development process. The design phase, the evaluation phase and the operation phase. This is in line with earlier concepts that took a lifecycle perspective and differentiated between a design, configuration, realization and recycle stage (Mannweiler & Aurich, 2011). A model specifically taking the development perspective was proposed by Marques et al. (2013). With four phases including Organizational preparation, Planning, Design, and Post-Processing (see Figure 4 below) they tried to structure the previously developed methodologies.

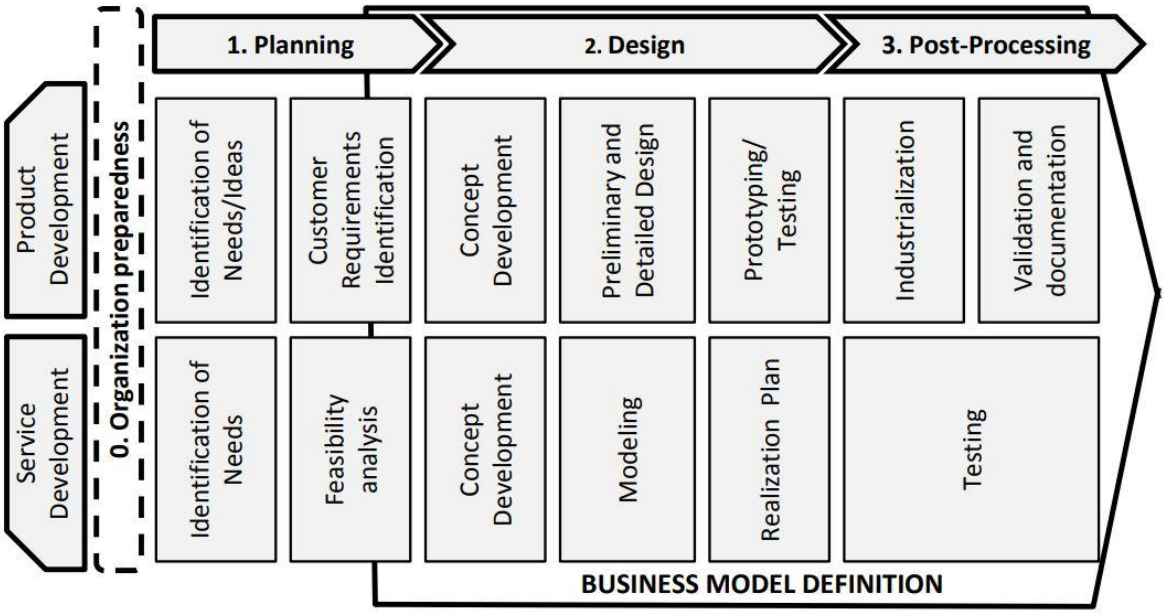


Figure 4: *PSS Development Process derived from Marques, P., Cunha, P. F., Valente, F., & Leitão, A. (2013). A methodology for product-service systems development. Procedia CIRP, 7, 371-376.*

During the first phase organizational processes and structures that are necessary for the following development steps are set up. However, this phase is not really part of the PSS development process and might be skipped in experienced organizations. The Planning phase is the start of the actual PSS development process. After defining the actual need or idea, which required or triggered the PSS opportunity, internal and external information about possible

solutions are collected. At the same time potential customers should be identified, analyzed and interviewed in order to develop requirements. Before starting the design phase, the potential PSS has to be evaluated for feasibility and in terms of cost-benefits relation (Marques et al., 2013). The main steps within the design phase are to develop and visualize a concept, develop, test and refine different PSS designs and create a plan for the realization. The last phase is about preparing and executing the realization plan and at the same time improving the PSS performance in order to guarantee that the desired results are achieved. Validation and documentation are therefore a crucial last step (Marques et al., 2013).
As a process is only the frame for the development, in practice it is necessary to identify different methods and tools that were tested in previous research and can be used for PSS development. Vasantha, Roy, Lelah, & Brissaud (2012) are offering a good summary of eight popular methods and tools for different steps. For a more extensive collection the literature review from Qu and colleagues (2016) can be consulted. However, an overview of all relevant methodologies and tools would go beyond the scope of this thesis.

As this thesis is written in collaboration with Care by Volvo and aims to assist in a specific step of the development process, not the entire process and therefore not every method and tool is relevant.
At the time of this thesis Care by Volvo had already developed the PSS concept, defined the target customers, investigated the general customer requirements and created a preliminary design including the relevant service attributes and their possible levels.
Thus, referring to the model of Marques et al. (2013), the final part of the design phase and more specifically the development, iteration and evaluation of the detailed design is the area of contribution of this thesis. Mannweiler and Aurichs (2011) study is more precisely defining these steps of the process as the PSS configuration.

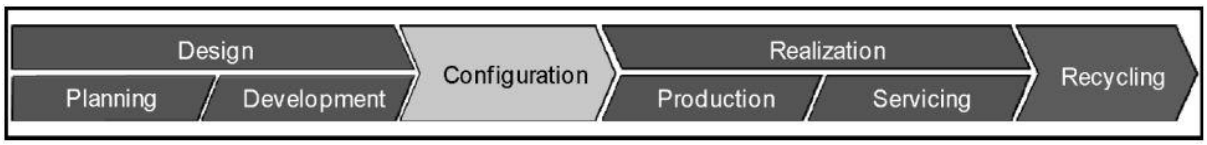


Figure 5: PSS Design process derived from Mannweiler, C., & Aurich, J. C. (2011). Customer oriented configuration of product-service systems. In Functional Thinking for Value Creation (pp. 81-86). Springer, Berlin, Heidelberg.

However, other models are including these steps into the evaluation phase (see Qu. et al, 2016 for overview or Sakao & Lindahl, 2012 as one example). Regardless of the term or concept used, the relevant tasks are to define, select and combine the relevant components and their specifications into a final PSS offering (Sakao & Lindahl, 2012; Mannweiler & Aurich, 2011). Strong evidence suggests that this process should fundamentally be based on the customers preferences and perceived values of each component or potential configuration (Sakao & Lindahl, 2012; Mannweiler & Aurich, 2011). Consequently, a customer-oriented view on PSS design is necessary. Thus, tools and methods that measure the customers preferences are needed.

2.2.3 Methods and Tools for Customer-Oriented PSS Design

A number of studies have highlighted the importance of a good understanding of the customer for the PSS development. Fischer, Gebauer, Gustafsson & Witell (2009), surveyed 123 industrial companies and found out that the second biggest problem is a mismatch between customer requirements and the service. Root of the problem is the lack of knowledge about the customer. Thus, companies are in need of more information on the customers preferences. In a similar study with eight PSS providers Lindahl, Sundin, Shimomura & Sakao (2006) proves this statement as they saw that companies are in need of methodologies that allow to collect and integrate such knowledge into the practical PSS design process. Giving companies tools that can be used in and adopted to different cases would help to reduce complexity and uncertainty. Sakao et al. (2009) also stress that the main uncertainty in PSS development and design comes from the customer.

Unfortunately, previous reviews of the PSS development literature have stated a lack of studies that propose relevant methods and tools for such customer interaction. Vasantha et al. (2012) state that "the evaluation of PSS offerings is at an initial stage of research" (p. 650) and "the feedback loops between the steps involved in the PSS process and the stakeholders are, most often, vaguely defined" (p. 650). Even more "the importance of co-creation between stakeholders is only mentioned" (Vasantha et al., 2012, p. 649). Taking into account that research showed that especially early and constant involvement of the customers is fundamental to the success of the PSS (Baines et al., 2009; Beuren et al., 2013), tools and methods to better include customer feedback are necessary (Rexfelt & Önas; 2009). At the same time existing methods are "not detailed enough to understand the uniqueness of this process and how to implement it in real time" (Vasantha et al., 2012, p. 649). Yang, Moore, Pu & Wong (2009) and Rexfelt & Önas (2009) are also emphasizing this point and state that existing methods and tools are often concerned with the general design steps but cannot easily be implemented for consumer-oriented PSS development in practice.

Nevertheless, some studies have already proposed methodologies and tools that can be practically applied and focus on the customer feedback. This research will hereby again focus especially on the applicability in the evaluation and configuration steps of the PSS design process.

Rexfelt and Önas (2009) have developed a methodology that puts consumer acceptance in the center. With the help of the activity theory and adoption literature they suggest a number of procedures that facilitate the evaluation of customer requirements and the developed PSS concept. Especially as their study focuses on consumer-oriented PSS, their findings are well in line with the area of this thesis. Unfortunately, Rexfelt and Önas (2009) lack to present specific tools that can be utilized in practice. Instead they state, "when developing a PSS this should probably be complemented by other data-collection methods such as observations, diaries, etc." (p. 691). Additionally, their methodology is mainly concerned with the first steps of the PSS development process. The general customer requirements and concept generation (Rexfelt &

Önas, 2009). Therefore, this methodology is only of limited use for the configuration phase this thesis is investigating.

Yoon and colleagues (2012) propose a method to evaluate a PSS both from customer and provider perspective. The customer perspective is focusing on identifying how customers will later value the service, how it will change their behavior and environment and to predict the degree of usage. Therefore, they evaluate expected value, intention to accept, and preferred usage of the service through a survey or interviews. Similar to Rexfelt and Önas this evaluation is mainly focused on the conceptual level rather than the detailed PSS design and the component configuration.

A study that passes the conceptual level and proposes a method that includes customer evaluation throughout all development steps has been conducted by Dewberry, Cook, Angus, Gottberg & Longhurst (2013). Using different tools like semi-structured interviews, workshops or focus groups they aimed to maximize the value for the future customers by using their feedback throughout all steps of the design process. Thus, they present tools to evaluate the concept but also the different criteria and attributes of the PSS. For the configuration of the final PSS an analytical hierarchy process (AHP) was tested. With the help of a questionnaire customers stated their preferences regarding different PSS design options and thereby allowed to create a detailed final design. Especially the AHP tool is an interesting suggestion that could fill the gap in the configuration phase. Further research would be beneficial as the study is limited to a single case (Dewberry et al., 2013). At the same time the overall methodology might not be applicable for the majority of PSS developments as tools like workshops or focus groups require a large budget and a small homogeneous target customer group. For a car subscription service which targets a large audience such qualitative tools might be less applicable.

In their study on PSS configuration, Mannweiler and Aurich (2011) use a similar, qualitative method to collect customer requirements on a component level. After creating a glossary for terms and keywords, they interview customers and translate their feedback directly into technical properties for the final PSS. In their article they offer a detailed description how to create the glossary and conduct the interviews. The benefit of this well-defined process is that the method allows to quantify to which degree the final PSS is actually representing the customer preferences (Mannweiler & Aurich, 2011). Such clear connection of the customers' preferences and the PSS can help to predict future success. Nevertheless, the study has developed this methodology based on a B2B case where the collaboration between customer and provider is different to a consumer targeting PSS. For example, the heterogeneity of the customers in the car market questions the reliability of the customer requirements derived from qualitative interview results.

Another method that has already been established in product design and is now tested in PSS design is the Quality Function Development (QFD) model. Shimomura and Arais' article (2009) is one example for studies that have adjusted the original model for the development of PSSs.

QFD is a method to translate customer requirements into design functions. By asking customers directly about certain components it allows to "find correlations between attributes of products and customer needs" (Kim & Yoon, 2012, p. 327). In more detail, one can calculate the importance of attributes or the expected value of different PSS designs based on the correlation and interaction of the attributes included. Shimomura and Arai (2009) argue that their method can reduce the chance of a failure design by connecting both the product and service side to the customer. Future research could prove that methods which adjust the QFD model are valuable methods for PSS design. However, a critique of the QFD model is that it only includes an initial evaluation of the customer preferences on the concept level but lacks a more iterative approach especially when it comes to evaluating different possible configurations.

A methodology that uses similar building blocks and can be coupled to a QFD has been proposed by Sakao, Birkhofer and colleagues (2009). In seven steps the methodology collects qualitative customer data, creates customer segments, identifies customer values, quantifies these, sets up design parameters, creates solutions and tests these for feasibility. For the qualitative customer data, the authors suggest using existing customer data or conduct interviews. In order to later quantify the requirements and translate them into design/ engineering guidelines QFD tools can be used (Sakao, Birkhofer et al., 2009). For their study they also used a questionnaire with preference scales. After further testing of the methodology an extended version was proposed in a study from Sakao and Lindahl (2012). Whereas the original methodology lacked an evaluation step of the developed solutions, the extended version now adds this. Instead of developing complete solutions right after setting the design parameters, the new method first derives components and then evaluates customers' preferences in order to find the optimal configuration of the solution. As a tool for the evaluation of the configuration they use a mathematical approach. Instead of collecting direct feedback from customers, they use the initial customer values, the available customer budget, the price for each component and the correlations of the components and values to optimize for the best configuration (Sakao & Lindahl, 2012). The authors state that "to a certain extent, this method is capable of substituting a customer utility analysis" (Sakao & Lindahl, 2012, p. 54). They also claim that it is "easy-to-learn and implement" (p. 54) and "that it builds on the levels for value provided without questioning the customers on value levels for individual offerings" (p. 54). Furthermore, Sakao and Lindahl (2012) argue that in many cases PSS consists of a large number of components that can hardly be evaluated by customers in practice. Therefore, their tool is able to provide more information than customer utility analysis tools like conjoint analysis. Unfortunately, there is neither a prove for this statement nor does an extensive research on customer preference measurement methods confirm this. The contrary might be the case as a number of tools exist that allow to test larger number of attributes with a high accuracy (Breidert, Hahsler & Reutterer, 2006).

Overall, a thorough literature review shows a number of methods that can be used to assist with the configuration of PSS. However, most methods are either not easily applicable in a consumer-oriented PSS, very complex and expensive in their execution or do not include direct customer evaluation. Thus, a method that is comparably easy to apply for managers and allows to evaluate different PSS configurations with real customer preferences is needed. One legit

approach towards filling this gap might be to develop a new method. Nevertheless, in many cases adjusting an existing method might lead to similar or better results. Despite Sakao and Lindahls' statement, a review of the consumer preference literature could help to find an established method that can be applied in the realm of PSS development.

2.3 Measuring Consumer Preference and WTP

This section will elaborate on consumer preference and how to measure it. As implied by the title of this chapter, however, also measuring willingness to pay (WTP) is included. Thus, this chapter addresses both topics, and actually does so jointly thanks to a highly applicable framework. This framework will be used in the upcoming chapter to present different methods for measuring preference and WTP. Then, in the next chapter, the advantages and disadvantages of these methods are investigated in a funnel approach, and it will be shown why the researchers deem the discrete choice analysis (DCA) as a suitable method for allowing PSS configuration. After that, the DCA is described more in detail by highlighting its methodological background and connection to consumer choice theory. To conclude, the last chapter will analyze how to design a DCA following a systematic design process.

Before diving into the different methods to measure preference and WTP, the latter should be defined briefly. Gupta and Çakanyıldırım (2016) state concisely that "Willingness to Pay (WTP) is the maximum amount a customer would be willing to pay in order to receive a product and it plays a central role in the selection of a product from several choices" (p. 1866).

2.3.1 Methods to Measure Preference and WTP

Matching the exact needs of this part of the literature review, Breidert et al. (2006) have elaborated a systematic overview and classification of the methods used to measure preference and WTP. Although they put their focus clearly on WTP in their work, they emphasize the direct connection of measuring WTP to measuring preference data and this will become clearer in the following chapters. As illustrated in the Figure 6 below, Breidert and colleagues (2006) primarily separate revealed preference methods and stated preference methods. As implied by their names, these two methods differ in the way preference and WTP information of a person is obtained.

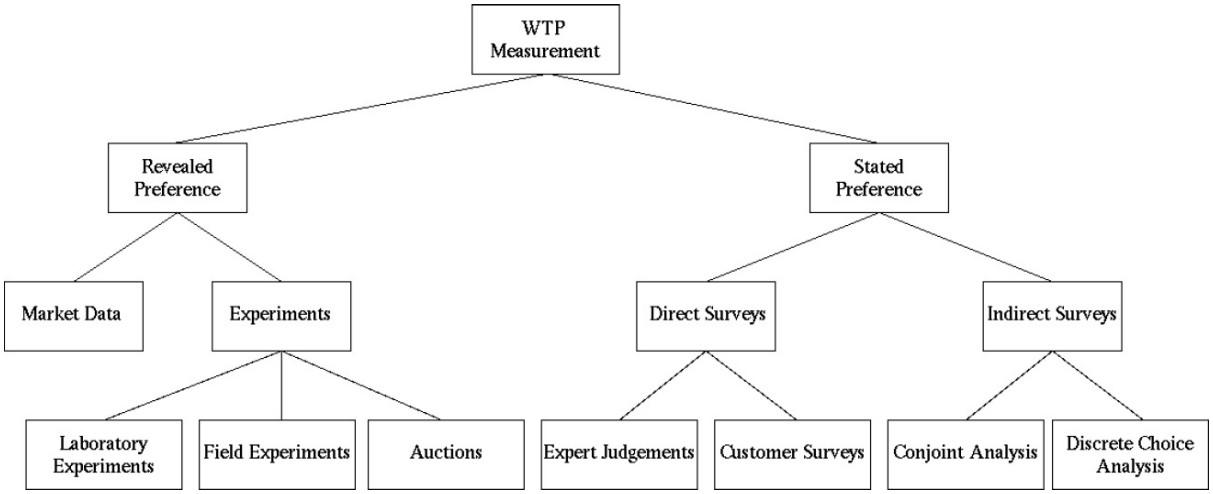


Figure 6: WTP Methods derived from Breidert, C., Hahsler, M., & Reutterer, T. (2006). A review of methods for measuring willingness-to-pay. Innovative Marketing, 2(4), 8-32.

Revealed preference (RP) methods obtain preference and WTP information from "actual behavior on a closely related market" (Alpizar, Carlsson & Martinsson, 2003, p. 83f). These methods include market data analysis (such as sales figures for instance) or experiments. Market data, on one hand, gives information about the purchases made in the real market. By considering the offerings that were rivalling to be chosen, it shows the real preferences of customers. On the other hand, experiments can be used to mimic a real market in a test setting. They can take three different shapes: laboratory experiments, field experiments and auctions (Breidert et al., 2006).

On the other hand, stated preference (SP) methods make respondents express their preference by means of a survey (Breidert et al., 2006). Following the sharp definition of Boxall, Adamowicz, Swait, Williams & Louviere (1996), stated preference methods "involve the elicitation of responses to predefined alternatives in the form of ratings, rankings or choice" (p. 244). In other words, depending on the type of method, respondents choose, rate or rank their preference(s) within a given a set of items. However, Breidert et al. (2006) open up this definition by also including methods in their framework that do not restrict the answers to predefined options. This will be further described below.

Two types of SP methods can be differentiated: direct and indirect surveys. In the former, respondents are asked explicitly to specify their preference. This type is also known as self-explicated methods (SEM) (Dubas & Mummalaneni, 1997). A direct survey may for instance use category scales, best-worst scales, or constant sum scales (Breidert et al., 2006; Louviere & Islam, 2008, p. 903). For example, a respondent might distribute a constant sum of 100 points on a given set of attributes of a product to express his or her subjective importance of each attribute.
Conversely, indirect survey methods focus on "analyzing an outcome measure like choices" to derive preference information about the attributes of an offering (Louviere & Islam, 2008. p. 904f). For instance, a number of respondents might be given an example product consisting of a random combination of product attributes (including also price for WTP estimations). By

conglomerating and then analyzing the choices whether to buy an offering or not, the importance of each attribute can be derived with statistical methods, thus representing customer preferences for the attributes (Cameron & James, 1987).
As shown in the classification of Breidert et al., indirect surveys include conjoint analysis and discrete choice analysis (DCA), while direct surveys can further be decomposed into expert judgements and customer surveys. For both expert judgements and customer surveys, Breidert et al. also name methods that prompt the respondents to give information freely, i.e. without showing a predefined solution space consisting of a set of options. As outlined above already, this broadens the specific definition of Boxall et al. and it should be emphasized here to avoid confusion. While customer surveys target customers, expert judgements typically come from employees in marketing or sales, who frequently interact with customers and thus answer on their behalf. (Breidert et al., 2006)
Regarding indirect surveys, it needs to be mentioned that conjoint analysis and DCA are clearly separated as shown in Figure 6, although they both use combinations of product attributes, so called "profiles", to be presented to respondents. Preference is not expressed freely but for those profiles (Cameron & James, 1987). While having additional similarities that will be described later in the research, it should be made clear that the traditional conjoint analysis has respondents rank (and/ or rate) the profiles, while the DCA has them choose a profile that they prefer (Otter, 2001, p. 64; Green, Krieger & Wind, 2001).

One can conclude that a number of methods are available to measure preference and WTP. However, with the information presented so far, evaluating the suitability of a method for configuring a new PSS is hardly possible. The next chapter will thus address this issue in detail.

2.3.2 Selecting a Method for Configuring a New PSS

When selecting a method to use, the advantages and disadvantages of each should be considered and compared to the specification of the study (Breidert et al., 2006). Regarding the latter, as defined earlier, the method needs to allow for configuring a new PSS. With this in mind and sticking to the classification framework used in the previous chapter, first the major advantages and disadvantages of the two revealed preference methods will be outlined, before continuing with the stated preference methods. Finally, the most suitable methods for this research will be reviewed.

Market data is the only method that gives information about the real purchase behavior and thus the preferences in the real market. The method shows both high reliability and high external validity, and depending on the data source, cost and time savings are additional benefits to be mentioned. However, it can only be deployed for already existing offerings, since market data must be available. It is thus not an option for new and yet to be developed offerings. (Breidert et al., 2006)

Experiments do not possess this downside, since data is generated by observing and monitoring participants in an artificially created purchasing situation. Researchers design this purchasing situation based on their needs and can include new offerings as well as specific scenarios with

selected product and price combinations to be tested. This artificiality, however, also leads to the clear downside that participants know to a certain extent that they are in a testing environment, which influences on their decisions. High external validity is thus not guaranteed, and in fact, the opposite has shown to occur. Furthermore, experiments result to be relatively costly and time-consuming, especially compared to surveying methods. (Breidert et al., 2006)

Surveying methods, on the other hand, remediate on the cost and time limitations of an experiment, while also allowing for studying new offerings and specific combinations of offerings and prices. Once established, a survey can be reused for future researches by simply updating or changing the offerings included. Furthermore, the external validity and thus generalizability of the results is generally higher than for experiments, even if the validity level of market data is not reached (Breidert et al., 2006). Another benefit of survey methods is that they have been applied extensively to new product or service development (e.g. Adamowicz, Louviere & Swait, 1998, p. 32; Meißner, Decker & Adam, 2011). Because of these advantages, surveying methods seem highly attractive for a research of this kind, and therefore the researchers focus on investigating them in detail.

It should be noted right away, however, that significant differences between direct and indirect surveying methods exist. Breidert et al. find that direct methods are advantageous in terms of time and budget needed. Additionally, Dubas and Mummalaneni (1997) name that these methods are capable of handling numerous attributes and levels, they can be deployed without specific software and training requirements, and they are relatively simple also for respondents to comprehend and answer. However, this is not the case if the type of direct survey has the respondents answer freely, i.e. without a set of defined answer options: especially if the offering is new to the respondent, he or she might find it challenging to answer reasonably. This is illustrated by Brown, Champ, Bishop & Mccollum (1996) at the example of responding freely with an exact number for price. Other disadvantages are mentioned in the literature that regard all direct methods. To the cost of realism, attribute levels are usually treated individually, i.e. without comparison to the other levels present in a real offering. The direct methods' "predictive and explanatory power" and "convergent validity for part-worth and importance ratings" are both deemed as little (Dubas & Mummalaneni, 1997, p. 38). Furthermore, a number of biases can be found depending on the exact method selected. For direct surveys exploring customers' WTP, over- or underestimating on purpose has been detected to take place, for instance by consumers who do not want to seem greedy and thus overestimate their WTP (Nagle & Holden, 2002, p. 344). Cohen and Neira (2003) also report issues with a direct method that presents a predefined set of options. According to them, when deploying a category scaling method, respondents tend to give each attribute a comparably high importance. These cases underline that the results of direct surveys can be biased, and in that case internal and external validity of the results are low (Breidert et al., 2006).

Indirect methods do not possess the disadvantages just named, since they are built upon a different methodological approach, which, as described before, presents pre-configured options that need to be evaluated. Moreover, indirect methods allow for deeper insights into real market trade-offs given that various hypothetical offerings are to be compared and evaluated against each other (Louviere & Islam, 2008). Again, compared to direct survey methods, they show superior predictive and explanatory power, as well as superior internal and external validity

(Dubas & Mummalaneni, 1997; Louviere & Islam, 2008). Also, indirect survey methods have already been deployed extensively for "simulating how consumers might react to changes in current products or to new products introduced into an existing competitive array", or for "product and service design problems in marketing, transportation and geography, among others" (Green et al., 2001, p. 57; Adamowicz et al., 1998, p. 32). This makes them further attractive for this research, since direct methods have been found less frequently in literature for new product or service development (two examples, however, are reported in Meißner et al., 2011), while indirect methods are claimed to be among the most pivotal methods for these tasks (Natter & Feurstein, 2002). As explained previously, a very limited number of studies have investigated the use of indirect methods even for PSS design tasks (Shih & Chou, 2011; Li et al., 2017). However, there exist also downsides of indirect methods. Mainly, they can be summed up with the term complexity. On one hand, researchers need specific software and knowledge to plan and work with an indirect survey method. An empirical study underlines this fact with the finding that indirect survey methods are typically not deployed by firms of all sizes but rather by large ones that have sufficient resources to stem the complexity (Creusen, Hultink & Eling, 2013). For respondents, on the other hand, complexity is formed with the more cumbersome and time-consuming survey-format as compared to the direct survey methods (Dubas & Mummalaneni, 1997).
Direct comparisons of the two methods for new product or service design have shown mixed results. Meißner et al. (2011), for instance, report a number of specific direct methods that outperform indirect methods in various aspects, while Oppewal and Klabbers (2003) claim the opposite by delivering a number of clear reasons. Overall though, despite possessing individual characteristics connected to shortcomings, both direct and indirect survey methods can be suitable for identifying consumer preference and WTP to configure a PSS. Choosing between these two highly depends on the specific case of study. In this research, indirect methods were favored over direct methods and the argumentation for this decision is presented in the methodology part. The rest of this chapter, however, will briefly review the two indirect methods outlined before, namely traditional conjoint analysis and DCA.

To begin with, it has to be clarified that both methods can actually be seen as classes of methods, since they count a large number of variants or even sub-methods (see e.g. Breidert et al., 2006 or Otter, 2001, p. 64). From now on, the researchers thus switch from naming them as one method to multiple methods.
Both methods have in common that they derive part-worth-utilities for the attribute levels of an offering (Breidert et al., 2006). This will be further described later in the research. As already stated, the traditional conjoint analysis methods are ranking-based (and/ or rating-based), while the DCA methods are choice-based (Otter, 2001, p. 64ff). This might not make a big difference to the respondent, since the only change he or she witnesses between the two is the way of responding to the survey questions. However, there are substantial differences for the researchers. For instance, analyzing choice-data claims for substantially different approaches than analyzing ranking/ rating-data does. In fact, DCA methods are linked to economic theory, while traditional conjoint methods are not (Adamowicz et al., 1998). For the latter, as summarized in the review of Breidert et al., ordinal data is usually analyzed deploying MONANOVA, while interval data can make use of ANOVA or OLS regression. DCA

estimations take place with probabilistic models that will be further described later in the research.
Another difference concerns their estimation level: DCA methods work on an aggregate level, and thus uncover the joint preferences of an entire population or target group. The preference of an individual can only be derived deploying additional statistical techniques like e.g. Bayesian estimation techniques. Estimations on individual level are recommended if a high expected heterogeneity is present in the sample. Conversely, traditional conjoint methods work on individual level, which is possible given a higher number of observations per respondent. Ranking all the options gives information about each option, while choosing does only about the selected product and not the residual ones in the choice set (Breidert et al., 2006).
On the other hand, choices offer more realistic market insights, since they are part of real purchasing situations of consumers (Natter & Feurstein, 2002). This is regarded as the largest advantage of DCAs over traditional conjoint methods. While Breidert et al. (2006) emphasize that this advantage is linked to an included no-choice option, other authors also report about empirical cases where the no-choice option was left out on purpose and the results still forecasted actual purchase behavior (Dhar, 1997). Via rating or ranking, however, choice information can only be estimated, and this represents a significant shortcoming of traditional conjoint methods, especially since WTP estimation can only be carried out when choice data is available. Breidert et al. (2006) mention that traditional conjoint methods remediate on this e.g. by having respondents state a status quo offering together with its price. Based on its ranking/ rating in respect to the other profiles included in the study, the WTP for these other offerings is derived. At the same time, however, the authors express their doubt on this procedure's robustness, since the results are based on one single data point. This is not the case for DCA methods, where different price levels can be included as attribute levels and numerous observations shape the utility-price-exchange rate. However, to the disadvantage of DCA methods, their WTP analysis is reported to be more complex.

In the end, both traditional conjoint and discrete choice analysis result to be suitable for identifying consumer preference and WTP to configure a PSS. While DCAs seem to deliver more robust WTP estimations and more realistic market insights than traditional conjoint methods, the latter are simpler to analyze and they allow for results on the individual level. Thus, once again it is in the hands of the researchers to select the method that guarantees higher applicability for the specific study case.
For this research the DCA appeared to be the most suitable method. The reasoning for this is given in the methodology section. The next chapter will thus investigate the DCA more in detail.

2.3.3 Discrete Choice Analysis

The traditional DCA, also known as choice-based conjoint (CBC) analysis, because of its similarity to conjoint methods (see e.g. Green et al., 2001), was proposed by Louviere and Woodworth based on the multinomial logit (MNL) model.
Each answer option represents a hypothetical offering that is also called profile. Each profile consists of a number of attributes and the profiles are distinguished from each other via the

level each attribute takes (Alpizar et al., 2003). To make this clearer, consider Figure 7 below for an example. It exhibits one choice situation where a respondent needs to choose one out of four options. Three of these options are hypothetical products, i.e. the profiles, and the last option is an opt out or no-choice. The respondent is asked to evaluate which tablet he or she is most likely to buy, and thus the profiles show different hypothetical tablets that consist of six attributes. Looking at the first attribute, namely brand and operating system, reveals that at least two levels are included, i.e. Apple (iOS) and Smarttab (Android).

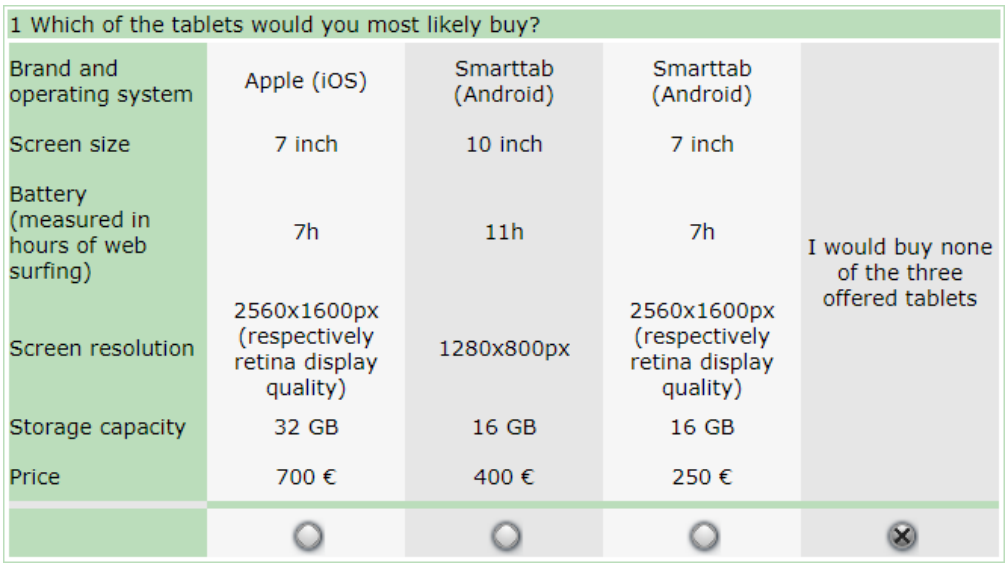


Figure 7: Example of a Choice set derived from Dynamic Intelligent Survey Engine DISE. (n.d.). Retrieved May 29, 2019, from https://dise-online.net/

The profiles are constructed by varying these levels, which is done following an experimental design (Blamey, Bennett, Louviere, Morrison, & Rolfe, 2000). With this experimental approach of studying choice behavior, a DCA allows for researching the respondents' process of choosing as well as how attributes are traded-off (Boxall et al., 1996; Louviere & Woodworth, 1983).

The DCA can not only be seen as an indirect survey method as shown previously, but also as part of a category called stated choice methods (SCM). These methods "are a means to generate behavioral data from consumers" and "well-established consumer choice theories and econometric modeling techniques can be applied to such data" (Adamowicz et al., 1998, p. 7). All SCM build upon the same behavioral pillars, of which two are Lancasters approach to consumer theory and random utility theory (RUT) (Adamowicz et al., 1998). Both pillars will be described more in detail in the following two sections, representing a methodological background of the method and its connection to choice theory.

2.3.3.1 Lancastrian Consumer Theory

In the view of Lancaster (1966), the utility of a good depends on its characteristics. Typically, a good consists of multiple characteristics that are not necessarily unique for one good but can

be found in others as well. He states that bundling goods might lead to diverse characteristics than those given for an individual good.
Fishbein and Ajzen (1975) also share this characteristics-based approach regarding utility. They use the term “attributes” instead of characteristics, which was adopted for this research.

2.3.3.2 Random Utility Theory

While the Lancastrian consumer theory defines that the utility of a good depends on its attributes, this does not yet explain why customers choose the way they do. This, however, can be accomplished with the random utility theory as introduced by Thurstone (1927).

The theory first of all assumes that customers aim at selecting the offering they prefer given constraints such as time or income. By doing so, they follow the overall goal of maximizing their utility (Adamowicz et al., 1998). RUT implies that along an observable (i.e. systematic) component Vi there exists an unobservable (i.e. random) component ei for each customer that influences on his or her choice. Because of its unobservability that component acts as an error component for the researchers. By putting this information in a so-called consumer utility function, the true (but unobservable) utility Ui of an offering i equals:

$$Ui = Vi + \varepsilon i$$

If two offerings i and j are presented to the customer in a set C, the probability that offering i is selected depends on the true utilities associated with both offerings. This can be stated with:

$$P(i|C) = Pr[Ui > Uj] = Pr[(Vi + \varepsilon i) > (Vj + \varepsilon j)], \forall j \in C$$

Integrating the Lancastrian consumer theory, it can be claimed that the observable component Vi is shaped by the attributes of the offering. Now, in order to explain why customers selected a specific offering, researchers replace the observable component Vi with a self-modeled function b'xi that represents the utility coefficients of the attributes of the offering. In other words, researchers define mathematically how the attributes contribute to the overall utility of an offering as perceived by the customers. Prior research about respondents’ opinions and desires is thus crucial to shape this function and to guarantee that the result actually reflects the customers’ perceived utility. However, once this replacement has been carried out, the following equation can be derived:

$$P(i|C) = P[(\beta' xi + \varepsilon i) > (\beta' xj + \varepsilon j)], \forall j \in C$$

Essentially, this equation implies that the probability of choosing offering i out of the set C can be repatriated to the attributes present in offering i and j. Offering i is likely to be chosen if the true utility perceived is higher than the one of offering j. By recording whether customers choose offering i or j, researchers can estimate the importance of each attribute with the help of statistical tools. A detailed description of the model deployed, and its statistical properties

can be found in the methodology part of this research or in the original work of McFadden (1973).

2.3.4 Process of Designing a DCA

In the DCA design context, it is often also spoken of "design of a choice experiment", since an experimental design is deployed to create the DCA (see e.g. Hensher et al., 2015, p. 189; Alpizar et al., 2003). For this research, the design process by Adamowicz et al. (1998) was chosen and enriched by the inclusion of elements from other existing literature. It entails the following seven stages:

1) Characterization of the decision problem
2) Attribute level selection
3) Experimental design development
4) Questionnaire development
5) Sample sizing and data collection
6) Model estimation
7) Decision Support System (DSS) development

2.3.4.1 Characterization of the Decision Problem

The very first stage of designing a DCA should clarify and refine the problem to be investigated. The researcher can accomplish this by analyzing the situation and building up knowledge about existing alternatives, their attributes and potential respondents (Hensher et al., 2015, p. 194).

2.3.4.2 Attribute Level Selection

This stage includes three tasks: selecting the alternatives, the attributes and the levels to be included in the experiment (Hensher et al., 2015, p. 195ff).

To begin with, it must be differentiated that there can be labeled or unlabeled alternatives. Labeled alternatives have been used for instance in transportation studies, where it is specified that one profile regards a train and one a bus. However, the alternatives can also leave out this information and name them generically with option A and B (Louviere, Hensher & Swait, 2000, p. 119ff). While labeled alternatives lower the cognitive burden by giving names and thus context to the alternatives, unlabeled alternatives make respondents choose exclusively based on the attributes and levels included (Blamey et al., 2000). If it is decided to use labeled alternatives, the researchers have to consider a number of additional tasks, which can be reviewed in Hensher et al. (2015, p. 196).
In the end, the selection of the alternatives should be coherent with the refined problem definition (Hensher et al., 2015, p. 196). However, typically two to four alternatives are deployed (Alpizar et al., 2003).

The next step is to refine the list of attributes. Similar to the search for alternatives, researchers may use primary data, secondary data, as well as prior experience. For example, focus groups,

academic literature or experience with similar products have been used in the past. It is vital to the success of the DCA to find and deploy the key attributes that drive choice (Adamowicz et al., 1998). Even though adding more relevant attributes to the experiment leads to higher variability in the choices, it should be considered for two reasons: one is to make sure attributes with the potential to be game-changing are included, and two is for decreasing bias (Islam, Louviere & Burke, 2007). Further information about topics such as interaction effects between the attributes and "free" attributes can be found in the literature (Hensher et al., 2015, p. 198f; Bradley, 1988). Furthermore, restrictions can be set up to guarantee that the profiles generated are credible (Alpizar et al., 2003).
Overall, the scope of this step is to learn about the respondents' evaluative process and to select those attributes that have significant influence on choice (Adamowicz et al., 1998; Alpizar et al., 2003).

Finally, the attribute levels need to be refined. As Alpizar and colleagues (2003) put it, "the levels are set such that they imply meaningful changes in utility" (p. 99). Their range should correspond to the range given by the market of interest (Adamowicz et al., 1998). Again, the primary and secondary research methods as described above can be used to determine this range.
Levels can be of quantitative or qualitative nature. An example for the former is purchase price, while an example for the latter is color. (Hensher et al., 2015, p. 199)
As Figure 8 shows, a higher number of levels included in an experiment leads to more data points and thus allows for discovering more complex utility relationships: while graph a.) can only show linear relationships, graphs b.), c.) and d.) make it possible to detect nonlinear ones. However, a higher number of levels also claim for making more observations, which increases the length of the experiment. Thus, the number of levels needs to be weighed-off carefully by the researchers. (Hensher et al., 2015, p. 199f)

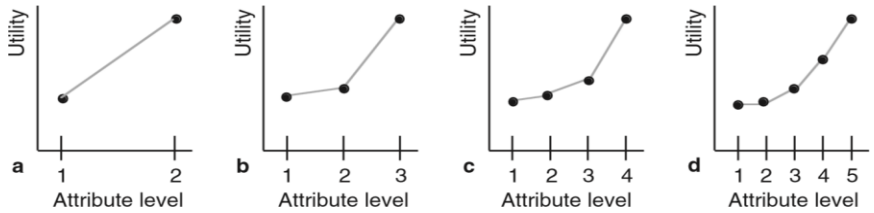


Figure 8: Connection between attribute levels and utility data points derived from Hensher, D. A., Rose, J. M., & Greene, W. H. (2015). Applied Choice Analysis. Cambridge: Cambridge University Press.

2.3.4.3 Experimental Design Development

As described already above, Alpizar et al. (2003) split the experimental design stage in two steps:

1) Obtain optimal combinations of attributes and levels (i.e. profiles)
2) Generate choice sets

For the first step, it must be decided whether to use a 'main effects only' or a 'main effects plus interaction effects' model (Green, 1974). Before explaining more in detail what these effects

are about, it should be noted that this decision goes hand in hand with whether to use a full-factorial or a fractional factorial design, and as can be seen below, this can oftentimes be decisive. A main effect, in essence, describes the influence of an individual attribute on the overall utility. As many main effects as attributes included can be estimated. An interaction effect enters the utility formula as an extra term that describes the influence a specific combination of levels has on utility (Hensher et al., 2005, p. 116f). Including interaction effects, however, enlarges the design significantly (Hensher et al., 2005, p. 124f), which can quickly exceed a size suitable for practical usage with time and budget constraints for researchers and limited cognitive burden for respondents. In fact, if all main as well as interaction effects should be estimated, a full-factorial design including all possible attribute and level combinations, i.e. profiles, is needed. Take, for instance, a DCA with four attributes at four levels and three attributes at two levels. That results in a total of 2048 possible profiles needed to be shown to each respondent. In those cases, several options to reduce this number are available. One is to decrease the number of levels deployed in the full-factorial design, however that is not always possible. Especially since they have been selected with care in the previous stage. Another option is blocking, where the full-factorial design is split up in smaller blocks. Each respondent is then shown only one block instead of the entire design. However, this leads to the issue that more respondents need to be found, since, in a sense, one respondent is replaced by multiple respondents to cover the full design. Thus, another option is deploying a fractional-factorial design. (Kuhfeld, 2010, p. 57; Hensher et al., 2015, p. 207; Hensher et al., 2015, p. 221f; Louviere et al., 2000, p. 89ff).
Fractional-factorial designs include only a share of all possible profiles but have limits regarding the estimability of effects (Green, 1974). A number of options exist to generate such a design, for instance orthogonal arrays and specific software like SPSS or SAS (Adamowicz et al., 1998; Kuhfeld, 2010, p. 60). Orthogonal arrays are pre-established experimental design templates that result in a design which is balanced and orthogonal. Balancedness implies that each level within an attribute is shown equally often. This can be decisive since showing one level more often could make it seem more relevant than others in the eyes of human respondent. Orthogonality on the other hand implies that each set of levels is shown equally often across all attributes. (Kuhfeld, 2010, p. 57ff; Kuhfeld et al., 1994)

By the end of this first step, the researchers have found a list of profiles that will be used in the choice experiment. However, depending whether labeled or unlabeled alternatives are used, and depending on how many profiles should be presented to the respondent in one choice situation, the choice sets need to be created and/or "assembled" with a matrix. This is described in the second step of this stage.

Different approaches to choice set creation exist. One example is the foldover/ shifting approach, which departs from a design matrix where each row represents one original profile. Each choice set will eventually include one original profile and multiple newly generated ones. The newly generated ones are created by taking the attribute level values from the original profile and applying a mathematical operation to them. With shifting, for instance, the profiles are generated by adding +1 to each level (and replacing the highest levels with the lowest).

(Louviere et al., 2000, p. 114f; Hensher et al., 2005, p. 147f) Other approaches to choice set generation are for instance reported by Chrzan and Orme (2000).

Reaching this point, the profiles have been generated and the choice sets formed. Thus, the experimental design has been fully developed. The researchers can proceed to the next stage, which is to develop the questionnaire.

2.3.4.4 Questionnaire Development

This stage focuses on developing the questionnaire used to collect respondents' choices. More specifically, topics to elaborate on in this stage might include the questionnaire format, the introduction, the choice part, and additional questions about e.g. sociodemographics (Adamowicz et al., 1998).

The questionnaire can either be worked through in an interactive interview format, or the respondents fill it out on their own. As further reported by Adamowicz and colleagues (1998), one goal in this stage is "to place the decision-maker in a realistic frame of mind to compare a number of alternatives, each described in terms of some number of attributes" (p.7). In order to accomplish this, an introduction scenario can include elements like videos, digital simulations or even virtual reality (Adamowicz et al., 1998; Backhaus, Jasper, Westhoff, Gausemeier, Grafe & Stöcklein, 2014). A specific issue of WTP studies is to consider whether or not to include a cheap talk script, which points respondents to the so-called hypothetical bias. Thereby, respondents are alerted not to overestimate their willingness-to-pay given that the choices in the experiment are hypothetical and not real. Cheap talk has been found to increase the reliability of WTP estimates and reduce the overall WTP, doing so especially for respondents new to the topic in question (Tonsor & Shupp, 2011; Lusk, 2003). Next up, the choice sets are presented to the respondents. The attributes and levels are typically written, but can also be shown with pictures, animations, charts etc. Depending on the purpose of the study, additional questions might be given to the respondents. These questions can range from sociodemographics and psychographics to attitudes and past experiences. (Adamowicz et al., 1998)

Before starting to collect data with the questionnaire, pretests should be executed. These should examine whether the questionnaire needs improvement, for instance in terms of understandability, credibility and conciseness (Johnston et. al, 2017). One way of doing so is to have respondents read the survey while thinking out loud (Alpizar et al, 2003).

2.3.4.5 Residual Stages

At this point three residual stages are left to complete the design process. These stages (Sample Sizing and Data Collection, Model Estimation and Decision Support System (DSS) Development) are highly specific for each study and will thus not be presented more in detail here but one can find information about it in Adamowicz et al. (1998). Additionally, the methodology section of this research can serve as an example.

3. Methodology

This section of the thesis shall review the methodological considerations and decisions that had to be taken during the research. It is included to explain the rationality behind important decisions and to inform about their influence on the overall quality of the study.

After introducing the selected research strategy and design, the systematic literature review and the primary data collection will be reviewed. In the following chapters the process of data collection and data analysis is explained. Throughout all parts, inherent challenges and drawbacks of the chosen approach will be discussed and within the final part connected to the overall research quality.

3.1 Research Strategy

Following the research goal and being led by the defined research questions, a research strategy has been developed. The term research strategy usually describes the general orientation of the business research and commonly differentiates between a qualitative and quantitative research strategy (Bryman & Bell, 2011).

This thesis uses a quantitative or deductive research strategy that has a number of characteristics which undoubtedly benefit this research.
First, quantitative research usually starts with existing theories in order to derive hypothesis and methods from. For the above described research questions a deductive approach is very helpful as there are a number of different studies that have previously tested the desirability of service attributes. At the same time, such existing studies have developed many different methods that can be used for the evaluation and determination of the consumer preferences and WTP. Utilizing these methods will help to increase the reliability of the research.
Second, quantitative research takes an objectivistic approach that aims to quantify the observed reality. As quantified measures are comparable and allow the researchers to define differences between entities, it increases consistency, reliability and allows to identify relationships between different variables (Bryman & Bell, 2011). This point is of great importance for this particular research. As the questions indicate, the research tries to measure a causal relation between different service attributes (or attribute levels) and the customer preferences or willingness to pay. In order to answer this, the relationship between the customer's choice and the evaluated attribute levels is important. Additionally, the direction of this relationship has to be observed in order to derive if a certain combination of attribute levels have a positive or negative influence on the customer's choice probability. Furthermore, consistency and reliability are especially important in order to allow the research to be to some degree representative and generalizable. As the research aim is to offer insights that can be used for the service launch to a great number of customers, causality and generalizability are desirable.
Lastly, in order to increase representativeness quantitative research commonly works with methods derived from the natural science logic. These methods allow to work with large samples and sufficient amounts of data. Referring to the research aim, the researchers will

collect data from a larger number of potential customers and therefore need applicable methods for such amounts of data.

Choosing a quantitative research strategy has a few implications on the research criteria that have to be borne in mind. For a quantitative research, especially one that investigates causality and hopes to generalize the findings, reliability and validity are of uttermost importance. A detailed evaluation of the quality of the study in terms of reliability, validity and generalizability will be provided in Chapter 3.6.

3.2 Research Design

The research design is strongly guided by the same, above presented and from the research aim derived, requirements. At the same time, the given resources in time and funding do not allow to choose from the whole range of research designs.

A classical experimental design, although it is the preferred design to investigate causality, is not feasible for the size of this research project (Bryman & Bell, 2011).
Taking the existing constraints into account and referring to the above stated research aims; the selected research design resembles a cross-sectional or experimental design. Bryman & Bell (2011) explain a cross-sectional design as a design that collects data on many cases at a single point in time including a number of variables that are measured and examined in order to detect patterns. However, as will be explained in the next part, many characteristics of the chosen research method will also show facets of an experimental research design. This concerns especially the manipulation of variables (service attribute levels in this research), which is typical for an experimental design and allows to analyze for causality but is not included in classical cross-sectional designs (Bryman & Bell, 2011). Thus, one can find good arguments that would allow to refer to it as a mix of a cross-functional and experimental design.

Besides the goal to match the research requirements, the chosen research design was found to be a common method used by previous studies that have conducted an analysis of consumer preferences and WTP (see Breidert et al., 2006). Thus, the research design is a validated design that allows to answer the research questions while accounting for the existing constraints.

3.3 Research Method

Closely related to the research design is the choice of methods to set the academic background and to collect and analyze the necessary data.
The first step for this research was to understand the theoretical background of the different research areas. A systematic literature review was conducted to achieve this.

3.3.1 Systematic Literature Review

In order to understand the relevant field of study and to later demonstrate this knowledge, a systematic literature review, which is also used to inform the reader, was conducted (Hart,

2018). More specifically, the researchers aimed to discover important variables relevant to the topic, establish the context of the topic or problem, rationalize the significance of the problem, enhance and acquire the subject vocabulary, understand the structure of the subject and relate ideas and theory to the research application (Hart, 2018).

Since the research topic spans across three theoretical fields, the literature review was structured accordingly. For each of the fields a systematic literature review was conducted. The main source for the review was academic literature that was found with the help of search engines like Google Scholar or the universities library search ("GU Supersearch"). The search was conducted by searching with relevant keywords, reading through relevant magazines or identifying important authors. Additionally, the literature within previously identified articles and recommendations on literature from experts within the field, especially from the researchers' university were another source.

3.3.1.1 Databases

The articles utilized were mainly published in academic magazines that can be found in databases like Researchgate, Tandfonline, EmeraldInsight, SpringerLink, Ebsco, JSTOR, Sciencedirect, Sage Journals, Wiley Online Library and Degruyter. Additionally, a number of books from the university's physical library were used. A list that provides an overview of keywords and search terms that were used to find relevant literature within each theoretical field can be found in Appendix 1.

3.3.1.2 Inclusion and Exclusion Criteria

In order to guarantee a sufficient quality of the review and to focus on the scientifically proven contributions, a number of inclusion and exclusion criteria were established.
First and foremost, the researchers tried to only include peer-reviewed articles. If, like in a number of cases, this criterion could not be fulfilled, the articles were only included if they were already cited by a large number of peer-reviewed articles.
Second, the number of citations and the reputation of the magazine was utilized as an indicator of the article's validity. A large number of citations can indicate that other authors have found the article to be useful and of scientific value. In general, the researchers have therefore tried to only include articles that were cited at least 10 times. However, one has to admit that the number of citations itself is not necessarily an indicator for overall quality (Hart, 2018).
Nevertheless, the combination of these criteria was hoped to allow a sufficient quality of the literature utilized.

3.3.2 Primary Data Collection Method

In order to find answers to the research questions, data needed to be collected and analyzed. Since no secondary data was available given that the offering under investigation is new-to-the-market, a primary data collection was necessary.
Referring to the literature review, a pool of methods for measuring preference and WTP in general was identified with the framework of Breidert et al. (2006). The researchers weighed off the distinct characteristics of the methods available, compared them to the specific case of

this study and finally selected indirect surveying methods. More specifically, they decided to make use of a discrete choice analysis (DCA) and the following section will reason for this choice.

First and foremost, the possibility to study trade-offs comparable to the ones from real market situations (Louviere & Islam, 2008), and the higher track record in past application for new product or service development tasks as well as for academic studies regarding this topic convinced the researchers for indirect methods (Natter & Feurstein, 2002; Eckert & Schaaf, 2009). To specify the latter more, Van Kleef, Van Trijp & Luning (2005) suggested using indirect survey methods (at the example of the traditional conjoint analysis) for the technical development of "incremental new products", which can for instance take the form of a repositioning of an existing product. This highly fits the case of this study, where a subscription for new cars already exists that builds the basis for the yet to be configured used car subscription. Last, but importantly, the disadvantages of indirect methods, which are connected to their higher complexity, seem manageable to the researchers. In fact, other existing PSS design methods (see Chapter 2.2.3) were found to be even more complex.

Regarding the DCA, the researchers valued the benefit of obtaining realistic market insights (Natter & Feurstein, 2002) since they followed the task of deriving true market preferences and WTPs for Care by Volvo. Indeed, considering WTP, the DCA also convinced with the fact that WTP can be assessed directly and with multiple data points. Traditional conjoint methods, conversely, need to derive that information based on one extra data point that typically consists of a status quo product plus its WTP (Breidert et al., 2006). The first issue with this is the following: considering that a new-to-the-market offering is investigated, it is hardly possible to define a status-quo offering or a comparable offering. The second issue, as Breidert et al. (2006) note, is that utilizing a single datapoint to derive WTP information for all other profiles seems less robust. In a sense, the researchers feared that this effect would further distort the results already biased due to an imperfect "status-quo offering". This is why the DCA seemed more suitable for this study.

In order to utilize a DCA to collect data, however, it needs to be designed first. In fact, the design process for DCAs has been reviewed and summarized in the literature review. This process will be used here as a step-by-step framework.

3.3.2.1 Characterization of the Decision Problem

At the very beginning of the study, the researchers held extensive talks and discussions with experts from Care by Volvo to ensure the problem is understood and refined with utmost care. Based on this, the final problem definition was carried out and one can read about it in detail by consulting the introduction part of this study. Specifically, Chapter 1.3 and its subchapters can be of interest in that case.

3.3.2.2 Attribute Level Selection

Regarding the stimuli, the researchers first off, all decided to use generic, unlabeled alternatives for two reasons.
First, labeled alternatives were not suitable because the DCA investigated one single offering only. Thus, since all labels would have been the same and in that scenario, no context is added to the answer options. In essence, the survey would have become longer at no added value.
Second, the aim of the study was to find preferences regarding the configuration of this offering, and as reported in the literature review, unlabeled alternatives force respondents to choose exclusively based on the attributes and levels included, which fits exactly to that aim (Blamey et al., 2000).

Again, referring to the literature, it is vital to the success of the DCA to find and deploy the key attributes that drive choice (Adamowicz et al., 1998). The advantage in this case was that Care by Volvo had already launched similar offerings, although for new cars. Still, the services (i.e., the attributes) included in those offerings had been carefully and extensively researched prior to market launch, and this offered a large amount of valuable information that could be transferred to this study to create attributes and levels. This corresponds to what Adamowicz et al. (1998) state with: "commonly, attributes are identified from prior experience, secondary research and/ or primary, exploratory research". In total, as can be seen in Table 2 below, seven attributes at three levels were selected and defined together with Care by Volvo following the goal of this research. Nevertheless, other important variables for choice could exist that were not included in the study. The researchers were aware of the sensitiveness of the topic regarding how many attributes and levels to include, since this is critical not to exceed the limits of human cognition (Alpizar et al., 2003). Because literature has shown to have diverse views on this, an expert in the field of DCAs was consulted who confirmed the feasibility of the selected numbers, since previous studies had already worked with more attributes and levels.
Other issues that were considered by the researchers are summed up as follows. Potential interaction effects between the attributes were tried to be identified with pretesting, however no evidence was found. Free attributes were not deemed interesting for this survey, since the researchers were interested in finding the best combination of already available attributes. An open field would have prolonged the survey significantly and, as reported, complicated the analysis (Bradley, 1988).

Attributes	Levels	Explanation of the attribute
1. Repair & Maintenance	● Included at any repair shop ● Included at a Volvo repair shop ● Not included	Defines if and at which type of repair shop repair and maintenance tasks are included
2. Tyres	● Summer & winter tyres + mounting & (…) ● All-weather-tyres + mounting ● Not included	Defines which type of tyres and additional services are included
3. Car Pick-up & Delivery Service	● For subscription start & repair shop visits ● For repair shop visits ● Not included	Defines if a service that covers the delivery of the car after the subscription start and/ or repair shop visits is included

4. Insurance included with…	● No deductible ● 500 € deductible ● 1000 € deductible	Insurance is included, but the deductible amount the customer needs to pay in the event of an accident/damage varies
5. Replacement car	● From similar car category ● From lower car category ● Not included	Defines if a replacement car and what type of car is given to the customer in the event of a longer repair or maintenance
6. Car condition	● Spotless ● Minor scratches ● Minor scratches & signs of usage	The condition of a used car can differ largely, and this attribute creates three broad categories for it
7. Price per month	● 600€ ● 500€ ● 400€	The monthly price a customer is charged for a subscription of a used XC40 plus included services

Table 2: Attributes and levels included in the DCA

While the levels were elaborated simultaneously to the attributes, the researchers defined them based on the available configuration alternatives. Again, input from the industry expert was crucial to find a relevant list of stimuli. For the WTP estimation, price levels were included.
As found in the literature review, a higher number of levels yields to more data points and thus allows for discovering more complex utility relationships. At the same time, it was clear that a larger number of levels would significantly prolong the survey (Hensher et al., 2015, p. 199f). This further motivated the researchers to work with the three levels identified by market research, since they would represent the minimum number to possibly measure non-linear relationships.
The price levels were defined by departing from the existing minimal price of a new Volvo XC40 model in the existing subscription offering. By considering Adamowicz et al. (1998), who claimed that the level range should correspond to the range given by the market of interest, additional two levels representing the minimum and maximum price levels were identified by the industry expert. As found in other empirical studies in the automotive sector, price has shown to be a crucial attribute (Hidrue, Parsons, Kempton & Gardner, 2011). Based on this, the researchers feared the danger that price might actually exhibit over-importance for respondents, but the pre-tests did not confirm the presence of such.

3.3.2.3 Experimental Design Development

As stated in the last section, the profiles of the DCA were to be constructed using seven attributes that each show one of three possible levels. Starting from there, the researchers calculated the number of total possible profiles with 2187. A full factorial design that would allow for discovering all main effects and interaction effects would thus have consisted of more than two thousand choices, which was deemed too large for practical usage. Thus, it was decided to use a fractional factorial design, accepting that this would imply a lower degree of statistical information to be obtained (Louviere et al., 2000, p. 89ff).
Orthogonal arrays were considered first, since "with relatively few combinations (under 30 in most cases), the researcher can still estimate all main effects on an unconfounded basis for a dozen or more factors, each at two or three levels." (Green, 1974, p. 67). Finally, an existing

orthogonal array that had been tested and validated in earlier studies was selected that reduced the number to 18 profiles. These 18 profiles were then taken as the starting point for choice set generation (Kuhfeld, 2010, p. 57; for the explicit matrix see: NCSS Statistical Software, 2019). The array consisted of seven attributes at three levels and one attribute at two levels. The former were used to represent the attributes and levels of the study as shown in Table 2 above, while the latter was deployed as a blocking variable. Therefore, two blocks of nine profiles were created and this solution was deemed highly suitable by the researchers.

To create choice sets, a technique called "mix and match" by Louviere (1988, as cited in Chrzan & Orme, 2000), was utilized independently for both blocks. The objective of the researchers was to create choice sets with three answer options. In fact, to assembly the final choice sets, all first answer options (i.e. the original profiles) of one block were put in one pool and mixed, all second options in another pool and mixed, and all third options in a last pool and mixed. Once this was done, the researchers started assembling the choice sets by randomly choosing one profile from each pool without replacement.

These profiles were then checked for credibility, as suggested by Alpizar et al. (2003). Unfortunately, the very first profile in the first block foresaw a "perfect" product with all non-monetary attributes at their highest level and the price at the lowest. At the same time a number of choice sets showed clear imbalance resulting in expected advantages for one alternative. To mitigate the imbalance and allow for more similarly desirable alternatives it was decided to include the price level reversely. In this way, the respondents would see more credible profiles. Although the researchers considered the inclusion of a "no choice" option, this option was refused eventually. As reported by Hensher et al. (2005, p. 176), a no choice option can actually represent a barrier in studies where the focus is to understand the effect each attribute level has on choice instead of understanding the desirability of the options overall. Rather, the non-existence of the no-choice option forces respondents to willingly trade-off the attribute levels present. For this study, this represents exactly the objective, since the preferences regarding the combination of services are to be found.

6 Which subscription plan would you choose?			
Repair & maintenance	Included at a Volvo repair shop	Included at a Volvo repair shop	Included at any repair shop
Tyres	Not included	Summer & winter tyres + mounting & storage	All-weather-tyres + mounting
Car pick-up & delivery service	For subscription start & repair shop visits	Not included	Not included
Insurance included with...	500€ deductible	1 000€ deductible	No deductible
Replacement car	Not included	From lower car category	From lower car category
Car condition	Minor scratches	Minor scratches	Spotless
Price per month	600 €	600 €	400 €
	○	⊗	○

Figure 9: Own illustration of an example choice set from the DCA

The final experimental design thus consisted of two blocks containing nine choice sets each. As can be seen in Figure 9 above, a choice set included three answer options or profiles, which showed seven attributes that take the form of one out of three possible levels each.

3.4 Data Collection

Logically, after presenting the research method and specifying the experiment design, the next part will shortly review the researchers data collection approach. This will include the utilized methods as well as detailed descriptions of the sampling process.

3.4.1 Collection Method

From the two most common ways of collecting data for the discrete choice analysis an online self-completion questionnaire, also called online survey, was used. An online survey is commonly created with a survey software and then distributed to the respondents who respond to the questions by themselves (Bryman & Bell, 2011). In recent years the distribution is commonly done online with the help of email or social networks. As this does not require the presence of the researcher or a designated laboratory, this method is very time and cost efficient. Additionally, online surveys have a number of other advantages that can be found in Evans and Mathurs' (2005) study. Following these arguments, it was found to be the most suitable data collection method.

Different survey software programs that have explicit conjoint-analysis tools are offered to support the survey creation. Common examples are SAS, Qualtrics or Sawtooth. However, as most of these software programs are not freely available and the researchers budget was limited, a free alternative developed by a professor of a German university was used.

Nevertheless, there are a number of disadvantages when conducting an online survey: One of the most important ones, especially regarding this research, is the inability of the respondent to ask for help (Evans & Mathur, 2005). If a question, task or scenario has not been understood, the respondent needs to answer without any clarification. This can lead to false answers and therefore wrong findings. For this research this demands the researchers to be very careful when explaining the setup and the different alternatives. Especially as car subscriptions are relatively unknown to many possible respondents. In order to reduce this risk, the researchers have conducted a pretest with ten respondents from different backgrounds. Additionally, experts within survey creation, market research and DCA were consulted and asked to review the survey. The resulting feedback was then used to refine the survey and reduce the risk of confusion.
Another set of disadvantages is connected to the distribution of the survey and the task of sampling (Evans & Mathur, 2005). The section 3.4.3 will include comments on these problems.

3.4.2 Questionnaire Development

As explained above, the questionnaire was created in the form of an online survey. Two different introduction scenarios were developed and tested. In the end, a fusion of both introductions resulted to be the most beneficial solution.
Crucial methodological decisions for the questionnaire involved the inclusion of cheap talk and a description of all attributes and levels prior to the choice set. Considering the benefits associated in previous WTP studies, the researchers opted for an inclusion of cheap talk. This is because car subscription offers are quite novel in general, and the pretests have shown that they are quite new also to respondents of the target group.
Last in this stage, additional questions controlling for the target group sociodemographic, past experiences and current habits regarding car usage and subscription were defined. In order to do so, the researchers conducted a literature research of other studies that investigated preference for car attributes in the automotive sector (Hidrue et al., 2011; Achtnicht, 2012; Potoglou & Kanaroglou, 2007; Ziegler, 2012; Ewing & Sarigöllü, 2000). The findings were used as a starting point for the researchers to identify control variables for their specific case, but they also served as a framework to make sure no important control variable was left out. The final selection of the additional questions was carried out again in collaboration with Care by Volvo and can be found in Appendix 9.

3.4.3 Sampling and Survey Distribution

Setting up the sampling strategy is a main task when conducting a quantitative research (Bryman & Bell, 2011). As the sample, the group of individuals who receive and answer the survey, should represent the population that is aimed to be analyzed, the selection of this sample is crucial for the quality of the findings. The better the sample represents the population, the more generalizable the findings are (Bryman & Bell, 2011).

The population in this research was defined by Care by Volvo as the findings aim to increase the market success of their future car subscription offer. Thus, the population follows Care by Volvos target customer audience for the offer. More specifically, the population includes male inhabitants in Germany, that are between 25 and 45 years old and have a yearly gross-income above 37 500 €.

In order to create a sample that allows to represent this population, the researchers needed to have reliable data of potential respondents that could be included in the sample. Fulfilling these requirements would have allowed the researchers to create a probability sample which would offer a high degree of representativeness and thereby generalizability.
A second variable when aiming for a sample that is representative is a sufficient sample size. For a homogeneous sample the number of responses can be smaller than for a more heterogeneous sample, but in general a larger sample will most likely increase the quality of the findings (Bryman & Bell, 2011). Although consisting of a number of characteristics, the above specified population has to be described as heterogeneous. Thus, a large sample size would be necessary to guarantee generalizability.

However, taking the existing budget, time and data availability constraints into account, these requirements were out of reach for this master thesis. Especially the existing GDPR laws and regulations did not allow the researchers to use existing Volvo customer databases that would offer data from sufficient amounts of possible respondents. Similarly, no budget to use a professional market research agency or to use other highly targeted distribution channels was granted.
Thus, following Bryman and Bells' (2011) definition, the selected sampling strategy has to be described as a combination of a snowball and convenience sample, instead of a more desirable probability sample. Snowball and convenience samples are subtypes of non-probability samples and offer little representativeness and generalizability. Nevertheless, such samples are not uncommon within business research and can still lead to relevant findings (Bryman & Bell, 2011).

The online survey was distributed during a month-long timeframe between the 24th of March 2019 and the 23rd of April 2019.
In a first step the survey was distributed with a snowball-like sampling strategy. Via direct messengers like Facebook Messenger, WhatsApp and LinkedIn contacts from the close network of the researchers who fulfill the populations' characteristics were contacted and asked to fill out the survey. The contacts were also asked to further distribute the survey to additional individuals of the population. However, it was neither possible to obtain a record of the number of additional individuals that were reached this way, nor the characteristics of those who were reached.
In a second step an indirect distribution through social and career networks was used in order to collect a sufficient number of responses. The networks utilized were Facebook, LinkedIn and Xing (a German LinkedIn alternative). The survey link was constantly published together with an introductory text within different virtual groups that were either relevant to the automotive and mobility topic of the survey or were hoped to contain mostly individuals from the target population. A sampling through virtual groups was used before (e.g. Baltar & Brunet, 2012), however such sampling relies on volunteer participation that bear relevant shortcomings (Hewson, Vogel & Laurent, 2003). A full list of all virtual groups that were used for this study can also be found in the Appendix 2.

Overall, the distribution approach utilized comes with a number of large drawbacks for the research quality that need to be elaborated.
First, the representativeness of a snowball sample is highly depending on the selection of the initial contacts that serve as recruiters (Baltar & Brunet, 2012). Preferably, the selection is done randomly to ensure that no selection bias influences the resulting sample. However, for this research the number of initial contacts that had a large network of individuals within the population was limited and therefore the initial contacts were selected on purpose by the researchers. Therefore, a selection bias has to be taken into consideration.
Second, both the snowball-like distribution via direct messaging and the publishing in virtual groups do not allow to control the number of individuals who received the survey, the characteristics of those and the situation and environment the survey is received in. Consequently, it is also not possible to measure the response rate or the sampling frame.

However, it is certain that a very high number of individuals who saw the survey did not respond, as this was observed in earlier studies (Hewson et al., 2003). Similarly, it has to be assumed that those who responded had either a strong interest in the topic or a personal connection to the researchers (Hewson et al., 2003).
Third, especially the indirect distribution through virtual groups inherently comes with a large sample bias (Hewson et al., 2003). The researchers' selection of which groups to publish in was eventually driven by assumptions about the characteristics of the groups' members. For example, members within mobility topic-related groups are most likely more open towards new car subscription offers than a random member from the above described population would be (Groves, Presser & Gipko, 2004; Hewson et al., 2003). Therefore, some members of the population were not reached as they have not been part of the targeted network groups.

The implications of these drawbacks on the different criteria of the research quality, namely the validity, reliability and replicability will be discussed further in Chapter 3.6.

3.5 Data Analysis Model

Choosing the data analysis model was one of the major challenges for the researchers, since they were no experts in the DCA field. After an initial screening of the generally most applied choice models, that are logit, probit, mixed logit or generalized extreme value models (Train, 2009, p. 34), the researchers understood that appropriating knowledge about a model is a time-consuming endeavor.
In order to be guided in their decision, they first of all reviewed existing studies that investigated preference for car attributes in the automotive sector. For instance, Hidrue et al. (2011) summarized six previous EV studies and report an MNL was deployed in four studies, a ranked logit in two, and a mixed and a nested logit were both used in one study. Also, other studies that fall into the category described report the use of mixed logit (Achtnicht, 2012), nested logit (Potoglou & Kanaroglou, 2007), multinomial probit (Ziegler, 2012), and the MNL (Ewing & Sarigöllü, 2000). The latter, however, seemed to be the most popular model for studies that compare different types of vehicles or means of transportation. As Hoffmann & Duncan (1988) state, MNL models "focus on the individual as the unit of analysis and uses the individual's characteristics as explanatory variables" (p. 416). However, for this research the unit of analysis are the characteristics, or attribute levels, of the different alternatives shown and the individuals' characteristics were instead predefined for the sample. Therefore, following Hoffmann & Duncan (1988) suggestion, the researcher decided to use a conditional logit model as it allows to match these requirements.

The conditional logit model was first introduced by McFadden (1973) and is based on the previously explained random utility theory and Lancaster's consumer theory.

(1) $U_i = V_i + \varepsilon_i$

Starting with the earlier explained utility function, one can replace the observable utility component *V*i. As it is the sum of all observable utilities of the observable attributes of the product or service, a more detailed function looks the following:

(2) $U_{jn} = V(x_j,z_n)+\varepsilon_{jn} = x_j\alpha + z_n\beta + \varepsilon_{jn}$

The observable utility component V is now a sum of the attribute utility x of the alternative's attribute j and the characteristics of the individual n, who is a utility maximizer.
Using this extended function in an actual choice situation between the alternatives j and $j*$, results in the following choice probability equation:

(3) $prob_{j*nt}(V(x_{j*nt},z_n)+\varepsilon_{j*nt} \geq V(x_{jnt},z_n)+\varepsilon_{jnt}) = prob_{j*nt}(y_{j*nt} = 1) = F_{j*n}(x_{j*n},z_n,\alpha,\beta)$ for all $j \in J$

The variable y_{j*nt} either takes a value of 0 or 1 depending if the alternative $j*$ was chosen by the individual n or not. Consequently, the logistic function F_{j*n} can range from 0 to 1 depending on the alternative's attributes x_{j*n} and the individual's characteristics z_n. Estimating this function allows to calculate the coefficients α and β and thus to determine the utility of the respective attributes and individual characteristics.

The researchers used Stata/ SE 15 to estimate the logistic function. With the help of the *clogit* command coefficients for the attribute levels could be estimated. In order to do so, the researchers arranged the obtained survey data in a table that matches the presented structure by Hoffmann & Duncan (1988, p. 420). The data from each respondent was spread over 27 rows as each row represents one displayed choice alternative. Therefore, one full choice set contained three rows and a specific column indicated which alternative was chosen by the respondent. All attribute levels, except the price, were coded as dummy variables and displayed in a separate column. The values for them depended on the previously explained design of the choice set. The decision for using dummy coding was made with great caution. Generally, the concerning literature shows good arguments for both coding styles (see e.g. Hasan-Basri & Karim 2013 for dummy coding or Hensher et al., 2015 for effect coding). The researchers decided in favor of dummy coding, as the obtained results were more significant and allowed for an easier interpretation. Nevertheless, the differences between the methods are minor and example results for the effect coded analysis can be found in Appendix 5. The socio-demographic respondents characteristics followed after the attribute levels. The exact data structure can be provided on request.

For the actual model, the next step was to set the column that indicated the respondents choice as the dependent variable and the attribute level columns as the independent variables. However, as will be explained in the data analysis chapter, one attribute level had to be set as a base level and was therefore not included in the model. In order to account for all three alternatives, that were shown simultaneously in one choice set, and the respondents characteristics, the *clogit* model allows to group each estimation by respondents and choice set.

As a result the researchers were able to obtain coefficients that could be interpreted according the previously explained theories. Chapter 5 is reviewing these results and highlighting relevant findings.

3.6 Quality of the Study

Bryman and Bell (2011, p. 41) mention three constructs that are of fundamental importance for assessing the quality of a business and management study: reliability, replication and validity. This chapter will illustrate how the researchers have addressed these topics to maximize the quality of the study.

"Reliability refers to the consistency of a measure of a concept." (Bryman & Bell, 2011, p. 158). It has three important facets: Stability, internal reliability and inter-observer consistency. Stability investigates whether the results with high correlations can be obtained when executing a research twice for the same sample, where the second time takes place after a certain time period. However, Bryman and Bell also report that stability cannot be given for each research, since learning effects and changes in society between the two studies can occur. Both topics might also affect this particular study. In terms of learning effects, however, the extent and complexity of the survey deployed was deemed as beneficial, since it would complicate memorizing all the attributes and levels and, more specifically, which of the sometimes quite similar profiles was chosen in the previous time. However, especially the unfamiliarity with car subscription services as an option might decrease in the next years.
Internal reliability deals with multiple-item scales that are conglomerated to obtain relevant information and is given if these scales show coherence. Given that this study does not involve any multiple-item scale, this issue is not a concern.
Inter-observer consistency regards the issue that subjective judgements can be present in both data collection as well as analysis if more than one observer is working on these tasks. The data of this research was collected via an online survey and not in an interview setting, which reduces the observer subjectivity for the data collection to a minimum. The researchers' largest concern for inter-observer consistency regarded the data analysis. In order to tackle it, however, they decided to work on the data analysis jointly to choose data categories where necessary. Overall, the researchers aimed with this to reduce the inter-observer consistency to a minimum.

Replication, on the other hand, concerns whether or not a study can be replicated by other researchers. In order to allow for replication, the original study needs to explain in detail how the study was designed and executed. (Bryman & Bell, 2011, p. 165)
With this extensive methodology section and the content in the appendix, the researchers aimed at delivering as precise and complete descriptions of their procedures. Therefore, this study should be as replicable as possible. However, one needs to bear in mind that the exact sample can only hardly be replicated and learning effects will bias the results.

Last, validity shall be addressed. A number of different validity types exist, and this research will cover measurement, internal and external validity.

Measurement validity looks into "whether or not a measure that is devised of a concept really does reflect the concept that it is supposed to be denoting", while internal validity measures to what extent the research can allow to conclude that the independent variable has an impact on the dependent variable, i.e. the ability to draw a causal relationship (Bryman & Bell, 2011, p. 42). Translated into this research this means to what extent the different service attribute levels represent the respective services behind and whether they (independent variables) have an impact on the customer's choice and WTP (dependent variables) and how sure one can be about this causal relationship. In the past chapters and in the literature review section, the researchers have outlined already that the DCA as a data collection method has been heavily utilized and tested before. Thus, one can assume that the method can provide high validity. Regarding the measurement validity, the newness of the research did not allow to utilize or compare to attribute levels from past research, which would provide construct or convergent validity. Nevertheless, the conducted pretest suggest that the attribute levels were able to measure the respective services and thus provide some degree of face validity.

When it comes to applying these results to settings or people outside the very study, external validity must be given. External validity measures to what extent the findings can be generalized (Bryman & Bell, 2011, p. 43). To do so, a study of this kind first of all needs to control for other variables that could influence the customers' choice and willingness to pay. These were found to be e.g. demographic variables, income or number of cars owned and more on this can be read in Chapter 3.4.2 above. However, external validity does not only depend on the method and the survey design. Sampling and distribution are significant factors for this as well, since they influence the extent sample findings can be generalized to the population. Relating back to the presented sampling and distribution approach (Chapter 3.5), the researchers were aware that sampling and distribution would indeed represent the largest barrier to high external validity. Eventually, they therefore expected a relatively low external validity that would not guarantee high generalizability. Still, the researchers tried their best at reaching respondents from the specific sample.

Overall, with the actions described above, the researchers believe to have taken active measures that set the space for high reliability, replication, as well as measurement and internal validity. Due to highly limited resources and means, however, the researchers expected the external validity to be low for this relatively narrow population. Thus, although the research aimed to generate generalizable results, this could not be achieved within academic standards.

4. Characteristics of the Sample

The following section shall shortly present the characteristics of the sample. This shall help the reader to set the context for the interpretation of the obtained results. At the same time, it will allow to assess the generalization of the findings towards the population.

Prior to showing the results of the data analysis and starting the interpretations, it is necessary to provide a short overview of the characteristics of the obtained sample. Taking the above outlined limitations regarding the sampling and survey distribution into account, it will allow to judge to what extent the data collection has allowed to obtain a sample that can represent the previously defined population.
Thus, the next section will provide an overview of the sample characteristics.

By the end of the data collection the researchers were able to use 176 out of 206 obtained answers. Due to non-completion of the full survey, intentionally misfiled answers and the requirement that both blocks of the experiment needed to have the same number of answers, 30 answers were not included.

The remaining fully and correctly answered surveys were obtained from a sample that shows the following characteristics:

Characteristics	Number of respondents N	Relative share in %
Sample size	176	100 %
Gender		
Male	131	74 %
Female	45	26 %
Age in years		
20-24	32	18.18 %
25-29	73	41.48 %
30-34	24	13.64 %
35-39	8	4.55 %
40-44	6	3.41 %
45-49	17	9.66 %
50-54	5	2.84 %
55-59	6	3.41 %
60-64	5	2.84 %
Mean	32.35 years	
Men		32.96 years
Women		30.64 years

Country			
Germany		114	64.77 %
Sweden		28	15.91 %
Italy		12	6.82 %
Austria		10	5.68 %
Norway		2	1.14 %
Switzerland		2	1.14 %
Others		8	4.55 %
Gross Income in €			
< 25 000 €		55	31.25 %
25 000 € to 37 499 €		32	18.18%
37 500 € to 49 999 €		33	18.75%
50 000 € to 62 499 €		24	13.64%
62 500 € to 74 999 €		8	4.55%
75 000 € to 87 499 €		10	5.68%
> 87 500 €		14	7.95%
Median	*37 500 € to 49 999 €*		
Men			37 500 € to 49 999 €
Women			25 000 € to 37 499 €
City size			
< 49 999		55	31.25%
50 000 to 99 999		13	7.39%
100 000 to 199 999		18	10.23%
200 000 to 499 999		23	13.07%
500 000 to 1 000 000		25	14.20%
> 1 000 000		42	23.86%
Median	*100 000 to 199 999*		

Table 3: Characteristics of the sample

As expected and outlined in the methodology section, the researchers were not able to target the distribution of the survey solely towards members of the predefined population. Although, for all relevant characteristics, except for the gross income, the majority of the respondents fulfilled each predefined characteristic (male, living in Germany, between 25-45 years old and gross income over 37 500 €), this is only true if one takes every characteristic individually. The actual number of respondents that fulfill all of the characteristics simultaneously and can therefore represent the population is 34 and thus only about 19% of the full sample. This might not be enough to guarantee scientifically significant results that can be generalized for the population.

Looking at the income distribution within the target group sample the median was at an income of 62 500 and 74 999 €. Almost 60% of the target group sample lived within a city that had at least 200 000 inhabitants and another 18% lived less than 20 km away from such a city. Thus, the target group sample can be described as highly urban.

As the target group sample only contains 34 respondents, the data analysis was not only conducted on those respondents that match the originally defined population but also on the full sample.

5. Results

The following section shall shortly present the results of the data analysis. It shall allow the reader to receive an overview of the obtained results and their significance. It is also included to build the foundation of the following analysis and allow to judge on the goodness of the utilized statistical models.

Prior to presenting the actual results of the discrete choice experiment, further insights about the sample were obtained. In order for Care by Volvo to learn more about the target group of this service and to compare the sample to previously conducted market research, the researchers included a number of behavioral questions. The results shall be presented in the next two chapters.

5.1 Behavioral Results

The following two subsections will briefly highlight the most interesting findings from the respondent's car related behavior and subscription behavior.

5.1.1 Car-related Behavior

All respondents were required to state whether they own a car, what type of car this is and how many cars their household owns. The results can be seen in the Figure 10 below.

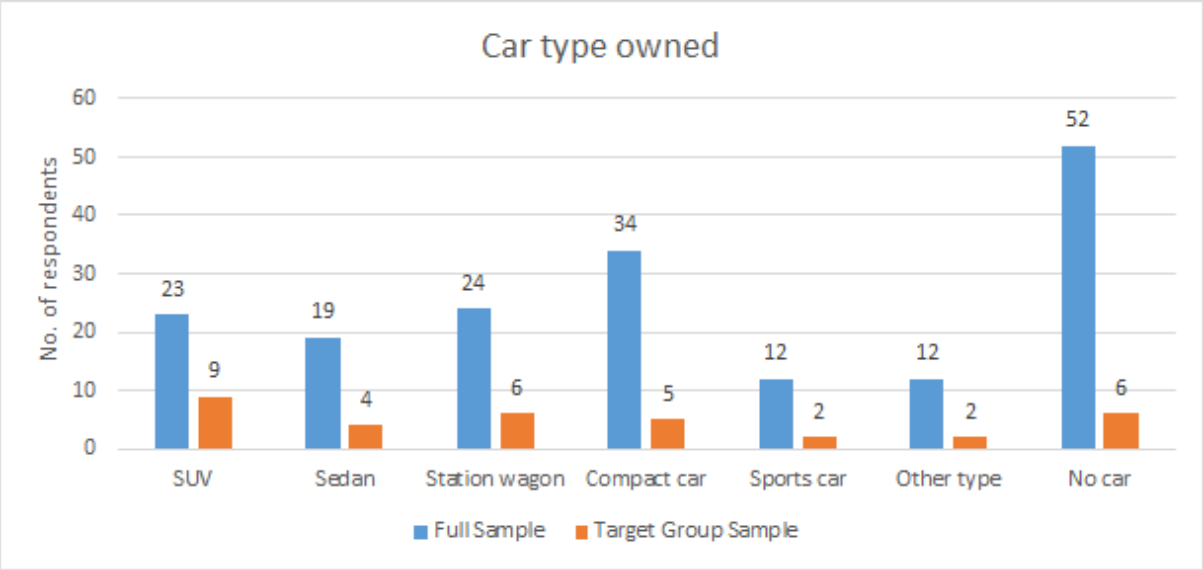
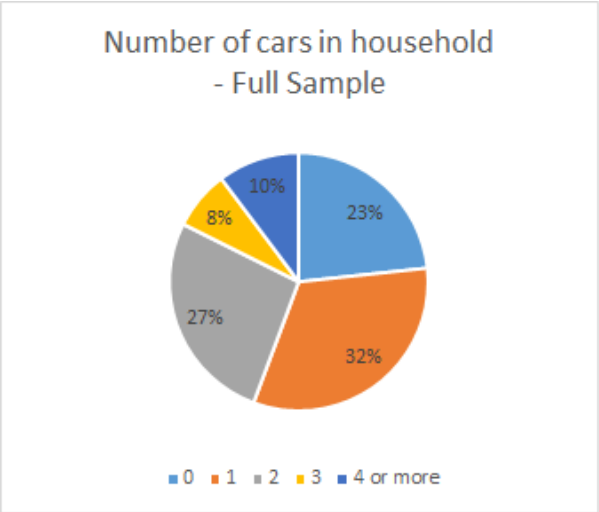


Figure 10: Own illustration on car ownership in the sample

Whereas almost 30% of the respondents of the full sample stated that they currently own no car, the most frequent car types owned were compact cars, followed by station wagons and SUVs. Within the target group the share of respondents without a car was significantly lower with 18% and the most frequent car type was an SUV.



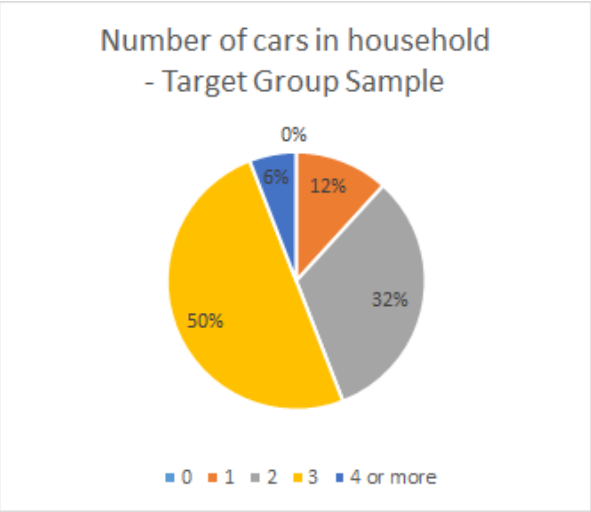


Figure 11 & Figure 12: Own illustrations on number of cars in household in the sample

On the household level the share of non-car owners is lower with about 23%, resulting in 1.49 cars per household in the obtained sample. These numbers are almost exactly in line with current data from the German Environment Agency (Umweltbundesamt, 2019) that state that 78.4 % of the households in Germany have at least one car. For the target group the share of non-car owners is at 6% and the average number of cars per household is significantly higher with 2.5 cars.

Additionally, all respondents were asked to estimate the distance they drove with their car in the previous year. As Figure 13 shows below, from all respondents who owned a car, most respondents drove between 10 000 km and 30 000 km. In fact, the average distance over the full sample is 15 165 km per year.

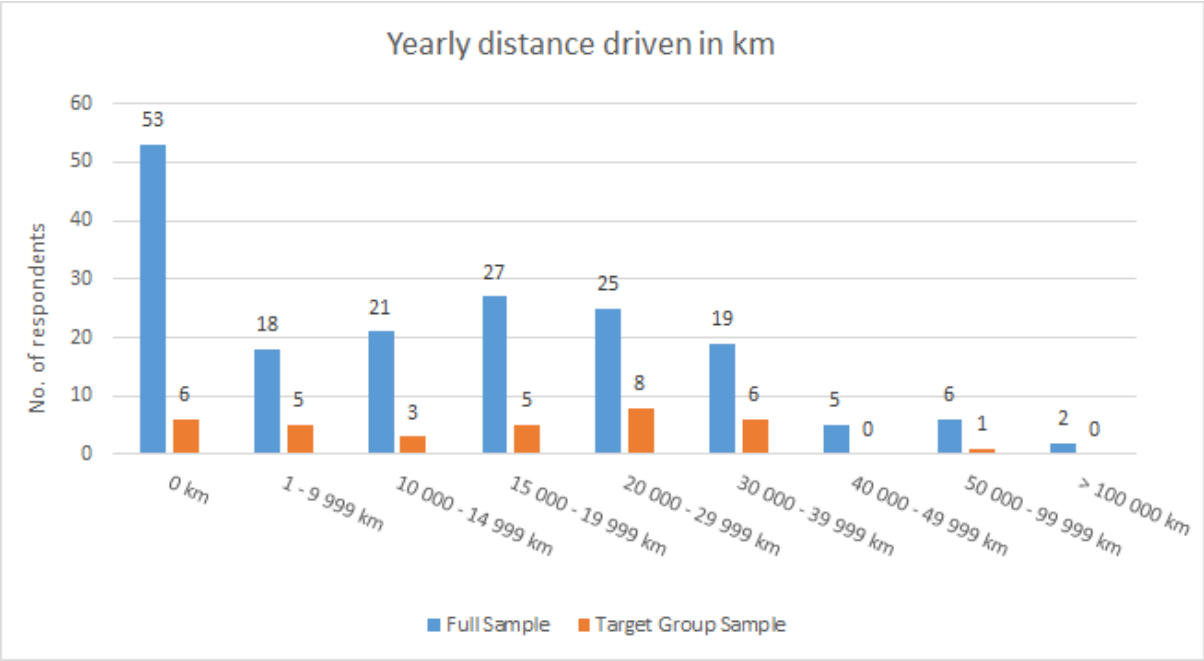


Figure 13: Own illustration on distance driven per year in km

Naturally, as Care by Volvos used car subscription is a new form of owning and financing a vehicle, it was of great interest to collect information about the financing options that were used for the respondent's last car. The results from within the full sample show that 75% of the respondents who own a car used a traditional purchase for their last car. For the target group this number is comparably lower with 56%. Other forms of financing were only used by a small share of the respondents, although 18% of the respondents from the target group used a private lease. One respondent stated that he had used a car subscription.

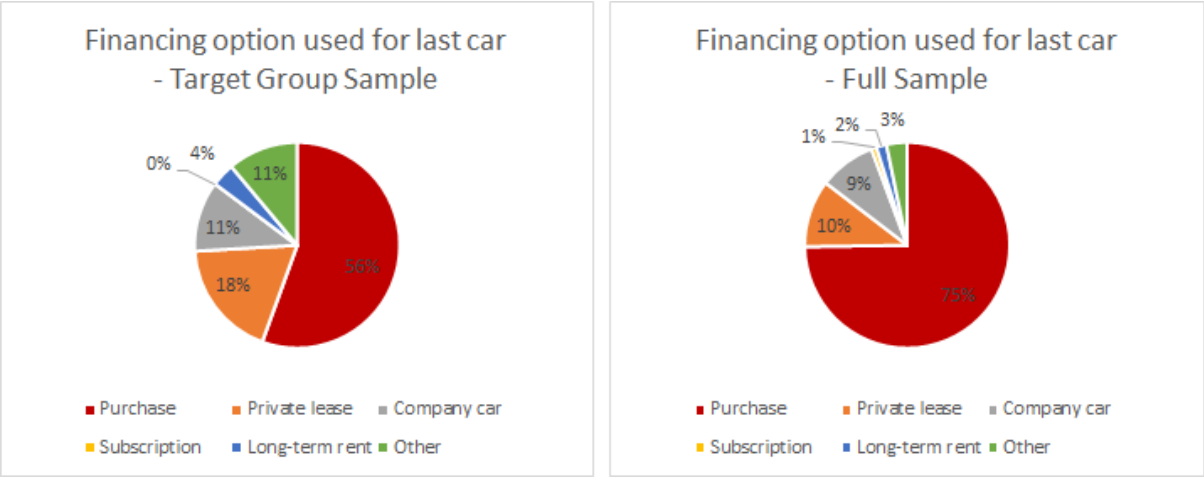


Figure 14 & Figure 15: Own illustrations on financing option used for last car

5.1.2 Subscription Behavior

Similar to the car-related questions, the researchers also asked the respondents about their current use of subscriptions. The results show that the majority of the respondents spend between 5€ and 19.99€ on subscriptions per month. These findings were similar for both genders and samples; however, men seem to spend a little more on average. One possible explanation for this could be the higher median gross income of men in the sample, but such further interpretations have to be made with caution.

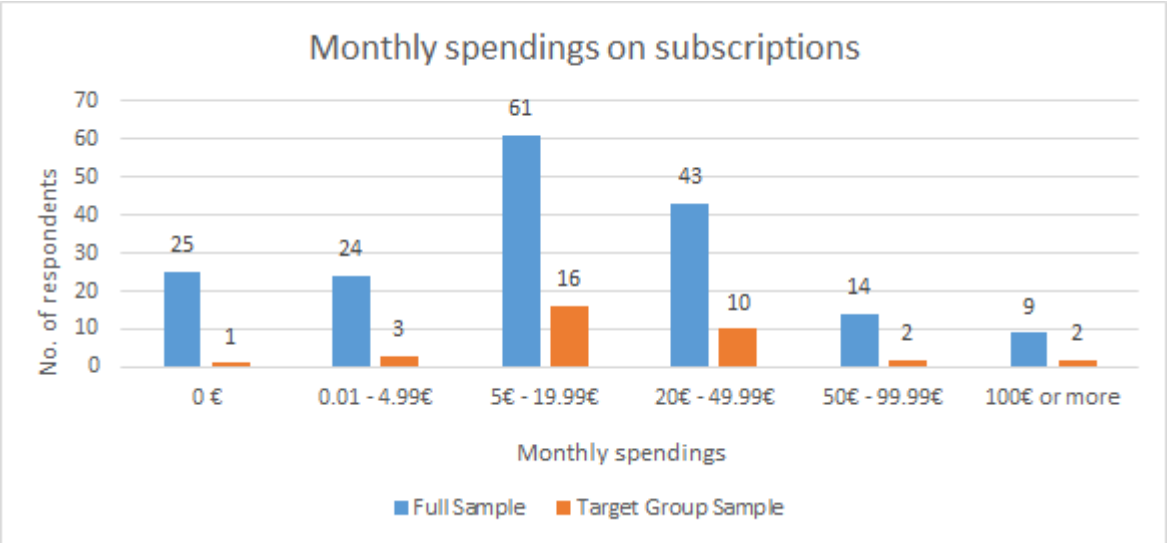


Figure 16: Own illustration of the monthly expenses on subscriptions within the sample

In more detail this spending is mostly connected to entertainment and streaming services such as Netflix, Spotify, Sky or similar offers. In the obtained full sample 78% of the respondents stated that they used such a subscription service and the target group showed a share of even 85%. Following are subscription services for magazines and newspapers and study and learning platforms.

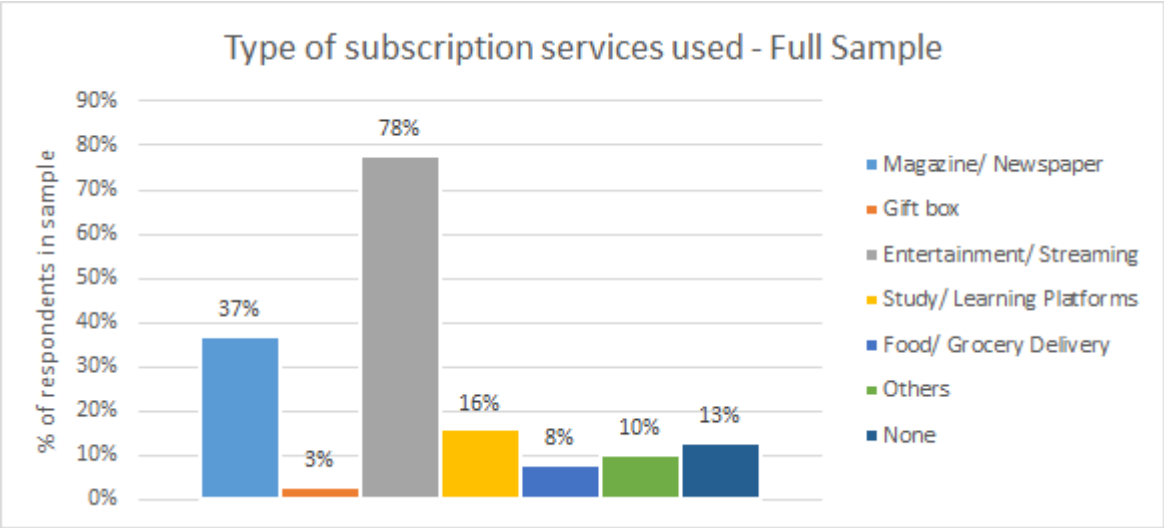


Figure 17: Own illustration of the monthly expenses on subscriptions within the sample

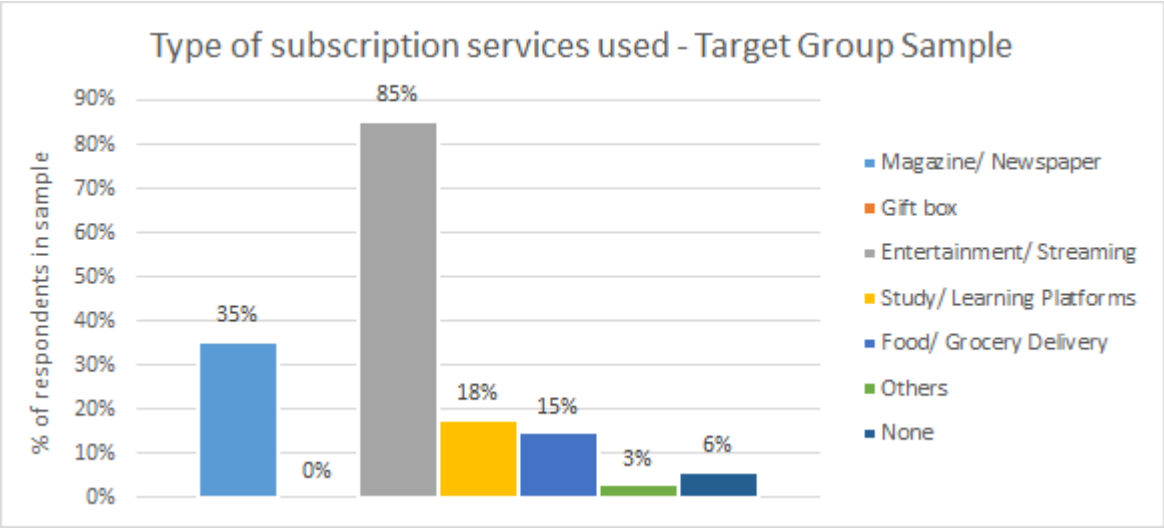


Figure 18: Own illustration of the monthly expenses on subscriptions within the sample

In order to find out more about the motivations why the respondents use a subscription service, the researchers asked to distribute 100 points between five preselected statements that were previously found to represent the most important motivations. The results show that especially the protection from unexpected extra costs in case of repairs, the ability to flexibly adjust their spending and the guarantee of a functional product/ service were the most important reasons for using a subscription service.

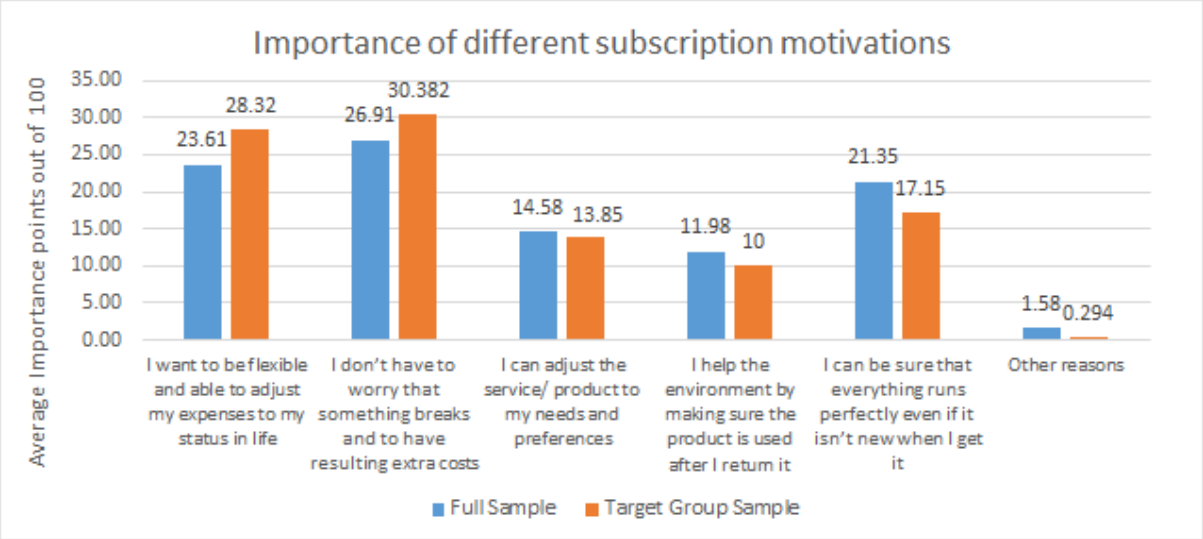


Figure 19: Own illustration on the motivations behind using subscriptions within the sample

5.2 Empirical Results

Following the methodology outlined in the data analysis part (Chapter 3.5) the researchers conducted an estimation of the conditional logit model over the full sample. The results can be seen in the Figure below, derived from Stata/ SE15.1. The commonly conducted Hausman Test, that assures that the independence of irrelevant alternatives (IIA) assumption holds true, was not conducted. Existing research states that the underlying assumption that a change in the attributes of one alternative proportionately draws from all other alternatives is usually violated at choice experiments with very heterogeneous alternatives (Petrin & Train, 2003). As the designed choice experiment includes three unlabeled alternatives of exactly the same type the test was deemed to be irrelevant. Overall, the full data set, a documentation of the analysis process within Stata and a correlation matrix of all attribute levels can be accessed upon request.

5.2.1 Full Sample

As each of the 176 respondents did nine choices with three alternatives each, the number of observations was 4 752. The McFadden pseudo R2, which measures the fit of the model by dividing the log likelihood of the fitted model, which is treated as the sum of squared errors and the log likelihood of the null model, treated as the total sum of errors, resulted in a value of 0.3488. As Louviere et al. (2000) state that any pseudo R2 between 0.2 and 0.4 is an excellent model, the calculated conditional logit model for the full sample seems to offer a good fit.

Conditional (fixed-effects) logit regression			**Full Sample**
		No. of obs.	4 752
Log pseudolikelihood	-1133.2044	Pseudo R2	0.3488

Choice	Coef.	Rob. Std. Err.	z	P>|z|	[95% Conf.	Interval]
Repair & Maintenance						
Any repair shop	1.683897	0.124	13.54	0	1.44	1.928
Volvo shop	1.731916	0.105	16.48	0	1.526	1.938
Not included	0	.	.	.	.	.
Tyres						
Winter & Summer tyres (...)	1.475261	0.117	12.59	0	1.246	1.705
All-weather tyres (...)	0.607234	0.124	4.91	0	0.365	0.850
Not included	0	.	.	.	.	.
Car Pick-up & Delivery						
Subscription start & repair shop visits	0.494156	0.167	2.96	0.003	0.167	0.821
Repair shop visits	0.488876	0.181	2.7	0.007	0.134	0.844
Not included	0	.	.	.	.	.
Insurance						
No deductible	0.522958	0.105	5	0	0.318	0.728
500€ deductible	0.124896	0.113	1.1	0.27	-0.097	0.347
1000 € deductible	0	.	.	.	.	.
Replacement car						
Similar car category	0.616135	0.201	3.06	0.002	0.221	1.011
Lower car category	0.217654	0.116	1.87	0.061	-0.01	0.446
Not included	0	.	.	.	.	.
Car Condition						
Spotless	0.313198	0.137	2.29	0.022	0.045	0.581
Minor scratches	0.287794	0.107	2.68	0.007	0.078	0.498
Minor scratches & signs of usage	0	.	.	.	.	.
Price						
Price per month	-0.007043	0.0004896	-14.38	0	-0.008	-0.006
Interactions						
Price * Men	0.003787	0.001	3.46	0.001	0.002	0.006
Replacement car sim. car categ. * Men	-0.615096	0.215	-2.85	0.004	-1.037	-0.193

Table 4: Own illustration of the results from the conditional logit of the Full Sample

Of the obtained results for the full sample all coefficients except for the *"Insurance included with 500 € deductible"* level and the "*Replacement car from lower car category"* level (10% significant) are significant on a 5 % significance level.

5.2.2 Target Group Sample

Referring to the aim of this thesis, which is to analyze the preferences and WTP of a specific target group for Volvos new subscription offer, an analysis on a sample that only contains respondents from this target group is of even greater interest than those of the full sample.
Consequently, the researchers created a sub-sample including 34 respondents that match the previously defined criteria of the target group (Male, living in Germany, between 25 and 45 years old and with a yearly gross income above 37 500 €).

The results of the conditional logit model can be found in Table 5 below. Naturally, the results for such a small sample are less significant compared to the full sample.

Conditional (fixed-effects) logit regression					**Target Group Sample**	
					No. of obs.	918
Log pseudolikelihood	-198.06176				Pseudo R2	0.411
Choice	Coef.	Rob. Std. Err.	z	P>|z|	[95% Conf.	Interval]
Repair & Maintenance						
Any repair shop	1.89338	0.3150794	6.01	0	1.275836	2.510924
Volvo shop	2.14006	0.29695	7.21	0	1.558047	2.72207
Not included	0	.	.	.	.	.
Tyres						
Winter & Summer tyres (...)	1.98307	0.3291116	6.03	0	1.338023	2.628117
All-weather tyres (...)	0.87462	0.315988	2.77	0.006	0.2552978	1.493948
Not included	0	.	.	.	.	.
Car Pick-up & Delivery						
Subscription start & Repair shop visits	0.593956	0.4529186	1.31	0.190	-0.293748	1.48166
Repair shop visits	0.703832	0.5181699	1.36	0.174	-0.311762	1.719427
Not included	0	.	.	.	.	.
Insurance						
No deductible	0.568326	0.254029	2.24	0.025	0.0704385	1.066214
500€ deductible	0.588547	0.2605551	2.26	0.024	0.0778688	1.099226
1000 € deductible	0	.	.	.	.	.
Replacement car						
Similar car category	0.335157	0.3530712	0.95	0.342	-0.35685	1.027163
Lower car category	0.416967	0.3120016	1.34	0.181	-0.194545	1.028479
Not included	0	.	.	.	.	.
Car Condition						
Spotless	0.574090	0.3136941	1.83	0.067	-0.0407388	1.188919
Minor scratches	0.329398	0.298802	1.1	0.270	-0.2562431	0.9150391
Minor scratches & signs of usage	0	.	.	.	.	.
Price						
Price per month	-0.0058085	0.0012526	-4.64	0	-0.0082634	-0.003353

Table 5: Own illustration of the results from the conditional logit of the Target Group Sample

The utilized conditional logit model does not show significant coefficients for both attribute levels for the *"Car Pick-up & Delivery"* and *"Replacement car"* attributes. Similarly, the

attribute level *"Car Condition - minor scratches & signs of usage"* is not significant and the attribute level *"Car Condition - spotless"* is only significant on a 10% basis. As a result, the coefficients for these attributes and levels do not allow reliable conclusions and the respective observations can only be indications that need to be used with caution.

6. Analysis and Discussion

The following Analysis and Discussion chapter will interpret the previously shown results and relate them to the research goals of the study. Additional calculations based on the results will be presented and discussed in order to answer the research questions.

In order to answer the proposed research questions, the obtained results will be first analyzed and interpreted regarding the customers preferences. Referring to the underlying theory this will be done with the help of part-worth utilities. In a next step the attribute importance will be calculated and at last the WTP can be estimated and interpreted.

6.1 Part-Worth Utilities of the Full Sample

Although the interpretation of the coefficients follows the random utility model outlined in the methodology part, one example will be outlined below.

In general, each of the coefficients expresses the part-worth utility of the respective attribute level (Breidert et al., 2006). However, for each attribute only two levels can be included in the model at once as the third one would be perfectly collinear with the other two. This means that the third attribute level can be perfectly predicted with a linear combination of the other two. As a result, one level of each attribute must be set as the base level (Hensher et al., 2015, p. 64). As the selection of this base level has major influence on the later described interpretation, the selection has to be done with caution. For this research the base level was always defined as the level with the lowest expected value for the respondents. In all cases except for the "*Car condition"* and "*Insurance"* attribute this was the "*not included"* level. Another exception is the price attribute, the reason will be explained in a following chapter. As an example, this means for the attribute "*Repair & Maintenance"* that the base level was "*not included"* and the above presented coefficients for the levels "*Repair & Maintenance at any repair shop"* and "*Repair & Maintenance at a Volvo shop"* represent part-worth utilities of the respondents in comparison to the base level. Meaning that the respondents' utility for a subscription offer that includes Repair and Maintenance at a Volvo shop is 1.7319 higher than for a service where no repair and maintenance is included (given that all other attribute levels remain unchanged).
As this example shows, the interpretation of the obtained coefficients has to be done with caution. One has to always bear in mind that the coefficients and consequently also the part-worth utilities are relative to the respective base level (Hensher et al., p. 64). Especially when the base level differs between the attributes or is not *"not included"* the derived meaning can be misleading. Additionally, the coefficients are related with each other and can thus only be interpreted when the respondents had to base their choice on the previously defined set of attribute levels.

However, when bearing these conditions in mind, a closer look at the coefficients for the different attribute levels can offer valuable insights about the consumer preferences. In a first step this will be done for the above presented findings for the full sample.

6.1.1 Full Sample Part-Worth Utility Insights

Starting with the first attribute *"Repair & Maintenance"*, both levels show the highest coefficients above all attribute levels. *"Repair & Maintenance at any repair shop"* has a calculated part-worth utility value of 1.684 and *"Repair & Maintenance at a Volvo shop"* a part-worth utility value of 1.732. Thus, both levels offer a high utility to the respondents if the alternative is to have no Repair and Maintenance included. Thus, both options are of great preference for the respondents. The fact that the part-worth utility for *"Repair & Maintenance at a Volvo shop"* is slightly higher than for the *"Repair & Maintenance at any repair shop"* is against the initial expectations of the researchers. One possible explanation could be that respondents were not sure if they could choose the repair shop themselves in case of a broken part and thus preferred the trustworthy Volvo brand shop. However, further research would be necessary to underline this explanation.

For the second attribute "*Tyres"* the difference between the coefficients for the two levels *"Tyres - Summer & winter + mounting & storage"* and *"Tyres - All weather tyres + mounting"* is more significant. Whereas, including summer and winter tyres offers a part-worth utility of 1.475, all-weather tyres only increase the respondents' utility by 0.607 compared to the option to not include any tyres into the subscription offer. Thus, it seems like the respondents clearly prefer to have summer and winter tyres rather than only all-weather tyres or no tyres included at all.

The attribute *"Car pick-up & delivery"* describes the different options concerning the delivery of the vehicle to the customer at subscriptions start and the pick-up and delivery before and after possible repair shop visits. The coefficients for *"Car pick-up & delivery service - For subscription start and repair shop visits"* and *"Car pick-up & delivery service - For repair shop visits"* show that the part-worth utility for both are very similar at 0.494 and 0.4889. Thus, including either one of these options increases the value of the offer significantly compared to a non-inclusion. However, the difference between both coefficients in this sample is insignificantly small and makes any interpretation whether one of the options is more preferred impossible.

For the *"Insurance"* attribute it has to first be mentioned that the base-level was *"Insurance included with 1000€ deductible"* and not a non-inclusion of any insurance. Thus, the coefficients are relative to this base-level option and an interpretation has to bear that in mind. The part-worth utility for *"Insurance included with no deductible"* is 0.523 and higher than the part-worth utility for *""Insurance included with 500 € deductible"* with a value of 0.125. However, it has to be noted that the coefficient for the second level is not significant for the full sample. Nevertheless, including an insurance with no deductible is the most preferred option, followed by an insurance with a deductible of 500 € and 1000 € respectively.

When choosing between the different options for the *"Replacement car"*, the part-worth utilities are 0.616 and 0.221 for the two estimated levels. Offering a *"Replacement car from a similar car category"* shows a higher utility than offering a *"Replacement car from a lower*

car category". Thus, including a replacement car into the offer in general results in a higher utility value for the respondent, compared to a non-inclusion. When interpreting the utilities, it has to be noted that the difference in utility is closely related to the gender of the respondents. More explanations on this can be found in the next chapter.

Although, the coefficients for the attribute levels connected to *"Car condition"* are both significant and slightly higher than the former two, the difference between the part-worth utilities of 0.313 and 0.288, however is insignificantly small. Preferences between *"Car condition - spotless"* and *"Car condition - minor scratches"* are thus hard to predict. However, both levels are significantly higher than the base level that would offer a car with minor scratches and signs of usage.

The coefficient for the *"Price per month"* attribute must be interpreted differently as it was not coded as a dummy variable. The result is that the coefficient of -0.0099234 is the change of utility connected to any raise of the price of 1 € between 400 € and 600 €. Thus, the attribute level connected to a price of 600 € results in a negative utility (or disutility) of 1.98468. In other words, a price of 600 € is lowering the respondents' utility by 1.98468 compared to the base price of 400 €. Consequently, for the middle level of 500 € the part-worth utility is calculated to -0.99234. Overall, the negative sign for the price attribute is not surprising as a higher price is generally considered less preferred. One limitation of such interpretation of the price attribute is that the model assumes that the price follows a linear function. However, if coded as a dummy variable the coefficients for this sample show that the difference in utilities increases between the 500 € and 600 € level more than between the 400 € and 500 € level. This might prompt to the assumption that the negative utility effect of a 1 € price raise (again only between 400 € and 600 €) increases with the absolute price. While this could indicate a nonlinear relationship, no definitive proof could be found. Additionally, the gender has a significant effect on the price and therefore on the coefficients and utility values. More details on this will be discussed after presenting Figure 20 below, which sums up the part-worth utilities for the full sample in a visual manner and highlights the insignificant relative values in red.

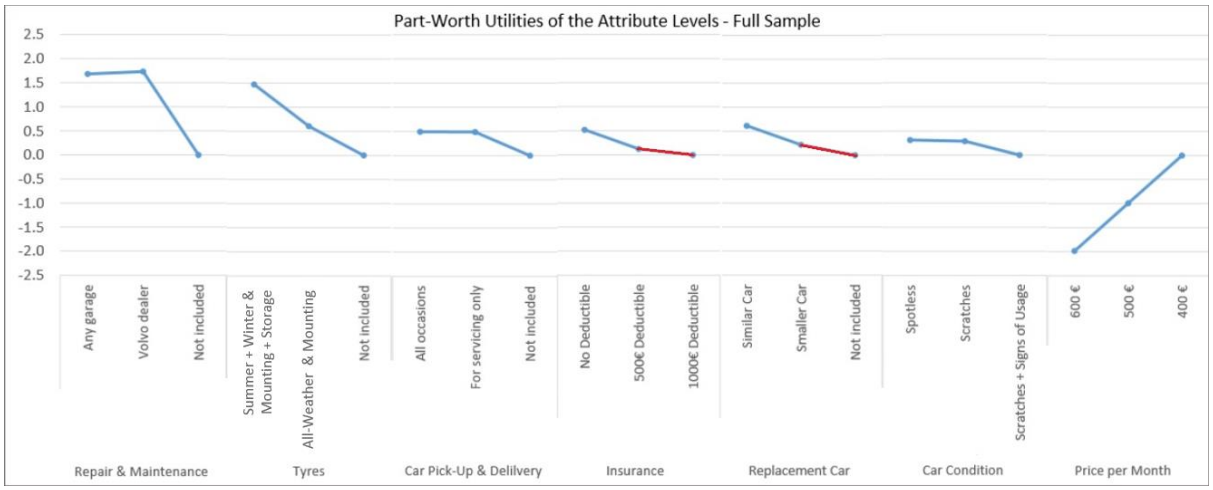


Figure 20: Own illustration, Part-Worth Utilities of the Attribute Levels for the Full Sample

6.1.2 Socio-Demographic Related Utility Insights

A number of interesting insights can be obtained when analyzing the influence of socio-demographic factors like the gender, age or income on the preference and utilities of the attribute levels. In order to estimate such influences, the researchers chose to create interaction terms for gender, age and income and the attribute levels from the choice experiment. This approach was proposed by earlier research and is preferable in comparison to other alternative approaches for unlabeled choice experiments (Hensher et al., 2015, p. 479). A table with all results for the interaction terms can be found in Appendix 3. Note that each interaction term was created exclusively between one socio-demographic factor and one attribute level and not between two attribute levels.

6.1.2.1 Price Utility

The first interaction tested was between income and price, as this was expected to be relevant. The income was stated in six different categories; thus, the interaction terms were created between each of the categories and price. Despite the initial expectations the results were insignificant for all income categories. It seems like income has no significant influence on the price utility in the sample. In other words, preferences and thus the choice probability for a configuration with a certain price would not change significantly, if the income of the respondent changes, given that all else remains unchanged.

A second assumption was the existence of an influence of age on the price sensitivity. However, the created interaction term was also insignificant. Thus, no influence of age on the utility of different prices can be proven.

The third tested interaction between gender and price lead to significant results. The interaction term was set up so that any influence of the male gender on price was tested. This allows vice versa deductions on the female gender. When estimated in combination with all significant interaction terms the coefficient shows a value of 0.0037872. The value implies that a raise of the price by 1 € would lower the utility for men by 0.0037872 less than it would be the case for the rest of the sample all else remaining unchanged. Thus, it seems like in the obtained sample men are less price sensitive than women. The resulting differences in the willingness to pay will be shown in Chapter 6.4.
The intuitive argument that the reason for this could be found in the lower average income of women in the sample has to be rejected as the income was earlier found to have no significant effect. Further research would be needed to explore the underlying reasons.

6.1.2.2 Other Attribute Related Utility Insights

Out of all attribute levels none showed any significant interaction with age. The only significant interaction detected was between the attribute level *"Replacement Car included from a similar car category"* and gender. With a coefficient of -0.6150961 the utility for a replacement car from a similar car category, that is included instead of no replacement car at all, is 0.6150961 lower for men than for the remaining respondents in the sample (all women). Thus, it seems that the preference for such a replacement car for men in the full sample

is significantly smaller than for women. However, such insight cannot be found for the second *"Replacement Car"* level. It therefore seems that this preference difference is not due to different preferences for a replacement car in general. As this is somehow counterintuitive any interpretation should therefore be used with caution.

6.2 Part-Worth Utilities Target Group Sample

When analyzing the results from the target group sample a few interesting insights can be obtained.

Compared to the full sample the coefficients for the two *"Repair & Maintenance"* levels show a higher magnitude compared to a non-inclusion of any repair and maintenance. Thus, the respondents in the target group obtain an even higher utility from a repair and maintenance service. The earlier observation that the *"Repair & Maintenance at a Volvo shop"* option is preferred over the *"Repair & Maintenance at any repair shop"* was made again.

Similarly, for the *"Tyres"* attribute the magnitude of the coefficients grew compared to the full sample and the preference order between the two levels remained strongly in favor for the *"Tyres - Summer & winter + mounting & storage"*. Thus, offering summer and winter tyres increases the offer utility for the target group significantly.

As stated earlier, the coefficients for *"Car Pick-up & Delivery"* were not significant and therefore the counterintuitive preference of the second level over the first might not be representative. Nevertheless, it seems like offering a pick-up and delivery service could result in an increased utility for the target group.

Another surprising finding is connected to the preference among the levels for the *"Insurance"* attribute. Although both levels show significant coefficients, the *"Insurance with a 500€ deductible"* was slightly preferred over the option without any deductible. The researchers could find no meaningful explanation for such preferences and as the difference is insignificantly small, any conclusions from this should be made with caution. Nevertheless, both options are offering a higher utility to the respondents of the target group than including an insurance with a 1000€ deductible.

For the *"Replacement car"* attribute unfortunately both coefficients were again not significant and as the preferences among the attribute levels are also counterintuitive, the researchers do not see any reliable findings for this attribute. Especially when taking the findings regarding the interaction between the *"Replacement car from a similar car category"* and the male gender into account, the value of this service for a male respondent does not show clear results in the obtained sample.

Although the coefficients for both attribute levels for *"Car condition"* were not found to be significant on a 5 % level, the *"Car condition - spotless"* can be interpreted with caution as it is significant on a 10 % level. Compared to the full sample the magnitude has increased, suggesting that the target group derives more utility from this option compared to a *"Car condition with minor scratches and signs of usage"* than the full sample.

Lastly, the coefficient for the price attribute has increased significantly compared to the full sample. For a 1 € increase of the price the utility decreases by 0.0058085 for the target group, whereas for the full sample it decreases by 0.0099234. This might seem minor on first sight but calculated for a difference in utility between a 400 € price and 600 € price the difference is

quite important. The target group's utility decreases for a 600 € price by 1.1617 (compared to the 400 € price) and for the full sample by 1.98468. Consequently, the target group is found to be less price sensitive within the price range of 400 to 600 € than the full sample. Looking back at earlier presented findings, the main reason might be that the target group only consists of men, that were found to be less price sensitive in the full sample model.
Figure 21 underneath serves as a visual summary of the part-worth utilities found for the target group.

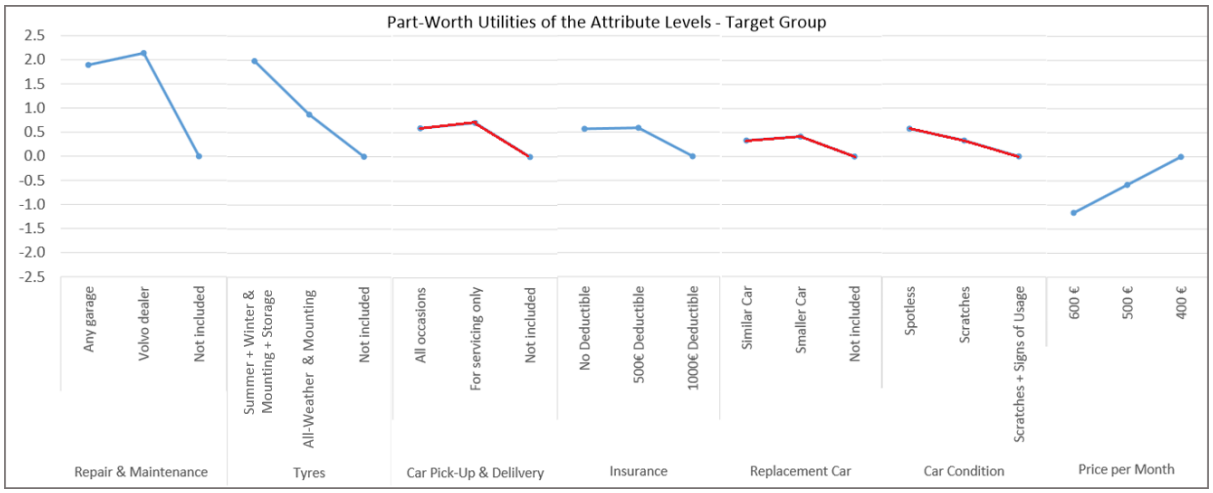


Figure 21: Own illustration, Part-Worth Utilities of the Attribute Levels for the Target Group

6.3 Attribute Importance

Not only can the part-worth utilities for the levels be analyzed, but also the importance of the attributes. This chapter will in fact include two analyses with the first one presenting the findings from the discrete choice analysis and the second one presenting the findings of another survey question that directly asked for the importance of attributes but for a subscription for four years old XC40 with 100 000 km instead.

As described by Orme (2010, p. 79ff), the utility range of the attribute levels can be used to calculate the relative importance of each attribute. The larger this range, the larger the importance for the overall utility of an offering.

Table 6 below concerns the full sample, where the researchers distinguish between men and women since two significant interaction effects were found that concern gender. The three attributes with the highest importance were highlighted in yellow and note that women and men differ significantly.
For women, *"Price per month"* is presented as the most important attribute with 28%. Its attribute level utility range was calculated by multiplying its utility value (-0.00992) with the range of the price levels, i.e. with 200€, and then taking the absolute value of it. The utility range for all the non-price attributes was instead calculated by deducing the lowest from the largest level part-worth utility. *"Repair & maintenance"* (24%) and *"Tyres"* (21%) follow the price attribute. For the residual attributes, which all show relative importance below 10%, one

can find that *"Replacement car"* (9%) precedes *"Car pick-up & delivery service"* and *"Insurance"*, which both share 7% relative importance, and finally *"Car condition"* with 4%. For men, on the other hand, *"Repair & maintenance"* (29%) results to be the most important attribute, followed by *"Tyres"* (25%) and *"Price per month"* (21%). Since the part-worth utility of price for men changes due to the interaction term, the attribute utility range was calculated by multiplying (-0.00992+0.0037872) with the range of the price levels, i.e. with 200€, and then taking the absolute value of it. What can be seen for the residual attributes is that *"Insurance"* (9%) precedes *"Car pick-up & delivery service"* (8%), *"Car condition"* (5%) and *"Replacement car"* with 4% relative importance. The latter was again calculated considering an interaction term.
For both genders, however, the attribute utility range for *"Insurance"* was calculated with an insignificant value. This implies that the result for its relative importance needs to be considered with caution.

Full Sample	Women		Men	
	Attribute Utility Range	Relative Importance	Attribute Utility Range	Relative Importance
Repair & maintenance	1.732	24%	1.732	29%
Tyres	1.475	21%	1.475	25%
Car pick-up & delivery service	0.494	7%	0.494	8%
Insurance	0.523	7%	0.523	9%
Replacement car	0.616	9%	0.218	4%
Car condition	0.313	4%	0.313	5%
Price per month	1.985	28%	1.227	21%
Sum	**7.138**	**100%**	**5.982**	**100%**

Table 6: Attribute importance for the full sample

These relative importance values change to some extent when the specific target group is investigated instead of the full sample. Note that the target group includes only men, which is why the relative importance below should only be compared to the ones for men from above.
Although the order of the three most important attributes does not change and *"Repair & maintenance"* is yet again the most important attribute with 28%, *"Price per month"* drops to 15% relative importance, which represents a reduction of over 30%. Again, the researchers see a link to the observed and aforementioned lower price sensitivity for men that is even lower for men of the target group. *"Car pick-up & delivery service" and "Insurance"* show minor changes (+-1%) while *"Car condition"* (+3%) and *"Replacement car"* (+2%) gain relative importance and display 8% and 6%, respectively. Note that also for these target group results a number of attribute levels used for the calculation were insignificant. Specifically, this concerns *"Car pick-up & delivery service", "Replacement car"* and *"Car condition"*.

Target Group	Attribute Utility Range	Relative Importance
Repair & maintenance	2.140	28%
Tyres	1.983	26%
Car pick-up & delivery service	0.704	9%
Insurance	0.589	8%
Replacement car	0.417	6%
Car condition	0.574	8%
Price per month	1.162	15%
Sum	**7.568**	**100%**

Table 7: Attribute importance for target group

At this point it is interesting to confront these findings with those from another question in the survey, which aimed at asking directly for the most important attributes but for an older Volvo XC40 instead. More precisely, the respondents were asked to assume that the car was four years old at a mileage of 100 000 km and they should state the two services/ attributes that would be the most important ones to them. Note that this resulted in adjusted circumstances in comparison to the choice experiment where respondents could not choose an attribute directly but needed to make trade-offs by selecting one out of three profiles with predefined combinations of certain attribute levels.

Figure 22 underneath shows the results for the full sample and since they showed only minor differences between the genders, the Figure below shows all genders in conglomerated form. A comparison between men and women can however be found in Appendix 4. While it is striking that *"Repair & maintenance"* is by far the most frequently chosen "most important" attribute, which is coherent with the results for relative importance for men from above, *"Tyres"* appears to have been chosen only by one percent of the respondents as the "most important" one. Similarly, it was chosen only by five percent of the respondents as the "second most important" attribute. *"Price per month"*, on the other hand, is the most frequently chosen "second most important" attribute and the second-most frequently chosen "most important" attribute. Overall, the combination of the two attributes *"Repair & maintenance"* and "*Price per month"* is the most frequent one with about 45% of all respondents choosing those two attributes as their top two important ones. The third most chosen attribute (for both "most important" and "second most important" attribute) is *"Car condition"*.

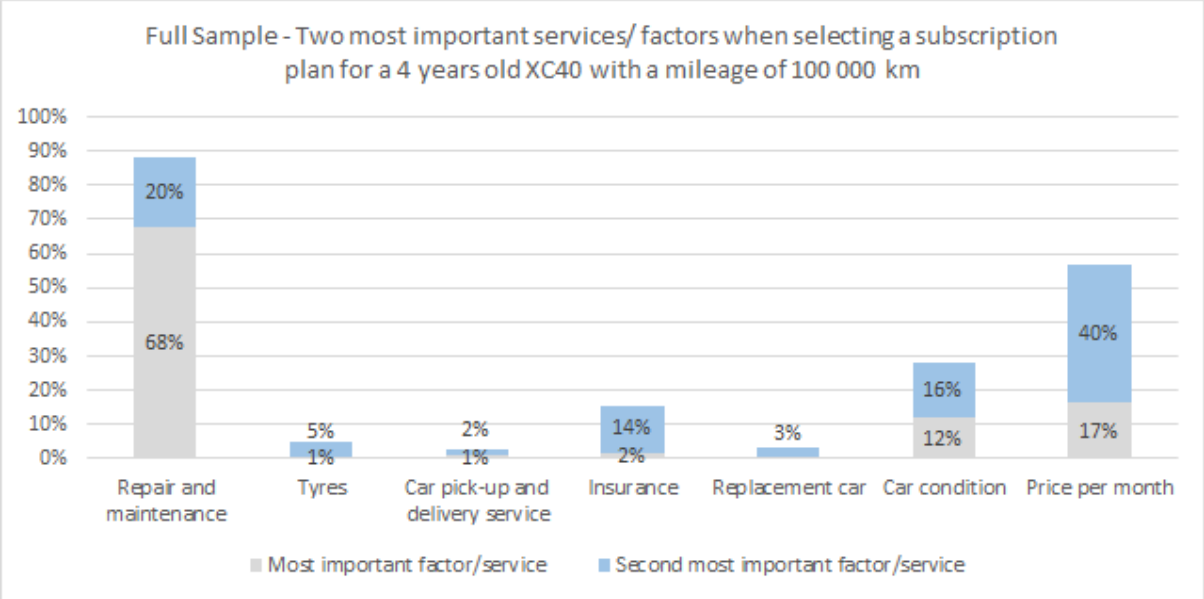


Figure 22: Own illustration on attribute importance for the full sample for a four-year-old XC40 with 100 000 km mileage

Comparing these results for the target group one can see that the magnitudes change, but overall a highly similar picture can be seen. *"Repair and maintenance"* was selected by more than 70% of the respondents as the "most important" attribute. This is followed by *"Price per month"* (26%), and *"Car condition"* (3%). For the "second most important" attribute one can find again *"Price per month"* (26%) at the top, then *"Car condition"* (26%) and *"Insurance"* (12%). Overall, the combination of *"Repair and maintenance"* and *"Price per month"* was again the most frequently chosen (44% of the respondents).

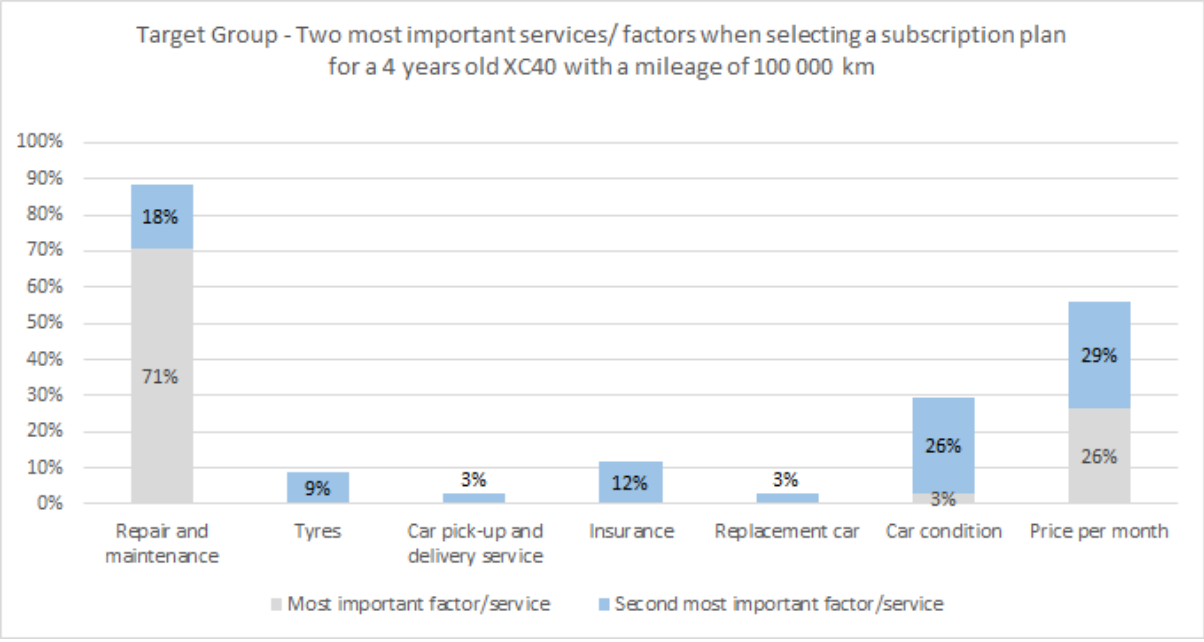


Figure 23: Own illustration on attribute importance for the target group for a four year old XC40 with 100 000 km mileage

6.4 Willingness to Pay

When relating the non-monetary coefficients to the monetary coefficient one can estimate the WTP for the non-monetary attribute levels (Shih & Chou, 2011). It is important to note that the attribute levels were dummy coded for this analysis, which implies that the base level is always assigned zero utility. This does not mean, however, that the base level has no utility for a respondent (Hensher et al., 2015, p. 45). Rather, zero is used a reference point. Another option is to use effect coding, which takes the grand mean of the attribute level utilities as a reference point and thereby allows for a non-zero utility for the base level. Although, as one can see in Appendix 5 and 6, effect coding leads to the same relative WTPs, the magnitudes of each level change dramatically (Hasan-Basri & Karim, 2013). It is thus highly important to consider that the WTP values obtained are always relative to the specific base level and have to be interpreted accordingly. Take, for instance, the WTP of men for a spotless car from Table 8 below. It states a value of 51.04€ for *"Car Condition - Spotless"* - and it means that overall, men are willing to spend 51.04€ more than they are willing to pay for a subscription including a car with minor scratches and signs of usage. An interpretation of the absolute monetary values without comparing to the base level on the other hand is highly questionable.

Since the monetary attribute *"Price per month"* was not dummy-coded but inserted as one variable with its three numeric levels, only one price coefficient exists. As described by Orme (2010, p. 85), the practice of using this coefficient for calculating WTP is popular, however only accepted if the price utilities are in an approximately linear relationship with the price levels. For instance, if a price of 10 € has a utility of -2, a price of 5 € is expected to have a utility of -1. To assure that an approximately linear relationship is present the researchers executed a test where price was inserted as a dummy variable. The results can confirm the existence of such a relationship (see Appendix 7) and thus the researchers made use of this WTP estimation procedure. However, for a definite proof more than three price levels would be required.

In general, the relative WTP values were calculated by dividing the coefficient (i.e. the part-worth utility) of a level by the price attribute (times -1 to correct for the negative sign of *"Price per month"*) (Shih & Chou, 2011). However, as already described above, two exceptions exist for men and they are based on the significant interactions found. The first one regards the price attribute: the interaction between price and men led to a price coefficient for men of (-0.00992+0.0037872=) -0.0061328. This coefficient was used for calculating all relative WTP values for men. The second exemption regards *"Replacement Car - Similar car category"*, where the non-monetary coefficient was amended via incorporating the interaction term *"Similar Replacement Car * Men"* into the WTP calculation.
Another important point that needs to be made is that again a number of insignificant attribute levels were deployed for the calculations. Their p-value is highlighted in red and they concern *"Insurance - 500 € deductible"* and *"Replacement Car - Lower car category"*. Yet again, this means that the results thus need to be taken with caution and can at maximum be seen as indications.

Investigating the results for the relative WTP one can see the different colors used to highlight cells. They are a visualization of the magnitude of the relative WTP value and as can be seen, the relative WTP for both women and men is highest for repair and maintenance. While women would spend about 175 € more for repair and maintenance at a Volvo shop compared to no repair and maintenance included, men are willing to pay around 280 € more. For women the WTP is lowest for *"Insurance - 500 € deductible"* (about 13€ more than they are willing to pay for an insurance with 1000 € deductible) and for men it is *"Replacement Car - Similar car category"* (only a few cents more than for no replacement car). Intriguingly, mens' relative WTP for a replacement car of lower car category is higher than for the latter. This fact might be explained with the insignificance of the middle level *"Replacement Car - Lower car category"* and that no significant interaction effect for this middle level was found while one was found for the high level.

For the attributes that have a significant level it is also of interest to compare the difference between the high level and the middle level of an attribute. Men are willing to pay about 8 € more for *"Repair & Maintenance - Volvo shop"* than for *"Repair & Maintenance - Any repair shop"* and for women it is about 5 €. By far the largest difference for both genders was found between *"Tyres - Winter & Summer tyres"* and *"Tyres - All-weather tyres"* with a clearly higher WTP for the former. Women result to be willing to pay about 87 € more and men even 141 €. In a sense, while respondents seemed quite indifferent about where the repair and maintenance tasks should be executed, they show to be much more sensible when it comes to tyres. A *"Car Pick-up & Delivery - Subscription start & Repair shop visits"* shows only a few cents higher relative WTP than *"Car Pick-up & Delivery - Repair shop visits"* for both genders. Last but not least, a spotless car possesses a 2.5 € higher relative WTP than a car with minor scratches for women (about 4 € for men).

To directly compare the relative WTP values between women and men, the last column at the very right was incorporated. It shows that men are willing to pay more in the majority of the cases (eleven out of twelve times). This again fits the finding of above that women in the sample are more price-sensitive.

Results for Full Sample - Base Level is the (-1) Level			WTP		WTP Difference
Variable	Coefficient	P>|z|	Women	Men	Increase for Men
Repair & Maintenance - Any repair shop	1.68390	0.000	€169.69	€274.42	€104.73
Repair & Maintenance - Volvo shop	1.73192	0.000	€174.53	€282.25	€107.72
Repair & Maintenance - Not included	-	-	-	-	-
Tyres - Summer & winter + mounting & storage	1.47526	0.000	€148.66	€240.42	€91.75
Tyres - All-weather tyres + mounting	0.60723	0.000	€61.19	€98.96	€37.77
Tyres - Not included	-	-	-	-	-
Car Pick-up & Delivery - Subscr. start & Repair shop visits	0.49416	0.003	€49.80	€80.53	€30.73
Car Pick-up & Delivery - Repair shop visits	0.48888	0.007	€49.26	€79.67	€30.41
Car Pick-up & Delivery - Not included	-	-	-	-	-

Insurance - No deductible	0.52296	0.000	€52.70	€85.23	€32.53
Insurance - 500€ deductible	0.12490	0.270	€12.59	€20.35	€7.77
Insurance - 1000€ deductible	-	-	-	-	-
Replacement Car - Similar car category	0.61614	0.002	€62.09	€0.17	-€61.92
Replacement Car - Lower car category	0.21765	0.061	€21.93	€35.47	€13.54
Replacement Car - Not included	-	-	-	-	-
Car Condition - Spotless	0.31320	0.022	€31.56	€51.04	€19.48
Car Condition - Minor scratches	0.28779	0.007	€29.00	€46.90	€17.90
Car Condition - Minor scratches & signs of usage	-	-	-	-	-
Price	-0.00992	0.000			
Interaction - Price * Men	0.00379	0.001			
Interaction - Similar Replacement Car * Men	-0.61510	0.004			

Table 8: WTP Full Sample

When investigating the relative WTP results for the target group in Table 9 below, a number of differences can be found.
The first difference lies in the magnitude of the relative willingness to pay values. Corresponding to the findings above, the target group shows higher relative WTPs in general. This goes back to the lower price coefficient used for calculating the relative WTPs, which was -0.00581 (in comparison to the -0.0061328 for men of the full sample).
The second difference lies in the order of the magnitudes of the relative WTP values within levels, which does not apply to each attribute, but for instance to insurance, where it is counterintuitive. Even though the difference is minor, respondents from the target group would be willing to spend more money for *"Insurance - 500 € deductible"* than for *"Insurance - No deductible"* (always compared to the base level, which is *"Insurance - 1000 € deductible"* in this case). Thus, for an insurance without deductible, the target group resulted to be willing to pay about 3.5 € less than for an insurance with 500 € deductible (97.84 € and 101.33 €, respectively). The researchers believe that this result expresses the relatively low importance of this attribute for subscription plan choice. In other words, respondents chose a plan based mainly on the other attributes and in this way, higher prices might have been accepted to be paid for the *"Insurance - 500 € deductible"* than for *"Insurance - no deductible"*.
"Car Pick-up & Delivery", "Replacement car" and *"Car condition"* result to be insignificant for the sample. Again, the results for these attributes presented in Table 9 can thus at maximum be seen as indicators.

When looking at the difference between the highest level and the middle level, the researchers found *"Repair & Maintenance - Volvo shop"* to have a 42 € higher relative WTP than for *"Repair & Maintenance - Any repair shop"*. Comparing these 42 € to the 8 € of the full sample for men (and about 5 € for women) shows that the target group seems to value a certified Volvo shop more than the full sample. *"Tyres - Winter & Summer tyres + mounting & storage"* has a 190 € higher relative WTP than *"Tyres - All-weather tyres + mounting"*. This represents a

127% increase, which is more than the double. Yet again tyres and connected services such as storage and mounting show to be a highly sensitive topic. The last significant attribute, i.e. *"Insurance"*, shows a 3.5 € smaller relative WTP for *"Insurance - No deductible"* than for *"Insurance - 500 € deductible"* - which is again counterintuitive as stated previously and the potential reasons for this are the same.

Results for Target Group - Base Level is the (-1) Level Variable	Coefficient	P>|z|	WTP
Repair & Maintenance - Any repair shop	1.89338	0.000	€325.97
Repair & Maintenance - Volvo shop	2.14006	0.000	€368.44
Repair & Maintenance - Not included	-	-	-
Tyres - Summer & winter + mounting & storage	1.98307	0.000	€341.41
Tyres - All-weather tyres + mounting	0.87462	0.006	€150.58
Tyres - Not included	-	-	-
Car Pick-up & Delivery - Subscr. start & Repair shop visits	0.59396	0.190	€102.26
Car Pick-up & Delivery - Repair shop visits	0.70383	0.174	€121.17
Car Pick-up & Delivery - Not included	-	-	-
Insurance - No deductible	0.56833	0.025	€97.84
Insurance - 500€ deductible	0.58855	0.024	€101.33
Insurance - 1000€ deductible	-	-	-
Replacement Car - Similar car category	0.33516	0.342	€57.70
Replacement Car - Lower car category	0.41697	0.181	€71.79
Replacement Car - Not included	-	-	-
Car Condition - Spotless	0.57409	0.067	€98.84
Car Condition - Minor scratches	0.32940	0.270	€56.71
Car Condition - Minor scratches & signs of usage	-	-	-
Price	-0.00581	0.000	

Table 9: WTP Target Group Sample

Before continuing to the conclusions, it should briefly be discussed about the magnitudes of the WTP values. The researchers deem them particularly high and referring to the literature, one reason for this could be the non-inclusion of a no-choice answer option (Hensher et al., 2005, p. 176). However, as no comparative studies exist an unbiased evaluation is not possible. More on this topic will be presented in the limitations and future research chapters.

7. Conclusions

The following chapter shall shortly summarize the most important findings and thereby answer the research questions. Additionally, it will highlight the value of the study for the managerial practice, propose further research that could help to evaluate and further develop the findings and finally present the inherent limitations of the study. This shall allow the reader to decide on the strengths of the study and the nature of its deficiencies.

After summarizing the main findings on the customer preferences, importance and WTP for the different services of the used car subscription offer, the applicability of the presented method will be discussed. In order to put this thesis into the holistic context the last sub-chapters will suggest implications for practice and areas for future research. Lastly, a number of very important limitations will be highlighted in order to remind the reader about the weaknesses of the research.

7.1 Customer Preferences

One main aim of this thesis was to assist Care by Volvo with identifying the preferences of potential customers for their used car subscription plan. The first research question was thus formulated in the following way:
"What are potential customers' preferences regarding the services included in a used car subscription plan?"
Using the above presented findings, the researchers can answer this question to a great extent. Nevertheless, a number of findings for the target group can only be used with caution as they could not be based on significant results. Additionally, the later discussed limitations need to be borne in mind.

When considering to include "*Repair & Maintenance"* into the subscription plan, the results have shown that respondents both from the target group but also from the full sample assigned the highest relative importance to this service. When choosing between the different options for the *"Repair & Maintenance"* service both options, no matter if the car was repaired and maintained by any repair shop available or by a contracted Volvo repair shop, showed high value for the respondents.
The respondents from the target group indicated strong importance for the inclusion of *"Tyres"* as it was stated to be the second most important service above all included. A comparison of the different options showed a very significant preference to have summer and winter tyres included instead of all-weather tyres.
Compared to the first two services a *"Car Pick-up & Delivery"* service was seen as much less important. Nevertheless, for the full sample such service, no matter if only for repair shop visits or also for the subscription start, offers value to the respondents. Unfortunately, the results for the target group were insignificant and do not allow additional insights.
A similar relative importance was obtained for the *"Insurance"* attribute. Respondents overall derived value from both an insurance with a 500 € deductible and without any deductible. A clear preference for the *"no deductible"* option could only be proven for the full sample.

For a decision regarding the inclusion of a *"Replacement car"* into the subscription plan, the results showed a relatively low importance for such a service. This is especially true when looking at the target group. Again, a significant preference for the *"similar car category"* option could only be proven for the full sample.
The last attribute tested was the *"Car condition"*, which, regardless if in a spotless condition or with minor scratches and signs of usage, was similarly important as the previous two attributes. However, in the scenario of an older car the importance increased heavily, signaling that for an older car a bad condition is strongly undesired. Although the coefficients and differences were not significant it seems like the preference differences among the two offered options are rather small.

As a conclusion, when configuring the used car subscription plan the results suggest that including winter and summer tyres and offering a repair and maintenance service will allow to satisfy the most important customer preferences. A pick-up and delivery service might create further value but limiting this service to repair shop visits seems to be a good option. Minor scratches on the car seem to be acceptable, although for an older car the car condition should still be well preserved. Similarly, including a 500€ insurance deductible for the customer should not lead to significant reduction of the offer's value. A replacement car was indicated to offer only little value to the target group.

7.2 Willingness to Pay

The second research question of this study regarded WTP and stated:
"What is the WTP of potential customers regarding the services included in a used car subscription plan?"
Similar to above, the researchers are able to answer this question to a great extent. However, one is referred to the limitations chapter below to consider the weaknesses found that indicate that the results need to be taken with caution.

The price attribute as a crucial part of WTP was found to be among the three most important attributes for a choosing a subscription plan. For a subscription offer based on a two-year-old XC40 with 40 000 km mileage, price results to even be the most important attribute for women. Instead, if the car is four years old at a mileage of 100 000 km the importance of price was observed to change, becoming the second-most important attribute for all respondent groups behind *"Repair and maintenance"*.

The WTP for the services connected to a subscription could only be calculated for a two years old XC40 with 40 000 km. The researchers concluded that the WTP for such a plan is generally highest for the target group and lowest for women of the full sample. This translates into the finding that women of the sample are the most price-sensitive group, men from the full sample represent the median and the actual target group is the least price-sensitive group for such a subscription plan.
Per se, the highest relative WTP was found for *"Repair & Maintenance at a Volvo shop"*, where the target group would pay 368.44 € more than for a subscription with no repair and

maintenance included at all (this compares to a 282.25 € for men of the full sample, and 174.53 € for women from the full sample). Interestingly, *"Repair & Maintenance at any repair shop"* shows a smaller WTP for all respondent groups than *"Repair & Maintenance at a Volvo shop"*. Another important finding is that *"Tyres - Winter & Summer tyres + mounting and storage"* has a significantly higher relative WTP than *"Tyres - All-weather tyres + mounting"* (190 € higher for the target group, about 140 € higher for full sample men and about 87 € higher for full sample women). This underlines that respondents from all samples are strongly willing to pay more for having winter and summer tyres and connected services such as storage and mounting included. For "*Car pick-up and delivery"* and "*Car condition"* only minor WTP differences between the middle and high level were found. For having a car pick-up and delivery services included versus not having any included, men from the full sample are willing to pay about 80 € more (full sample women around 50 € more). A better car condition (compared to a *"Car condition with minor scratches and signs of usage"*) is worth about 50 € more for men from the full sample and 30 € more for women. For the target group no significant WTP values could be found for these attributes.

In summary, one can see that price is among the three most important attributes for choosing a used car subscription offer and it was found that women of the sample are the most price-sensitive group, men from the full sample the middle and the actual target group the least price-sensitive group. All respondent groups were found willing to pay the most money for *"Repair & Maintenance"* and *"Tyres"*. *"Winter & Summer tyres + mounting and storage"* thereby shows significantly higher relative WTP than *"All-weather tyres + mounting"*. Respondents exhibit a medium high WTP for "*Car pick-up and delivery"* over not having such a service included, while difference regarding WTP is generally low between a better car condition and *"Car condition with minor scratches and signs of usage"*.

7.3 Applicability of the Proposed Method

As outlined in Chapter 1.3.2, this research aimed also at contributing to the sparse literature around consumer preference driven PSS design, where a research gap was discovered mainly for the configuration and evaluation steps within the PSS design process. More specifically, a lack of tools to identify preferences and WTP of potential customers during these steps was identified.

Although a number of researchers have started to develop PSS design methodologies (Qu et al., 2016), very few of them put the potential customers and their preferences in the center of activity. Baines et al. (2009) mention that such methods, however, would indeed be of high value since the underlying logic behind PSS is service driven.
In this research, an existing method for measuring consumer preference and WTP was reviewed and applied for a configuration of a new PSS. As such, the researchers departed from the well-established framework of Breidert et al. (2006) and identified indirect survey methods and specifically the discrete choice analysis (DCA) as a potential candidate for this task. Other authors such as Green et al. (2001, p. 57) and Adamowicz et al. (1998, p. 32) mentioned that such indirect survey methods have already been used for new product and service design and

market simulation. A very limited number of recent studies has applied them even for PSS design (Shih & Chou, 2011; Li et al., 2017).
With the findings of this study, the researchers hope to confirm the applicability of indirect survey methods in general, but also the applicability of the DCA as a specific method to identifying consumer preference and WTP for configuring a PSS. For the full sample of 176 respondents, almost all preference and WTP results were obtained with 95% significance (11 out of 13 variables where one of the two residual values is 90% significant). Customer preference was measured by obtaining utility values for the various attribute levels (i.e. the services potentially included) using a conditional logit model. Then, these utility values, also called part-worth utilities, are taken to calculate the WTP. Although the results for the full sample were mostly significant and the researchers are confident in their findings, the relative monetary values seem rather high and additional research must confirm these. Suggestions for respective improvements can be found in Chapter 7.5.

Overall, as already outlined before, the researchers have designed and applied a DCA that made it possible to find customer preferences and their WTP in order to configure a PSS and specifically, a subscription-based PSS. This last fact and the extensive literature review about existing PSS development methods and customer preference measurement methods should thus contribute to reducing the literature gap in customer-centered PSS design. Furthermore, by reviewing servitization, PSS and subscriptions for the automotive industry, the researchers hope to add to the sparse literature available for car subscriptions.

7.4 Managerial Implications

As outlined in the introduction and literature review, servitization is a major trend in most industries and thus the shift towards product-service systems is immanent. Consequently, designing and configuring PSS in a way that allows to take customers preferences into account is of great value to the responsible managers. A prerequisite is to find appropriate methods that are reliable and easy to use in practice. However, as the literature review highlighted, only very few methods that meet these requirements exist.
Nevertheless, the presented results show that even with a limited budget and little prior knowledge it is possible to obtain valuable insights for the configuration of a PSS, if the right method is used. Thus, the researchers are confident to suggest that the presented DCA method can be applied by managers in practice to similar PSS configuration cases. Especially within the automotive industry the researchers expect great interest in the proposed method. New PSS offerings, not only car subscriptions but also car-pooling, ride-hailing and MaaS subscriptions, are currently developed by many large companies. The ability to design those offers in a customer-focused way should offer benefits to those companies.
By making use of existing customer databases or professional market research institutes larger samples can easily be obtained. This is expected to increase the quality of the findings even further. Additionally, in practice the results of the WTP can be used for connected bundling decisions as the results can be paired with factors like internal costs or synergy effects from other services. Overall, the researchers see great potential for the application of the methods in other PSS development cases.

7.5 Limitations

A number of important limitations were found by the researchers. First of all, the relatively high number of insignificant attribute levels (six of thirteen) for the target group shall be discussed. Two possible reasons for this are the small target group sample and the not evenly over both blocks distributed respondents for this sample (20 respondents from Block I and 14 from Block II).

Second, the researchers could not exclude the presence of an order effect for the attributes, since *"Repair & maintenance"* and *"Tyres"* received comparably high coefficients while being placed at the very top of each profile. Since a respondent is expected to read from top to bottom, an order effect could have influenced on the results, but this could not be proven.

Third, one has to bear in mind that this study aimed at finding the customer preferences regarding the services included. Other important decision variables that are not services per se, such as e.g. the length of the termination period for the subscription, were not taken into account. However, they might actually influence the subscription offer choice.

Fourth, the researchers discovered that the respondents tended to increasingly select the same answer options the further they were in the choice experiment (see Appendix 8). A distinct reason for this could not be identified, but it could be due to learning effects or tiredness. The latter was indeed reported by number of respondents, although the researchers set the number of choice sets according to common standards (Bech, Kjaer & Lauridsen, 2011).

Fifth, an important limitation concerning the WTP values is connected to the non-inclusion of a no-choice answer option and the non-inclusion of competitor offers. Following Hensher et al. (2005, p. 176), a no-choice offer could have been a barrier to detecting preference relationships, which is why the researchers opted not to include one. However, Hensher and colleagues also mention that market related estimates (such as WTP) are more likely to be biased upwards if respondents must select a given option and cannot opt out with a no-choice. Furthermore, as reported by Orme (2010, p. 86f), the non-inclusion of competitor offerings can substantially lower the WTP estimates. These two aspects might thus be reasons for the relatively high WTP estimates the researchers obtained from the results.

Sixth, another WTP limitation concerns the relationship between the utilized price levels and their connected part-worth utilities. Based on the latter and relevant literature (e.g. Hensher et al., 2015, p. 199f), the researchers deemed the relationship as approximately linear, which allowed for the chosen WTP calculation. However, if more price levels had been included, a nonlinear relationship might have been proven (see Appendix 7).

Last, as indicated in the analysis, a number of counterintuitive insights were obtained (e.g. the preference of a repair and maintenance at a Volvo dealer over any given repair shop including also Volvo dealers). Multiple potential explanations for this were detected. One could be that the study did not control for unfamiliarity with car characteristics and car subscriptions. Another could be that the samples were too small. A third potential reason could be misinterpretation of the attribute levels, since they were not explained in detail before the start of the choice experiment. Also, a left-to-right survey response bias might have been present (Hensher et al., 2015, p. 473f) but this could not be verified.

7.6 Future Research

Naturally, the newness of the research field around PSS configuration methods and car subscriptions suggests various topics for future research.

On the business model level further research around the differences between the existing car subscription types, the connected target groups and the services included would benefit to explore the upcoming car subscription trend. At the same time such research could help to understand the reasons for the identified preference differences between the two analyzed samples.

More importantly, further research that conducts similar measurements of customer preferences and WTP for car subscriptions is needed to evaluate and confirm the presented findings. As such comparative research is not yet existing, the newness of this research does not allow for a reliable assessment.

In this context one specific question is of special interest for the researchers. Compared to classical WTP studies on products or services, WTP for PSS shows the particularity that the respondent has to evaluate a combination of a product and services that is priced in a bundle. If studies, like the presented one, aim to only evaluate and thus experiment around the service part, how can the inherent product related WTP be taken into account? The same question occurs vice versa when evaluating the product and not including the services as attributes. To what extent is the respondent able to separate the tested and not tested parts of the PSS and to what extent does this enter into the different calculated WTPs for the attributes? Answering these questions would surely provide value for future PSS focused WTP studies.

Additionally, on the methodological side it would be of great interest to compare the results of this research with a similar study that uses a probabilistic sample and applies adjustments to the experiment design. Especially, regarding the detected limitations of this research, adding a no-choice option and reducing the number of choices for the respondent could help to evaluate the presented findings. Similarly, testing other statistical models like a mixed or nested conditional logit would offer additional value.

Appendix

1) Keywords Used for Searching Literature

The following lists shall provide an overview of keywords and search terms that was used to find relevant literature within each theoretical field. However, as mentioned earlier keyword-based search was not the only source of literature.

Servitization, PSS and Subscription:
“Product-service system”, “PSS”, “Servitization”, “PSS in car industry”, “PSS automotive”, “Servitization car industry”, “PSS Car sharing”, “PSS MaaS”, “Car Subscriptions”, “PSS Subscription”

PSS Development:
“PSS Design”, “PSS Development”, “PSS Development Process”, “PSS Configuration”, “PSS Evaluation”, “Service development”, “Service engineering”, “PSS development methods”, “PSS design methodologies”, “PSS customer preferences”, “PSS customer evaluation”, “PSS design tools”

Consumer Preferences and WTP:
“choice set design”, “choice set” AND design, "consumer choice", "Models of Consumer Choice Behavior", “choice methods for product development”, “methods for measuring choice”, “methods for measuring preference”, “discrete choice experiment vs attitude measurement”, “self-explicated method”, disadvantages AND “self-explicated methods”

2) List of Social Media Groups Used for Data Collection

The following groups on social media were deployed to collect the data:

Name of group	Link	Number of members	Date posted
Alumni BWL Institut CAU	https://www.xing.com/communities/groups/alumni-institut-fuer-betriebswirtschaftslehre-der-cau-kiel-18f3-1100480	202	01.04.2019
Automotive World | Grasp the future of mobility...	https://www.linkedin.com/groups/8129034/	3669	01.04.2019
Autos, Motorräder, Fahrzeuge, Teile und Zubehör	https://www.facebook.com/groups/AMFTZ/	4549	01.04.2019
Connected Driver & Smart Mobility	https://www.linkedin.com/groups/12001970/	1050	01.04.2019
Düsseldorf Xing Ambassador	https://www.xing.com/communities/groups/duesseldorf-xing-ambassador-community-18f3-1071151	51021	01.04.2019
Marktforschung in Automobil & Automotive	https://www.xing.com/communities/groups/marktforschung-in-automobil-und-automotive-18f3-1074572	979	01.04.2019
Motorsportfreunde Deutschland	https://www.xing.com/communities/groups/motorsportfreunde-deutschland-18f3-1055331	726	01.04.2019
Premium Community Berlin	https://www.xing.com/communities/groups/premium-community-berlin-cb9b-1063755	1682	01.04.2019
Premium Community Deutschland	https://www.xing.com/communities/groups/premium-community-deutschland-cb9b-1065166	221	01.04.2019
Umfragen & Online-Experimente – Teilnehmer für empirische Studien finden	https://www.facebook.com/groups/studie.umfrage.posten.probanden.teilnehmer.finden/	4232	01.04.2019
Umfragen für Studienteilnehmer	https://www.facebook.com/groups/1438198899793916/	8810	01.04.2019
Volvo owners and fans	https://www.linkedin.com/groups/71374/	1329	01.04.2019
Volvo S60/V60/XC60 Gruppe Deutschland	https://www.facebook.com/groups/1811736855711192/?ref=br_rs	201	01.04.2019
VOLVO XC series enthusiasts	https://www.linkedin.com/groups/3056184/	32	01.04.2019
VOLVO XC90 - Germany	https://www.facebook.com/groups/268735993515022/	382	01.04.2019
Auto OEM Network - World's Largest Automotive Group	https://www.linkedin.com/groups/82857/	293830	02.04.2019
Automotive EMEA	https://www.linkedin.com/groups/1894692/	24064	02.04.2019
The Next Mobility: Automotive & Transportation Industry Innovation	https://www.linkedin.com/groups/1795405/	20620	02.04.2019
Auomotive OEM Professionals	https://www.linkedin.com/groups/85731/	66414	04.04.2019
Automotive Industry Professionals	https://www.linkedin.com/groups/78017/	99760	04.04.2019
Automotive News Professionals Community	https://www.linkedin.com/groups/2474084/	89850	04.04.2019

E-Mobility: Die Zukunft der Mobilität ist elektrisch = E-Bikes, Pedelec, LEV's	https://www.xing.com/communities/groups/e-mobility-die-zukunft-der-mobilitaet-ist-elektrisch-gleich-e-bikes-pedelec-levs-8a7d-1056971	780	04.04.2019
Electric and Autonomous Vehicles and Infrastructure; Mobility Services of the (near) Future	https://www.linkedin.com/groups/904087/	12332	04.04.2019
eMove 360	https://www.xing.com/communities/groups/emove360-8a7d-1052313	592	04.04.2019
Future Trends	https://www.linkedin.com/groups/145854/	536435	04.04.2019
Intelligent Mobility	https://www.linkedin.com/groups/8382671/	6169	04.04.2019
Smart Mobility Hub	https://www.linkedin.com/groups/7421699/	2220	04.04.2019
Sustainable Urban Transport and Mobility Management	https://www.linkedin.com/groups/1886322/	3174	04.04.2019
Auto-Netz-Werk-Club	https://www.xing.com/communities/groups/auto-netz-werk-club-cb9b-1003204/about	4457	05.04.2019
Netzwerk Verkehr und Mobilität	https://www.xing.com/communities/groups/netzwerk-verkehr-und-mobilitaet-cb9b-1065799/about	2299	05.04.2019
New Mobility Services	https://www.xing.com/communities/groups/new-mobility-services-cb9b-1079768/about	18	07.04.2019
Xing Studenten	https://www.xing.com/communities/groups/xing-studenten-8762-1065685	682185	07.04.2019
Connected Car - Das Automobil der Zukunft	https://www.xing.com/communities/groups/connected-car-das-automobil-der-zukunft-e47f-1066053	835	08.04.2019
E-Mobility	https://www.xing.com/communities/groups/e-mobility-e47f-1067943	3167	08.04.2019
eMobilität live	https://www.facebook.com/groups/364416523705874/?ref=group_browse_new	726	08.04.2019
Postfossile Zukunft und Mobilität	https://www.facebook.com/groups/1704797829544092/?multi_permalinks=2424950590862142%2C2424704324220102%2C2424637637560104%2C2423225474367987%2C2422603417763526&notif_id=1554403249161416&notif_t=group_activity	117	08.04.2019
Ich fahre Elektroauto	https://www.facebook.com/groups/elektroauto/?ref=group_browse_new	3286	14.04.2019
Automobil - Alles rund um die Automobilindustrie	https://www.xing.com/communities/groups/automobil-alles-rund-um-die-automobilindustrie-7544-1063469	1975	15.04.2019
Business Model Innovation	https://www.xing.com/communities/groups/business-model-innovation-7544-1065802	306	15.04.2019
Internetmarketing für das moderne Autohaus	https://www.xing.com/communities/groups/internetmarketing-fuer-das-moderne-autohaus-7544-1006910	1048	15.04.2019
Umwelt - Verkehr - Technologie	https://www.xing.com/communities/groups/umwelt-verkehr-neue-technologie-7544-1068803	2904	15.04.2019

Auto Motorrad und Sport	https://www.xing.com/communities/groups/auto-motorrad-und-sport-bf42-1029307	225	17.04.2019
automotiveIT	https://www.xing.com/communities/groups/automotiveit-bf42-1033763	639	17.04.2019
Carsharing Deutschland	https://www.xing.com/communities/groups/carsharing-deutschland-bf42-1006839	137	17.04.2019
Center for Automotive Research	https://www.linkedin.com/groups/2875550/	4862	17.04.2019
Frankfurt - XING Ambassador Community	https://www.xing.com/communities/groups/frankfurt-xing-ambassador-community-bf42-1071376	85720	17.04.2019
Europäisches Netzwerk für bezahlbare und nachhaltige Elektromobilität	https://www.linkedin.com/groups/4067267/	232	21.03.2019
AutoVision GmbH	https://www.xing.com/communities/groups/autovision-gmbh-kontaktnetzwerk-1071-1002310	510	20.04.2019
Self-driving cars/ Autonomous cars	https://www.facebook.com/groups/1713689612209307/?ref=group_browse_new	1130	20.04.2019
Springer Professional Automobil	https://www.xing.com/communities/groups/springer-professional-automobil-1071-1094883	229	20.04.2019
AktienTipp	https://www.facebook.com/groups/aktientip/	13101	24.03.2019
Auto-Flohmarkt	https://www.facebook.com/groups/395879583782069/	58618	24.03.2019
Autonomes Fahren - Mobilität 2030	https://www.facebook.com/groups/1712036678869432/	583	24.03.2019
Beach-Volleyball in Kiel	https://www.facebook.com/groups/1145440219739 25/	428	24.03.2019
Business Deutschland	https://www.facebook.com/groups/1424651087820845/	2479	24.03.2019
Männer mit Eiern'	https://www.facebook.com/groups/476801262459703/	2452	24.03.2019
NeuWagen	https://www.facebook.com/groups/neuwagen.groups/	521	24.03.2019
Programmieren macht Spaß	https://www.facebook.com/groups/programmierspass/	3720	24.03.2019
SCANIA & VOLVO FANS	https://www.facebook.com/groups/gerdsumeier/	859	24.03.2019
Shared Mobility Solutions | Car Sharing	https://www.linkedin.com/groups/8492186/	64	24.03.2019
Tennis in Hamburg und Umgebung	https://www.facebook.com/groups/166140513408678/	688	24.03.2019
Volvo C30 Germany / Deutschland	https://www.facebook.com/groups/954222944626296/?ref=br_rs	325	24.03.2019
Volvo Freunde Deutschland	https://www.facebook.com/groups/904610443000915/?ref=br_rs	352	24.03.2019
Volvo Freunde OWL und Umgebung se	https://www.facebook.com/groups/1620924534886030/?ref=br_rs	283	24.03.2019
Volvo XC60 Club "deutschsprachig"	https://www.facebook.com/groups/1136345169740055/?ref=br_rs	1314	24.03.2019
Volvo XC90 Besitzer Deutschland	https://www.facebook.com/groups/189652931504307/?ref=br_rs	1314	24.03.2019

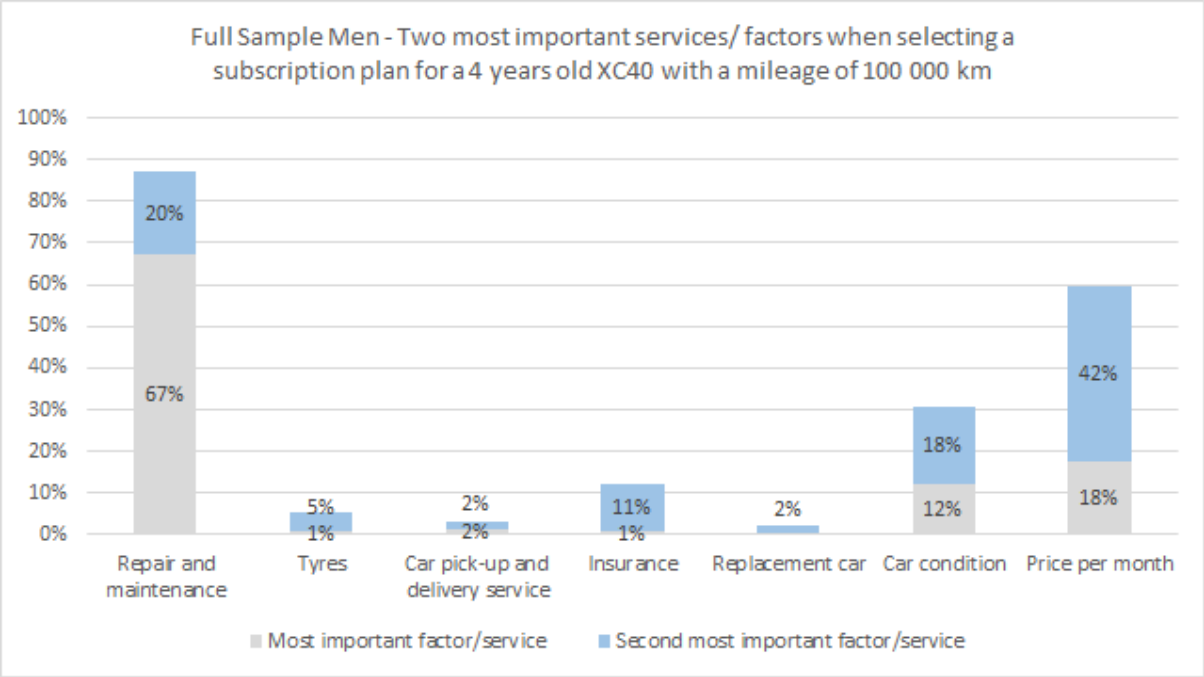
Winterhuder Nachbarn	https://www.facebook.com/groups/423246697689653/	7784	24.03.2019
Zukunft der Mobilität [Mobility Mag]	https://www.facebook.com/groups/mobilitymag/	331	24.03.2019
Mitfahrgelegenheit von/nach BERLIN (auch Bahn) / über 19000 Mitglieder	https://www.facebook.com/groups/418201428231949/	20288	25.03.2019
Tennis in Berlin und Umgebung	https://www.facebook.com/groups/1646300548917211/	1112	25.03.2019
Tennisflohmarkt	https://www.facebook.com/groups/511613442217316/	6003	25.03.2019
Volvo Teilemarkt Deutschland	https://www.facebook.com/groups/475722525844768/	5470	25.03.2019
automobil	https://www.xing.com/communities/groups/automobil-cb9b-1070236	962	28.03.2019
Berliner Köpfe	https://www.xing.com/communities/groups/berliner-koepfe-9299-1070726	58386	28.03.2019
Elektromobilität die Zukunft fährt elektrisch	https://www.xing.com/communities/groups/elektromobilitaet-die-zukunft-faehrt-elektrisch-9299-1058125	2180	28.03.2019
Forschung zu Verkehr und Mobilität	https://www.xing.com/communities/groups/forschung-zu-verkehr-und-mobilitaet-cb9b-1061168	227	28.03.2019
Marktforschung und Trendforschung	https://www.xing.com/communities/groups/marktforschung-und-trendforschung-xing-ambassador-community-9299-1000365	11570	28.03.2019
Mobilität von morgen	https://www.xing.com/communities/groups/mobilitaet-von-morgen-9299-1000172	1570	28.03.2019
Mobility Management	https://www.xing.com/communities/groups/mobility-management-cb9b-1078316	486	28.03.2019
Neue Mobilität	https://www.xing.com/communities/groups/neue-mobilitaet-9299-1068352	4280	28.03.2019
Premium Community Hamburg	https://www.xing.com/communities/groups/premium-community-hamburg-cb9b-1030558	784	28.03.2019
Premium Community München	https://www.xing.com/communities/groups/premium-community-muenchen-cb9b-1068153	4290	28.03.2019
Smart Urban Mobility	https://www.xing.com/communities/groups/smart-urban-mobility-cb9b-1031081	153	28.03.2019
SUV Faszination & Zukunft	https://www.xing.com/communities/groups/suv-faszination-und-zukunft-cb9b-1002604	429	28.03.2019
Vekehr und Mobilität	https://www.xing.com/communities/groups/verkehr-und-mobilitaet-9299-1010803	983	28.03.2019
BWL Erstis CAU 2012/13	https://www.facebook.com/groups/bwl.erstis.cau1213/	214	30.03.2019
Subscription Business Model for E-Commerce	https://www.linkedin.com/groups/4443825/	585	30.03.2019
Subscription Marketing	https://www.linkedin.com/groups/2157713/	2586	30.03.2019
Umfragen für Wiwi-Arbeiten von Studenten + Doktoranden	https://www.facebook.com/groups/434643516578194/	478	30.03.2019

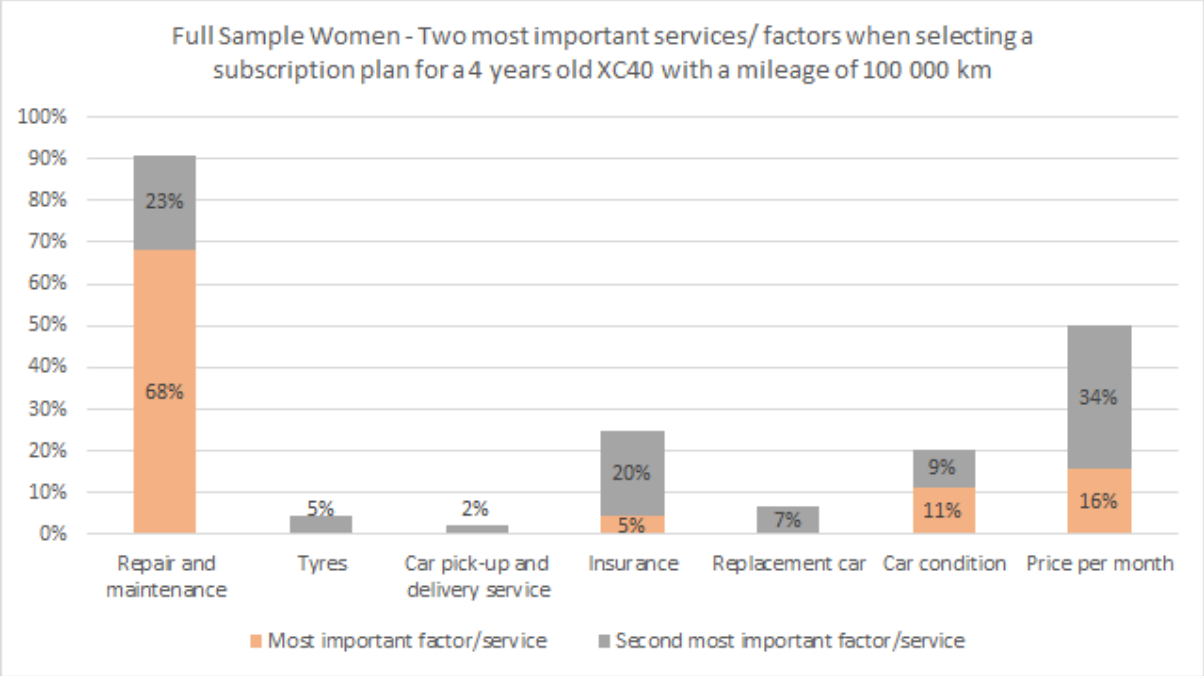
3) All Interaction Effects Tested for the Full Sample

Interaction Effects					**Full Sample All interactions** No. of obs. 4 752	
	Log-pseudolikelihood: -1113.2807				Pseudo R2 0.360	
Choice	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
repmanany	2.005904	0.3500658	5.73	0	1.319788	2.69202
repmanvol	1.939245	0.2730267	7.1	0	1.404123	2.474368
tyresall	1.344464	0.3113045	4.32	0	0.734319	1.95461
tyresone	0.7084599	0.3770119	1.88	0.06	-0.03047	1.44739
picdelall	-0.2056458	0.4655186	-0.44	0.659	-1.11805	0.706754
picdelrep	-0.2404104	0.535007	-0.45	0.653	-1.28901	0.808184
insurfree	0.8659792	0.2910258	2.98	0.003	0.295579	1.436379
insurfive	0.4588785	0.3516345	1.3	0.192	-0.23031	1.148069
repcarsim	1.089587	0.379873	2.87	0.004	0.34505	1.834124
repcarlow	0.1648405	0.3111298	0.53	0.596	-0.44496	0.774644
condspotl	0.3111576	0.4961929	0.63	0.531	-0.66136	1.283678
condscrat	0.2780365	0.288575	0.96	0.335	-0.28756	0.843633
price	-0.0083867	0.0018745	-4.47	0	-0.01206	-0.00471
Price_Men	0.0031704	0.0015925	1.99	0.046	4.93E-05	0.006292
Price_Age	-0.0001003	0.0000575	-1.74	0.081	-0.00021	1.24E-05
Price_Inc1	0.0008657	0.0014716	0.59	0.556	-0.00202	0.00375
Price_Inc2	-0.0002088	0.0015488	-0.13	0.893	-0.00324	0.002827
Price_Inc3	-0.0001051	0.0015951	-0.07	0.947	-0.00323	0.003021
Price_Inc4	0.002741	0.0021341	1.28	0.199	-0.00144	0.006924
Price_Inc5	0.0024647	0.0022507	1.1	0.273	-0.00195	0.006876
Price_Inc6	0.0026613	0.0020245	1.31	0.189	-0.00131	0.006629
RepMainAny_Men	-0.2612799	0.3462261	-0.75	0.45	-0.93987	0.417311
RepMainAny_Age	-0.0052912	0.0117831	-0.45	0.653	-0.02839	0.017803
RepMainVol_Men	-0.2788223	0.2748019	-1.01	0.31	-0.81742	0.259779
RepMainVol_Age	0.0018431	0.0099404	0.19	0.853	-0.01764	0.021326
TyresAll_Men	0.0143618	0.2975038	0.05	0.961	-0.56874	0.597459
TyresAll_Age	0.0075792	0.0117409	0.65	0.519	-0.01543	0.030591
TyresOne_Men	0.0020589	0.3406704	0.01	0.995	-0.66564	0.669761
TyresOne_Age	-0.0069251	0.0113616	-0.61	0.542	-0.02919	0.015343
PickDelAll_Men	0.6347738	0.4239765	1.5	0.134	-0.1962	1.465752
PickDelAll_Age	0.0118488	0.0170092	0.7	0.486	-0.02149	0.045186
PickDelRep_Men	0.4351684	0.4783534	0.91	0.363	-0.50239	1.372724
PickDelRep_Age	0.0214846	0.0173621	1.24	0.216	-0.01254	0.055514
InsurNoDed_Men	-0.4039092	0.2757451	-1.46	0.143	-0.94436	0.136541
InsureNoDed_Age	0.0000559	0.010484	0.01	0.996	-0.02049	0.020604

Insur500Ded_Men	-0.2643669	0.3147394	-0.84	0.401	-0.88124	0.352511
Insur500Ded_Age	-0.0061031	0.0109676	-0.56	0.578	-0.0276	0.015393
RepCarSim_Men	-0.8985809	0.3531528	-2.54	0.011	-1.59075	-0.20641
RepCarSim_Age	-0.0115061	0.0128348	-0.9	0.37	-0.03666	0.01365
RepCarLow_Men	0.1719415	0.284696	0.6	0.546	-0.38605	0.729935
RepCarLow_Age	-0.00478	0.0109902	-0.43	0.664	-0.02632	0.016761
CarCondSpotl_Men	0.4602148	0.4390759	1.05	0.295	-0.40036	1.320788
CarCondSpotl_Age	-0.0239178	0.0130555	-1.83	0.067	-0.04951	0.001671
CarCondScrat_Men	-0.0227087	0.2627572	-0.09	0.931	-0.5377	0.492286
CarCondScrat_Age	0.0008701	0.0100843	0.09	0.931	-0.01889	0.020635

4) The Two Most Important Services/ Factors for Selecting a Subscription Plan for a Four Years Old XC40 with 100 000 km





5) Effect Coding - Full Sample Results

The table below shows the results from the conditional logit if all attribute levels (except for the price) where effect-coded. This means that instead of using a 1 or 0 to indicate whether a level was included in the choice alternative a combination of 1, 0 and -1 are used to express which level was included. As a result the coefficients for the base level is not set to 0 but rather estimated in a way that all coefficients add up to 0. As an additional significant interaction term was found the results differ slightly to the presented ones that are based on dummy coding.

Conditional (fixed-effects) logit regression						
					Number of obs	4 752
Log pseudolikelihood	-1132.9146				Pseudo R2	0.3490

Choice	Coef.	Rob. Std. Err.	z	P>|z|	[95% Conf.	Interval]
Repair & Maintenance						
Any repair shop	0.5443922	0.0641242	8.49	0	0.4187111	0.6700733
Volvo shop	0.593617	0.0513866	11.55	0	0.4929012	0.6943328
Not included	-1.1380092	.	.	.	.	.
Tyres						
Winter & Summer tyres	0.7809618	0.0677864	11.52	0	0.6481029	0.9138206
All-weather tyres	-0.0832234	0.0719517	-1.16	0.247	-0.224246	0.0577993
Not included	-0.6977384	.	.	.	.	.
Car Pick-up & Delivery						
Subscription start & Repair shop visits	0.1695529	0.0825988	2.05	0.04	0.0076622	0.3314436
Repair shop visits	0.158453	0.0924592	1.71	0.087	-0.0227636	0.3396697
Not included	-0.3280059	.	.	.	.	.
Insurance						
No deductible	0.3085199	0.0595662	5.18	0	0.1917723	0.4252676
500€ deductible	-0.0915122	0.0642614	-1.42	0.154	-0.2174622	0.0344377
1000 € deductible	-0.2170077	.	.	.	.	.
Replacement car						
Similar car category	0.3462554	0.1306376	2.65	0.008	0.0902104	0.6023004
Lower car category	-0.1398996	0.1391168	-1.01	0.315	-0.4125636	0.1327643
Not included	-0.2063558	.	.	.	.	.
Car Condition						

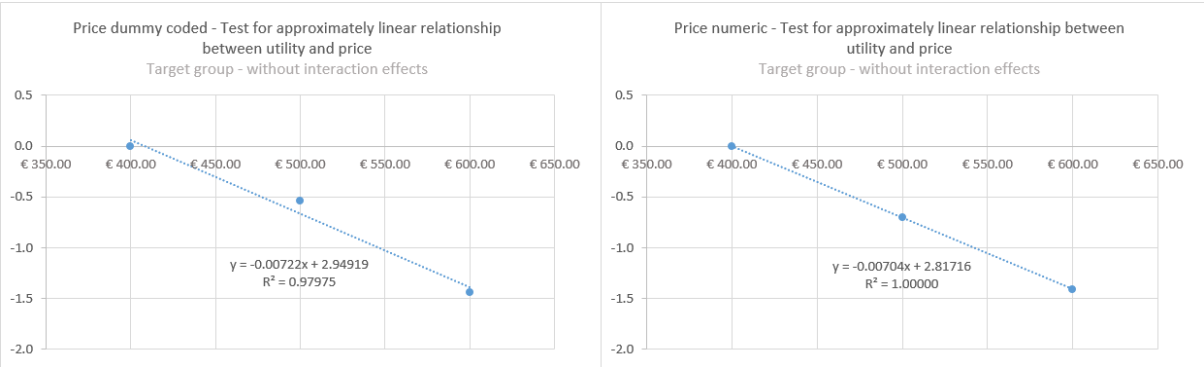
	Spotless	0.1130432	0.0777806	1.45	0.146	-0.039404	0.2654903
	Minor scratches	0.0899573	0.0604933	1.49	0.137	-0.0286074	0.2085221
	Minor scratches & signs of usage	-0.2030005	.	.	.	.	.
Price							
	Price	-0.0098206	0.0009968	-9.85	0	-0.0117742	-0.0078669
Interactions							
	Price * Men	0.0036483	0.0011093	3.29	0.001	0.0014742	0.0058225
	Replacement car similar car category * Men	-0.4234224	0.1452424	-2.92	0.004	-0.7080922	-0.1387526
	Replacement car lower car category * Men	0.3088054	0.1590751	1.94	0.052	-0.0029761	0.620587

6) WTP Based on Effect Coding (for the Target Group)

This example exhibits that the relative WTP values are the same for both dummy and effect coding. The column at the very right of the table below shows these relative WTP values and if one compares them to the dummy coded values presented in the Chapter 6 the identical values can be found.
Importantly, however, the absolute WTPs change. As visible from the table below, effect coding does not set the base level to zero utility, but rather assigns it a different value, which is negative in all cases of this research. Since the researchers only used the relative WTPs for the analysis, this topic is irrelevant.
Furthermore, one can see that the p-values and thus the significance of the variables change from dummy to effect coding. Since dummy coding allowed for higher significance overall, this coding type was preferred by the researchers for this study.

Results for Target Group - Base Level is the (-1) Level - Effect Coded				
Level	coef	P>|z|	WTP	Difference to base level
Repair & Maintenance - Any repair shop	0.54890	0.000	€94.50	€325.97
Repair & Maintenance - Volvo shop	0.79558	0.000	€136.97	€368.44
Repair & Maintenance - Not included	-1.34448		-€231.47	-
Tyres - Winter & Summer tyres	1.03051	0.000	€177.41	€341.41
Tyres - All-weather tyres	-0.07794	0.668	-€13.42	€150.58
Tyres - Not included	-0.95256		-€163.99	-
Car Pick-up & Delivery - Subscr. start & Repair shop visits	0.16136	0.473	€27.78	€102.26
Car Pick-up & Delivery - Repair shop visits	0.27124	0.311	€46.70	€121.17
Car Pick-up & Delivery - Not included	-0.43260		-€74.48	-
Insurance - No deductible	0.18270	0.202	€31.45	€97.84
Insurance - 500€ deductible	0.20292	0.167	€34.94	€101.33
Insurance - 1000€ deductible	-0.38562		-€66.39	-
Replacement Car - Similar car category	0.08445	0.727	€14.54	€57.70
Replacement Car - Lower car category	0.16626	0.455	€28.62	€71.79
Replacement Car - Not included	-0.25071		-€43.16	-
Car Condition - Spotless	0.27293	0.112	€46.99	€98.84
Car Condition - Minor scratches	0.02824	0.862	€4.86	€56.71
Car Condition - Minor scratches & signs of usage	-0.30116		-€51.85	-
Price	-0.00581	0.000		

7) Test for Approximately Linear Relationship Between Utility and Price



For this test, price was dummy coded (the 600€ and the 500€ per month level were included as dummy variables and 400€ was set as the base level with a utility of zero). The resulting function for utility (left Figure) was compared to the function where price was included numerically (right Figure).

As can be seen on the left Figure, a linear trendline could be added that fits the values with an R^2 of 0.97975. This trendline shows a slope of -0.00722, which is similar to the one obtained through numeric price coding (-0.00704). Also the y-intercept is similar. Overall, this led the researchers to believe that the relationship between utility and price is approximately linear.

Note that no interaction effects were considered for this test, which is why the utilities differ from the ones presented in the research.

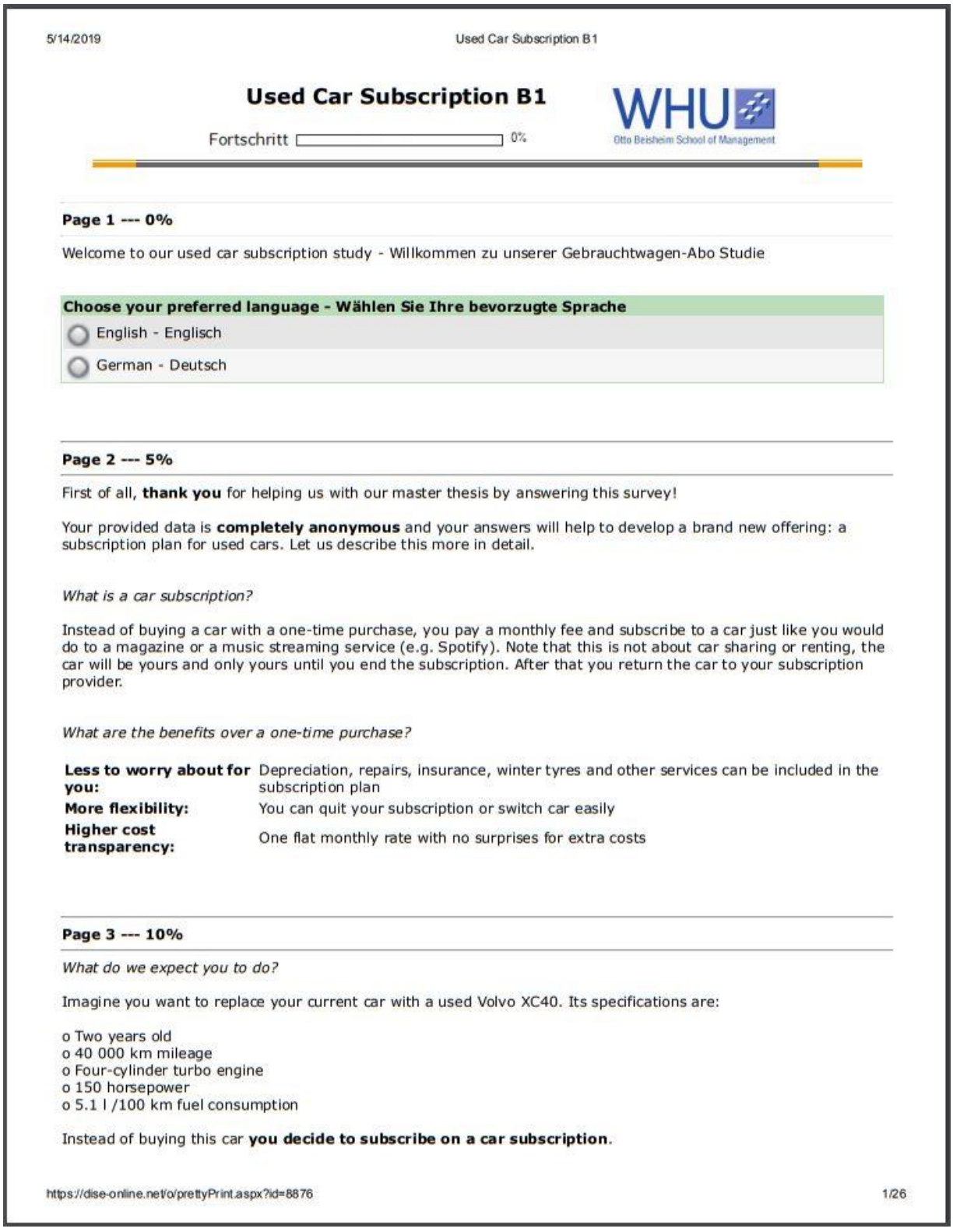
8) Test for Tiredness-Effect

The table below illustrates the percentage of respondents who have chosen the same answer option twice in a row. Importantly, this refers to the positioning and not the content of an answer option. For instance, the very left field for block 1 investigates the percentage of respondents who have selected the same answer option for choice question 1 and choice question 2. It thus captures the share of respondents who chose either very left answer option twice in a row, the middle answer option twice in a row or the very right answer option twice in a row. This might constitute a tiredness effect and one can see, indeed, that the share for Q7, Q8 and Q9 is relatively high overall.

	Percentage of respondents who have repeatedly chosen the same answer option							
	Q1 & Q2	Q2 & Q3	Q3 & Q4	Q4 & Q5	Q5 & Q6	Q6 & Q7	Q7 & Q8	Q8 & Q9
Block 1	24%	46%	34%	10%	35%	55%	55%	81%
Block 2	66%	44%	13%	54%	10%	28%	60%	64%

9) Printout of the Survey

Note that the original survey was not shown on various single pages and the respondent had to click through (on the printout as “Page” marked). Also, this printout only contains one choice set as an example. The real DCA contained 9 choice sets that differed to each other.



5/14/2019 Used Car Subscription B1

Used Car Subscription B1

Fortschritt 0%

Otto Beisheim School of Management

Page 1 --- 0%

Welcome to our used car subscription study - Willkommen zu unserer Gebrauchtwagen-Abo Studie

Choose your preferred language - Wählen Sie Ihre bevorzugte Sprache

- English - Englisch
- German - Deutsch

Page 2 --- 5%

First of all, **thank you** for helping us with our master thesis by answering this survey!

Your provided data is **completely anonymous** and your answers will help to develop a brand new offering: a subscription plan for used cars. Let us describe this more in detail.

What is a car subscription?

Instead of buying a car with a one-time purchase, you pay a monthly fee and subscribe to a car just like you would do to a magazine or a music streaming service (e.g. Spotify). Note that this is not about car sharing or renting, the car will be yours and only yours until you end the subscription. After that you return the car to your subscription provider.

What are the benefits over a one-time purchase?

Less to worry about for you:	Depreciation, repairs, insurance, winter tyres and other services can be included in the subscription plan
More flexibility:	You can quit your subscription or switch car easily
Higher cost transparency:	One flat monthly rate with no surprises for extra costs

Page 3 --- 10%

What do we expect you to do?

Imagine you want to replace your current car with a used Volvo XC40. Its specifications are:

o Two years old
o 40 000 km mileage
o Four-cylinder turbo engine
o 150 horsepower
o 5.1 l /100 km fuel consumption

Instead of buying this car **you decide to subscribe on a car subscription**.

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Page 4 --- 20%

In the upcoming section we will display **nine pages, each showing three potential subscription plans**. Please carefully choose the alternative that you think is the best.

Treat each choice as if it were an actual decision with real money on the line.

Before you start, consider:

1) The plans vary in the services included and the monthly fee you pay, but the car is always the Volvo XC40 shown earlier

2) Fuel is always excluded from the offer

3) Even if purchased, cars have a significant total cost of ownership that can also be calculated down to one month (including e.g. purchase price, registration, insurance, taxes, depreciation, maintenance, repairs, tyres...)

Page 5

6 Which subscription plan would you choose?

Repair & maintenance	Included at a Volvo repair shop	Included at a Volvo repair shop	Included at any repair shop
Tyres	Not included	Summer & winter tyres + mounting & storage	All-weather-tyres + mounting
Car pick-up & delivery service	For subscription start & repair shop visits	Not included	Not included
Insurance included with...	500€ deductible	1 000€ deductible	No deductible
Replacement car	Not included	From lower car category	From lower car category
Car condition	Minor scratches	Minor scratches	Spotless
Price per month	600 €	600 €	400 €
	○	⊗	○

-- Most important service/factor --

-- Second most important service/factor --

Page 7 --- 70%

Do you have a car and if yes, which type?

- SUV
- Sedan
- Station wagon
- Compact car
- Sports car
- Other type
- No car

How many cars does your household currently have?

- 0
- 1
- 2
- 3
- 4 or more

Page 8 --- 75%

About how many kilometers did you drive last year (or do you drive on average each year)?

Which financing option did you use for your last car?

- Purchase
- Private lease
- Company car
- Subscription
- Long-term rent
- Other

Page 9 --- 80%

Have you had a subscription plan before? Check the ones that apply

- Magazine/newspaper

- [ ] Gift boxes
- [ ] Streaming services for entertainment (e.g. Spotify, Netflix, Sky)
- [ ] Study/learning platforms
- [ ] Food/grocery delivery subscription (e.g. HelloFresh)
- [ ] Other
- [ ] None

In case you selected "other" above, please specify the subscription type

What are your estimated monthly expenses on subscriptions?

- ○ 0€
- ○ 0.01 - 4.99€
- ○ 5.00 - 19.99€
- ○ 20.00 - 49.99€
- ○ 50.00 - 99.99€
- ○ 100€ or more

Out of the reasons for subscribing stated below, how important is each of them to you? Please divide 100 points among the alternatives

I want to be flexible and able to adjust my expenses to my status in life	0
I don't have to worry that something breaks and to have resulting extra costs	0
I can adjust the service/ product to my needs and preferences	0
I help the environment by making sure the product is used after I return it	0
I can be sure that everything runs perfectly even if it isn't new when I get it	0
Other reason	0
Zu verteilende Punkte:	**100**

In case you selected "other reason" above, please specify the reason

Page 10 --- 90%

How old are you (in years)?

-- Select Age --

What is your gender?

- ○ Male

Female

Other

Which of the categories describes your gross income last year ?

- <25 000€
- 25 000 to 37 499€
- 37 500 to 49 999€
- 50 000 to 62 499€
- 62 500 to 74 999€
- 75 000 to 87 499€
- >87 500€

In which country do you live?

-- Select --

In case you live in a country other than listed above, please specify which one

How many inhabitants has the city you live in?

- <49 999
- 50 000 to 99 999
- 100 000 to 199 999
- 200 000 to 499 999
- 500 000 to 999 999
- >1 000 000

How many km is the closest city with 200 000 inhabitants away from you?

- I live in it
- 0 - 10 km
- 10 - 20 km
- 20 - 50 km
- >50 km

Page 11 --- 100%

Thank you very much for participating! The survey is now complete.

As a small thank you, we would like to give you the opportunity to test the Care by Volvo subscription in Germany for 30 days with no strings attached. If you are interested, please select it in the query below. We will then redirect you to the official offer webpage.

Check below:

- ○ I am interested and want to be redirected to the official Care by Volvo offer webpage
- ○ I am not interested in the offer

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