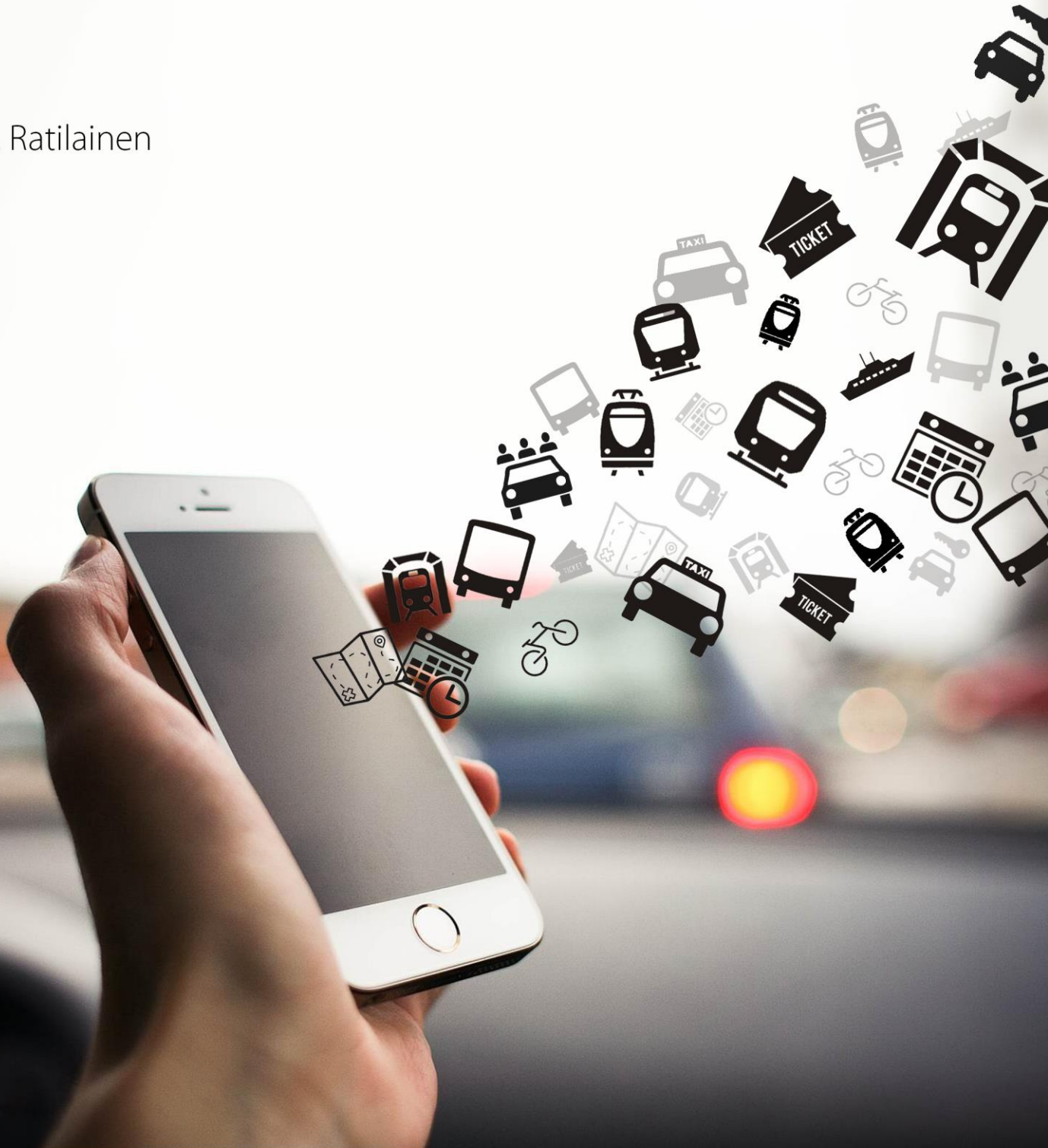


Mobility-as-a-Service

Exploring Consumer Preferences for MaaS
Subscription Packages Using a Stated Choice Experiment

H. Ratilainen



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Choice Experiment

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Preface

Tämä diplomityö on omistettu Leilalle ja Elmalle.

This master thesis has been conducted on behalf of SITO Oy and Finnish Transport Agency (FTA) as the final part of the Master of Science in Transport, Infrastructure and Logistics at the Delft University of Technology. This thesis is based on a stated choice survey for which data has been collected in the extended capital region of Finland in the spring of 2017. The aim of this thesis was to gain more knowledge on consumer preferences towards monthly mobility subscription packages. Before getting to the results, I would like to take this opportunity to thank those who have helped me during this process.

First of all, I would like to express my utmost gratitude to my committee members Prof. Dr. Ir. Caspar Chorus, Dr. Sander van Cranenburgh and Dr. Gonçalo Homem de Almeida Correia for their detailed feedback and overall guidance throughout the process of this thesis. Thank you for everything you have done for me.

Also, I would also like to thank SITO Oy and Finnish Transport Agency for facilitating this research and giving practical feedback together with Helsinki Regional Transport Authority when carrying out the survey. I hope you will find use for the results.

Moreover, I would like to thank everyone who has actively contributed to the content of my thesis. Special thanks to the people participating in the interviews and those who took part in the surveys in order for me to have data to analyse. Without you, this study would not have been possible.

Further, I would like to thank my family and friends. Special thanks to my family, Ruben, Liza and the fellow students in the Hok. You saw the light at the end of the tunnel miles before I did. I shall be forever grateful for your love and support.

Last but not least, I would like to dedicate this thesis to the late Leila Timola and late Elma Mononen for encouraging me to follow my dreams and convincing me that I was capable of achieving them. It is a shame that you never got to read the results.

Hanna Ratilainen
Delft, 2017

Executive Summary

Together with the increase in urbanisation, there is a constant need for more transportation and travellers are seeking for ways to improve the journeys they make. Simultaneously, the youth has become accustomed to using products instead of owning them and businesses, such as Uber, Netflix and Spotify are great examples of this. Similarly, people in developed countries are decreasingly interested in owning a car and, therefore, huge potential market exists to replace private cars. This can be achieved by providing mobility as a service which is both natural and appealing to its customers as it eliminates the need of owning a car and provides a convenient door-to-door mobility service. It is an interesting concept also to both profit-seeking mobility providers, health organisations as well as governments wishing to address the environmental issues caused by the use of private cars without impacting mobility. Mobility-as-a-Service (MaaS) can be provided in various ways of which monthly subscription packages are an example. However, it remains unclear what kind of packages consumers are interested in, what those interested consumers are like and how much they are willing to pay for the service. If the needs and people's willingness to pay for the service is not researched, it will not be possible to create a design for a user-friendly MaaS-service that attracts customers. Hence, the main research question of this thesis is formulated as follows:

“Which factors, in terms of consumer preferences and willingness to pay, need to be taken into consideration in the design of fixed Mobility-as-a-Service subscription packages?”

MaaS brings the local mobility services onto one shared platform that covers their door-to-door travel needs. By using the service, the customer can use it to plan their trips, book the modes, view their route and timetable as well as use the mobile platform as an electronic ticket to pay for the journey. The schematic overview of the service is shown in Figure 0.1:

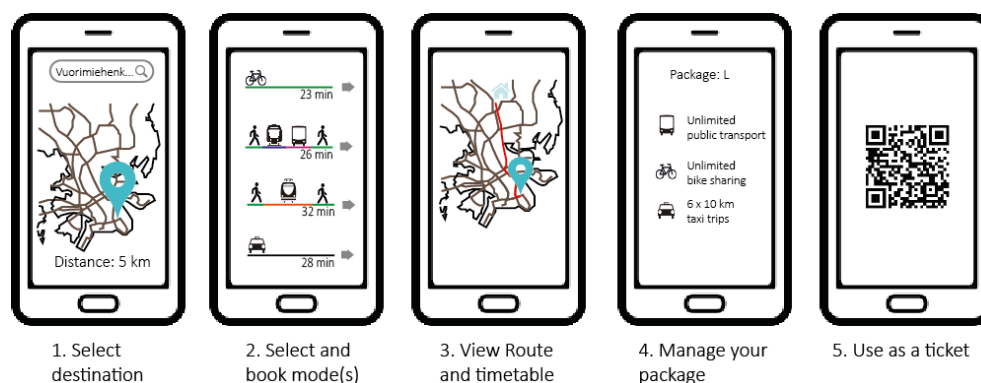


Figure 0.1: Schematic overview of how MaaS works from a consumer's perspective.

Focus of this research has been set on the fixed monthly subscription packages of Mobility-as-a-Service while pay-as-you-go and flexible subscription packages have been left out of the scope. Each mobility plan offers a consumer a certain amount of mobility services than can be used by the consumer, or the whole household. This study looks into consumers' preferences on fixed MaaS-packages and will use the collected data to estimate a choice model that can be further used to assessing potential future demand for the service. The case study area is the wider capital region of Finland, more specifically the service area of Helsinki Regional Transport Authority.

Methodology

Firstly, literature review and interviews were conducted in order to derive the definition of MaaS for this study. These sources were also used to list the factors that affect consumers' choices of purchasing MaaS packages. The final set of attributes used for the Stated Preference (SP) experiment were selected with the use of Multi-Criteria Analysis. The selected attributes can be divided into two main categories: modes and features, and they are: price, public transport (within one travel zone), bike sharing, car sharing, taxi, promise of the pick-up speed and sharing the package within the household. Attribute linearity was not assumed.

The chosen SP method for the research was stated choice in order to evaluate which attributes, and to which extent, affect travellers' choice of a mobility package. As MaaS is yet to be widely operational, SP data was the only possible solution for data collection. Hence, hypothetical subscription packages were created with the use of D-efficient design and they were presented to respondents who chose which packages (if any) they would purchase for themselves. For the purposes of this research, the packages were created based on the transport supply within the study area.

A pilot survey was conducted to design the final questionnaire. For this, prior values for parameter estimates were drawn from interviews. The main purpose of the pilot survey was to test the clarity and length of the survey as well as to find more accurate prior values for the final survey. Additionally, respondents were encouraged to give feedback on the survey which was then used, together with the results, to create the final survey. The final survey consisted of the following parts: i) introduction to MaaS, ii) choice tasks on packages, iii) choices on package add-ons, iv) questions on socio-demographic characteristics, and v) travel behaviour. Each choice task consisted of three alternatives: two unlabelled packages as well as the option to choose neither of the packages (no-choice meaning they would continue to use their current mode instead).

The survey was sent out to a set of 2,000 people living within the HSL service area in Finland (the cities/municipalities of Helsinki, Espoo, Vantaa, Kauniainen, Kerava, Kirkkonummi and Sipoo). In order to achieve a random sample, it was possible to reach the sample by mail and phone from which paper survey was selected. However, the survey was also made available online in order to speed up the data collection process. Respondents got a link to the online version together with the invitation letter. Giving feedback was made available for participants via email.

263 people filled in the survey with 252 responses being valid and possible to use for data analysis. The sample was not representative in terms of age, disposable income, gender or municipality of residence so the results cannot be automatically generalised to the general population. However, the results give a decent impression of the consumers' attitudes towards the service. In addition, 26 respondents provided qualitative data through additional feedback via email.

Data analysis was done by estimating a Multinomial Logit (MNL) model as this model is a good starting point for analysis. MNL model was evaluated both with and without interaction effects and with regard to the Likelihood Ratio Test, the model with interactions is significant at 0.01%. The included interaction effects were age and income for no-choice, and household size for the importance of sharing. Out of sample validation was performed for both models.







Findings

From the respondents, 51% (so-called "Package pessimists") did not choose any of the packages. Majority of those who chose at least one package during the survey ("Package Optimists") were young and had low disposable household income with age being a more important socio-demographic factor. However, qualitative data shows that it could be possible to attract elderly customers for the service

by providing discounts when travelling outside of peak hours. Moreover, the barrier to adopt MaaS was larger to current car users than regular public transport users due to *status quo* bias.

From the estimation of the MNL model, public transport, pick-up time, price and interaction effects got statistically significant parameter estimates while bike- and car sharing and taxi received insignificant estimates. All the parameter estimates were of expected sign and suggest non-linearity. These parameter estimates were used further to evaluate the sample's willingness to pay (WTP) for the service attributes as shown in 0.1:

Table 0.1: Respondents' Willingness-to-Pay (WTP) for MaaS-subscription package attributes.

Attribute		Model 2: MNL + interaction effects			Current services	
Name	Count	WTP	WTP for increase	Price	Difference to WTP	
	Bike sharing	6 trips	1.20 €	1.2 €	5.0 €	▼ -3.80 €
		Unlimited	6.65 €	5.5 €	4.2 €	▲ 2.42 €
	Car sharing	4 h	-21.71 €	→ 0 €	40.0 €	▼ -40.00 €
		8 h	-24.93 €	→ 0 €	80.0 €	▼ -80.00 €
	Public Transport (HSL)	15 trips	56.50 €	56.5 €	32.7 €	▲ 23.80 €
		Unlimited	117.14 €	60.6 €	52.4 €	▲ 64.74 €
	Taxi	3 x 10 km	11.57 €	11.57 €	63.0 €	▼ -51.43 €
		6 x 10 km	16.00 €	4.4 €	126.0 €	▼ -110.00 €
	Pick-up speed	30 min	29.93 €	29.93 €	N/A	N/A
		15 min	28.00 €	→ 0 €	N/A	N/A
	Sharing the package	HH: 1 person	-25.21 €	→ 0 €	N/A	N/A
		HH: ≥ 2 persons	71.29 €	71.29 €	N/A	N/A

The table illustrates how much the respondents are willing to pay for a set amount of each attribute, what is the increase for WTP from the previous attribute level, and the difference between the WTP and current market price of the service when purchased separately. For instance, respondents' WTP for public transport is ~117€ which considerably higher than the current cost of purchasing the service (~52€). Also unlimited bike sharing received a higher WTP value in comparison to current market prices while bike sharing trips, car sharing and taxi received significantly lower WTP values. Moreover, respondents valued having the mode available within 30 minutes more than 15 minutes which is an interesting finding. Lastly, members of households were willing to pay for sharing function to be added in the packages.

Furthermore, the MNL model was applied to estimate potential demand for MaaS packages. The packages were created based on the varying needs of different traveller groups (students, young professionals, middle-aged family members and seniors). The demand results demonstrate that people are more sensitive to increase in price and provision of public transport than other modes of features included in the plan. Lastly, the demand for MaaS packages by members of households of more than 2 persons can be increased by providing 'sharing the package' as an additional feature for any package rather than promoting only family packages.

Main conclusion: answering the research question

Taking consumers' preferences and willingness to pay for the service into consideration, it is crucial that the design of MaaS packages concentrates around public transport. Additionally, it is important that the service promise includes an assurance of the pick-up speed in order to increase people's trust in the service. While the main potential for the service is in the youth as well as the users of public transport, it might be possible to attract elderly to the service by creating discount schemes for travel outside of peak hours. However, regional differences may occur and, therefore, these recommendations should not be applied to locations abroad without further study.

Recommendations for MaaS providers

Although it is challenging to design fixed MaaS packages that attract large markets, the results of this research allow to conclude that the design of packages can be significantly improved by considering the following aspects:

- **Consumers are very price sensitive.** While public transport users are eager to adapt to MaaS, the service needs to be considerably cheaper in comparison to private car in order for car users to buy the service. Furthermore, elderly customers can be gained through discount schemes.
- **Public transport as the core.** In order to maximise the level of accessibility without private cars, MaaS should be built around public transport.
- **Consumers cycle either a lot or not at all.** Therefore, the inclusion of bike sharing in the packages should be unlimited.
- **Reliability of the service is important.** Consumers are willing to pay for reliability and including a promise of pick-up speed in the packages will increase their demand. Instead of a set number, it is more important to have a promise of a pick-up speed.
- **Taxi trips should not increase the price.** Although taxis are appreciated in the packages, people are more likely to look for an alternative mode than pay for the price difference.
- **Consumers need experiences from car sharing.** Before car sharing should be included in MaaS-packages, consumers need experiences from using them. Currently, the barrier to using them is too high and therefore consumers are not willing to pay for them.
- **Families are interested in sharing the package.** To cater for different families' needs, it is better to make sharing with household an additional feature rather than providing only family packages.
- **Long distance travel is well-received.** Including them lessens the need for private cars.

Recommendations for further research

This research has concentrated on looking into people's preferences and willingness to pay for MaaS packages. The next steps in research are to analyse data with more sophisticated choice models, such as Mixed Logit and Latent Class. With them, it is possible to get more insight into the different market segments and therefore pinpoint the design to meet the needs of the market segments. Additionally, research needs to look into the needs and preferences of the youth (15-17-year-olds) in addition to consumers living in areas with less dense transport infrastructure. Due to the size of the sample, it is difficult to draw conclusions on the attitudes of the future generations and geographical locations' influence on the choice behaviour. Lastly, research on alternative provision methods of MaaS, namely flexible and pay-as-you-go packages as well as their effect on the demand of fixed packages is needed. As consumers are eager to have more flexibility in their packages, it is important to know how the provision of such packages will impact the demand of fixed packages.

Contents

PREFACE.....	III
EXECUTIVE SUMMARY.....	V
LIST OF FIGURES.....	XI
LIST OF TABLES.....	XIII
GLOSSARY.....	XV
1 INTRODUCTION.....	1
1.1. Background	1
1.2. Problem Statement	3
1.3. Relevance of the Research	4
1.4. Research Questions	4
1.5. Project Scope	5
1.6. Report Structure	5
2 STATE-OF-THE-ART.....	7
2.1. Designing a Service	7
2.2. Current Design of MaaS	8
2.3. Choosing a Service	12
2.4. Proposed Definition of MaaS for this Study	15
2.5. Conclusion	16
3 METHODOLOGY.....	17
3.1. Data Collection	17
3.2. Data Analysis	19
3.3. Conclusion	22
4 INTRODUCTION TO CASE STUDY AREA.....	23
4.1. HSL Service Area	23
4.2. Transport Supply	24
4.3. Factors Influencing Choice of Packages	29
4.4. Conclusion	31
5 DESIGN OF STATED PREFERENCE EXPERIMENT.....	33
5.1. Selection of Factors	33
5.2. Pilot Survey	35
5.3. Final Survey	39
5.4. Conclusion	41

6 DATA ANALYSIS AND MODEL ESTIMATION	43
6.1. Descriptive Analysis of the Results	43
6.2. Attitudes towards Mobility Packages	51
6.3. Choice Model Estimation of Survey Data	53
6.4. Conclusion	58
7 APPLICATION OF THE CHOICE MODEL.....	59
7.1. Willingness-to-Pay	59
7.2. Package Design	61
7.3. Potential Demand of MaaS Packages	62
7.4. Conclusion	65
8 CONCLUSION AND RECOMMENDATIONS.....	67
8.1. Conclusion	67
8.2. Limitations of the Research	70
8.3. Recommendations	72
 BIBLIOGRAPHY	 75
 APPENDICES	
A INTERVIEWS.....	83
B CHOOSIN ATTRIBUTES.....	87
C PILOT SURVEY	89
D FINAL SURVEY DESIGN.....	93
E FULL FINAL SURVEY	97
F PERSONAL REFLECTION	107

List of Figures

Figure 0.1: Schematic overview of how MaaS works from a consumer’s perspective.	v
Figure 1.1: Visualisation of the research structure.	6
Figure 2.1: Example of packages provided by Whim (Maas Global, 2017).	11
Figure 2.2: End-user perspective on convenience in relation to cost when travelling long distances (Giesecke, et al., 2016).	15
Figure 2.3: End-user perspective on convenience in relation to cost when travelling short distances (Giesecke, et al., 2016).	15
Figure 2.4: Conceptual framework of MaaS for this study.	16
Figure 4.1: Visualisation of the study area in relation to the rest of the Helsinki Region	23
Figure 4.2: Availability of modes within the study area.	24
Figure 5.1: Example choice task from the final SP survey.	41
Figure 6.1: Distribution of the final survey respondents' home municipalities (N=252).	43
Figure 6.2: Age and gender distribution of the 252 survey respondents (42% male, 58% female).	44
Figure 6.3: Frequencies of annual disposable household income and occupation of respondents. (N=252).	45
Figure 6.4: Frequency of subscriptions amongst the respondents (N=252).	46
Figure 6.5: Travel behaviour of the respondents (N=252).	46
Figure 6.6: Responses to questions 21, 22 and 23 on mobility package add-ons (N=252).	47
Figure 6.7: Demand for packages within each municipality.	50
Figure 6.8: Choice task 10.	54
Figure 7.1: WTP curves with 4 different assumptions of the meaning of 'no promise'.	60
Figure 7.2: Created example packages.	62
Figure 7.3: Consumer segments' demand for packages with respect to each other in three different price points.	62
Figure 7.4: Predicted demand for plan “Large” over different traveller segments.	63
Figure 7.5: Difference in demand for packages between the two pricing schemes.	64
Figure 7.6: Difference in families' demand for packages between the exemplary packages and packages with sharing as an add-on.	65

List of Tables

Table 0.1: Respondents' Willingness-to-Pay (WTP) for MaaS-subscription package attributes.	vii
Table 2.1: Main traveller segments in the UK based on their travel needs (Transport Systems Catapult, 2015).	13
Table 3.1: Use of data for model estimation and validation.	22
Table 4.1: Fare zones and the municipalities included in them.	25
Table 4.2: Ride sharing platforms.	28
Table 4.3: Car Rental Services within HSL service area.	29
Table 4.4: Attributes found in literature and interviews that could have an influence on the choice of buying a MaaS package.	31
Table 5.1: Attributes and levels used for the SP pilot survey.	34
Table 5.2: Parameters and prior estimates for the pilot survey.	37
Table 5.3: Parameter estimates for the pilot SP survey with an MNL model.	38
Table 5.4: Attributes and attribute levels included for the final SP survey.	40
Table 5.5: Experimental design of the final SP survey.	40
Table 6.1: Correlations of the socio-demographic- and mobility-related characteristics of the respondents.	49
Table 6.2: Correlations of the socio-demographic- and mobility-related characteristics, and trading behaviour of the respondents.	51
Table 6.3: Distribution of all respondents' answers on the 10 choice tasks (N=252). Darker green refers to higher portion of respondents.	54
Table 6.4: Final SP experiment MNL model estimation results.	55
Table 6.5: Linearity of attributes.	57
Table 6.6: Model validation - multinomial logit model with (Model 2) and without (Model 1) interactions.	57
Table 7.1: Respondents' Willingness-to-Pay (WTP) for MaaS-subscription package attributes.	59
Table 7.2: Characteristics of the artificial consumers within their traveller group for Mobility-as-a-Service.	61
Table 7.3: Two differing pricing Schemes for the experimental packages.	64
Table A.1: Interviewee Characteristics	83
Table A.2: Attribute scores	84
Table A.3: Proposed sanctions for failed service promise	84
Table A.4: Additional features mentioned during interviews	85
Table B.1: Complete list of attributes that affect potential users' choice of a package.	87
Table C.1: The 14 choice tasks generated for the SP pilot survey.	90
Table C.2: Information on the respondents of the pilot survey.	91
Table D.1: Final Choice Task Design.	94

Table D.2: Cross table of Gender and HSL Season pass ownership. It can be seen that women are more likely to own a Seasonal public transport pass. 94

Table D.3: Cross table of household's disposable income and ownership of seasonal travel pass. It can be seen that majority of seasonal pass owners have below average income. 95

Table D.4: Cross table of age and smart phone ownership. The table shows that smart phone ownership decreases as the respondents' age increases..... 95

Table D.5: Cross table of age and interest in MaaS packages. It shows that interest in packages decreases when age increases. 95

Table D.6: Cross table of household disposable income and interest in MaaS packages. It can be seen that interest in packages decreases with higher income. 95

Glossary

This glossary includes also abbreviations

Capital Region

Area consisting of the cities of Helsinki, Espoo, Kauniainen and Vantaa.
(in Finnish: "Pääkaupunkiseutu")

FPRC

Finnish Population Register Centre

Helsinki Region

The Helsinki metropolitan area that consists of the Capital region and the following surrounding municipalities: Hyvinkää, Järvenpää, Kerava, Kirkkonummi, Nurmijärvi, Sipoo, Tuusula, Vihti, Mäntsälä and Pornainen.
(in Finnish: "Helsingin seutu")

HSL

Helsingin Seudun Liikenne (in English: Helsinki Regional Transport Authority - HRT).

HSL Service Area

Area consisting of the Capital Region and the following cities and municipalities: Kerava, Kirkkonummi and Sipoo.

LL

Log-likelihood

MaaS

Mobility-as-a-Service

No-Choice Alternative

Choosing neither of the provided packages with the assumption that the respondent then continues to use their current mode of transport.

MNL

Multinomial Logit Model

Package Optimist

Person who chooses a MaaS package at least once during the choice experiment

Package Pessimist

Person who never chooses a MaaS package during the choice experiment

Pick-Up Speed

Promise of how fast the mode is available to consumer from the moment of booking it

RP

Revealed Preference

SP

Stated Preference

WTP

Willingness-to-Pay

1

Introduction

This study explores the preferences that consumers have towards a new innovative mobility service, namely Mobility-as-a-Service, in terms of the monthly subscription packages that it offers. The primary research for this study consists of a survey including a series of discrete choice sets to enable the evaluation of consumers' preferences towards the structure of the packages. The main aim of this study is to provide valuable information for mobility operators on the elements that need to be taken into consideration in the construction of the subscription packages. Having such a tool may guide in turning the abstract ideas of Mobility-as-a-Service into reality and, therefore, have an impact on the challenges of future mobility.

1.1. Background

This section will provide background to the research by looking into the enabling factors of Mobility-as-a-Service (1.1.1), introducing the concept of Mobility-as-a-Service (1.1.2) and its implementation (1.1.3) as well as consumers' willingness to pay for the service (1.1.4).

1.1.1. Era of as-a-Service and Digitalisation

Due to continuously increasing urbanisation, there is a constant need for more transportation. Additionally, travellers are increasingly seeking for improvements to the journeys they make (Transport Systems Catapult, 2015). For instance, 75% of journeys made in the UK are subject to negative experiences which could have been addressed with the use of intelligent mobility (ibid.). Different intelligent solutions to mobility issues are enabled mainly as a result of two things: the era of services and the increase of smartphone use.

We are living in the era of services where the line between 'ownership' and 'access' is beginning to blur. Especially young adults have become accustomed to usership instead of ownership, thanks to businesses such as AirBnB, Uber and Netflix (The Economist, 2016). Before establishing new transport services, however, it is of importance to consider the differing preferences between age groups as older generations may be more hesitant to embrace innovative services with such speed (Spickermann, et al., 2014).

Moreover, the use of smartphones and applications increased tremendously in the past decade. They have impacted mobility already by making navigation through a city by public transport considerably easier (Holmberg, et al., 2016). They guide their users to make the most informed decisions use live information on congestion as well as disruptions due to accidents. This is crucial as people are increasingly considering their choice of transport more consciously (Spickermann, et al., 2014).

With people's limited budgets, expensive items, such as cars, have started to lose their appeal and consumers have started to question whether the convenience provided by cars is really worth it (The

Economist, 2016). Hence, consumers have become more willing to consider new ways of mobility. One way to address this curiosity is the notion of providing transport as a service which is both natural and appealing to its customers as it eliminates the need of owning a car and provides a convenient door-to-door mobility service. It is an interesting concept to not only its users but also both profit-seeking mobility providers as well as governments wishing to address the environmental issues caused by the use of private cars without impacting mobility.

1.1.2. Mobility-as-a-Service

Mobility-as-a-Service (subsequently also referred to as MaaS) aims at providing people with an alternative to the full ownership of private cars. Kamargianni et al. (2015) argue that customers' needs of flexibility, convenience and ease-of-use can only be met through the integration of separate public and private mobility systems. Moreover, Jittrapirom et al. (2017) argue that combining all modes into one service will enable the removal of obstacles that discourage people from giving up their private vehicles, and create a service that gives its users access to all areas without the use of a private car. Literature (Giesecke, et al., 2016; König, 2016) also points out that sustainability is a critical aspect of MaaS: while it is a user-centred service, it has the potential to meet the consumers' needs through more sustainable means than private modes.

The service lacks a concrete definition but in this research, MaaS refers to a service that provides subscription packages. Users can access the service on an electronic platform (mobile application) where one determines their point of departure and destination and they can travel between these two points with the use of one electronic ticket. The application provides a choice of mode, route, timetables as well as live information on the trip (e.g. disruptions) and an electronic travel ticket.

Services provided by MaaS are dependent on the local mobility supply which it brings together. MaaS unites already existing transport solutions and transport providers, including public transport (trains, buses, trams, metros), taxis, carsharing and bikesharing as well as rental cars, and offering them in a package to customers through a single subscription service (Sochor, et al., 2015b). The service is convenient to its user as it reduces the number of travel cards and subscriptions needed: the service provides the use of all the modes with a single subscription.

1.1.3. Implementing MaaS

Research (Transport Systems Catapult, 2015; Giesecke, et al., 2016; Karlsson, et al., 2016) suggests that MaaS has potential; during a trial in Gothenburg, the service was popular and its users were pleased with it. Moreover, the test users were willing to continue the use of the service later on. Additionally, MaaS is currently operational in Helsinki Region, Finland. However, Karlsson et al. (2016) point out that the key service attributes (simplicity, improved access, convenience and economy as well as a wide range of available modes) have to be carefully considered in order to implement MaaS successfully in the future.

It is important to notice that MaaS is not a 'better' solution for everyone; individuals who have no need for a car may benefit more from a conventional subscription to a public transport system. Instead, MaaS targets the people who need a car regularly and live within a decent distance to the infrastructure of large variety of transport modes so that they can benefit from MaaS. Its purpose is to promote current car users to shift from full ownership towards shared ownership of cars or even using cars merely as a service (Sochor, et al., 2014).

Although the main obstacles in the implementation process are found between service providing companies and organisations, Sochor et al. (2014) emphasise that the service must offer some relative

advantage to its users: it has to appeal on a practical (economic and convenience) level as well as facilitate their daily travel. Although new innovations are at first adopted due to interest in the innovations, such practicalities motivate consumers to continue using the service once curiosity fades. Moreover, Mulley (2017) argues that one of the most significant barriers that MaaS faces, especially in the US, is the culture of private car ownership: a cultural shift is needed away from relying on cars.

Strömberg (2015) states that the design of travel services ought to appear flexible enough in order to truly be considered as available options to travellers. Otherwise, the service will not attract users and, therefore, affect people's travel behaviour. This supports prior research (Walsh & Godfrey, 2000) which states that in order for a service provider to be successful, it must be able to react to the varying, and constantly changing, needs of the customers. The European MaaS Alliance (2016) emphasises that the service should be considered from the end-users' perspective. Consequently, it becomes interesting to look into the construction of the travel packages as they will determine the end-users' travel behaviour.

1.1.4. Willingness to Pay for MaaS

Generally, customers wish that all their needs are satisfied at once; in this case, it could be explained as unlimited travel for free. In reality, however, people make decisions by balancing pros and cons of the product/service. In the case of MaaS, customer sacrifices comprise of the monetary costs (price of the package) and non-monetary costs (e.g. effort of obtaining the package and using it).

By assessing consumers' Willingness to Pay (WTP), it is possible to explore consumers' willingness to pay for different types of services under alternative levels of prices. Kamargianni et al. (2016) state the importance of research into the willingness to pay for MaaS packages. Moreover, Holmberg et al. (2016) argue that different user groups have different willingness to pay for the service. This information will guide the creation of a user-friendly service that has the capability to affect future mobility.

1.2. Problem Statement

As suggested by Kamargianni et al. (2015), MaaS packages should be built based upon the concept of collaborative customisation in order to facilitate the needs and requirements of the user. Before a MaaS package can be offered to a consumer, however, it is crucial to understand which attributes create the most value for the customer and to learn how this value can be further improved (Parasuraman, 1997; Woodruff, 1997).

An UK-based study (Transport Systems Catapult, 2015) has looked into the key traveller segments of MaaS. This research has shed some light on the travel needs of the people and described their lifestyles. Nevertheless, the real issue in the successful formation of any product/service, is the failure of understanding the *correct* customer needs and desires (Kuzmanović, et al., 2011).

Kamargianni et al. (2016) state the importance of research into stated preference of MaaS purchases and the willingness to pay for MaaS packages (either as pay-as-you-go or monthly/annual packages). This will guide the creation of a user-friendly service that has the capability to affect future mobility. In addition, it is essential to provide more generalisable information on the preferences of multiple, different target groups so that it is possible to attract a broad range of users for the service. Consequently, the following problem statement can be derived:

“Without looking into the needs and willingness to pay of people, it is not possible to create a design for a user friendly MaaS-service that attracts customers.”

1.3. Relevance of the Research

Research can provide added value in various ways. This section will explain the relevance of this research in terms of science (1.3.1), practice (1.3.2) and society (1.3.3).

1.3.1. Scientific Relevance

Up to now, limited amount of research (Mayas & Kamargianni, 2017) exists on the travellers' preferences of MaaS packages and their contributing attributes. Although it is known that the packages need to be an economically viable option for the traveller (Sochor, et al., 2014), this study aims to understand the market segments relevant for the development of MaaS and their preferences as well as willingness to pay for monthly mobility packages.

1.3.2. Practical Relevance

This research provides information on whether the potential users of MaaS are interested in the service. Consequently, it will guide the aforementioned parties in the creation of MaaS packages in terms of the modes that should be included in the packages. It will also provide them with information on the consumers' willingness to pay for the service.

1.3.3. Social Relevance

Although MaaS is of interest mainly to private enterprises wishing to develop a product, the topic is an interesting concept also to governments as MaaS may enable the reduction of private car use. Therefore, MaaS has also potential to affect the air and noise pollution as well as congestion caused by traffic (Sochor, et al., 2015a).

Moreover, health experts have interest in the app as the packages it provides can be modified so that healthier life choices can be encouraged for instance, through the use of walking and cycling (The Economist, 2016). Therefore, this study is made socially relevant through the potential development and implementation of MaaS.

1.4. Research Questions

A series of research questions will be adopted to guide the research and to enable deeper understanding of the overarching research question:

“Which factors, in terms of consumer preferences and willingness to pay, need to be taken into consideration in the design of fixed Mobility-as-a-Service subscription packages?”

The following sub-questions have been set to guide the project and enable answering the main research question:

1. What are the characteristics of Mobility-as-a-Service (MaaS)?
2. Which factors influence consumer choices of mobility services and how can this be related to MaaS subscription packages?
3. How, and to what extent, do personal characteristics have an influence on preferences towards MaaS subscription packages?
4. What are the most significant reasons for travellers to want to use/ not want to use MaaS packages?
5. Given that we know consumers' willingness to pay for MaaS packages, what could MaaS subscription packages look like and what is their potential demand?

1.5. Project Scope

MaaS can be researched in macro (e.g. legislation), meso (infrastructure) and micro (consumers) levels as shown by Koglin (2017). While gaps in knowledge exist in all these levels, this research will concentrate on the microlevel by looking into the packages from the users' perspective.

Section 1.1.2 mentioned that MaaS can be provided, and defined, in various ways. For the purposes of this study, however, the only relevant service type is the comprehensive integration of services and providing the service in the form of monthly subscription packages. This means that the pay-as-you-go –option will not be presented to respondents in the survey. The case study area of this study is the wider Capital area of Finland. Additionally, the packages will be built based on short- to mid-distance travel needs as 97% of trips originating from the Helsinki region stay within the region as well (HSL, 2013).

1.6. Report Structure

The approach to this research can be visualised in Figure 1.1. Chapter Two provides an overview of scientific literature and current provision of MaaS. The chapter will review the relevant concepts with regards to MaaS' consumer segments, designing a service and consumers' choice between services as well as define MaaS for this study based on the different definitions provided for it until now.

Based on the literature, chapter Three consists of the methodology and methods used to collect and analyse the data. It justifies why using quantitative methods was the most appropriate approach to the area of study. Additionally, the ethical considerations that had to be taken into account throughout the research will be explained.

Chapter Four will give an introduction to the case study area and the current supply of transport infrastructure. Moreover, the chapter will provide a full list of potential factors that affect consumers' choice of fixed MaaS packages.

Chapters Five and Six will cover the Stated Preference Survey part of this research. Chapter Five will explain how the choice experiment was put together and Chapter Six follows from this by presenting the findings of the primary data collected by conducting a survey in the service area of Helsinki Regional Transport Authority. The results are divided into three parts: descriptive analysis, qualitative analysis and choice model estimation.

Chapter Seven will discuss the practical implications of the findings, including willingness-to-pay analysis in addition to the possible demand of the service based on the application of the estimated choice model from chapter Six.

The report will then conclude in Chapter Eight by reviewing what the study has done and summarising the important findings. The chapter will also discuss the limitations of the chosen methodology. Based on this, the study will recommend what needs to be taken into consideration when creating MaaS subscription package and on what could be improved when carrying out future research on the topic.

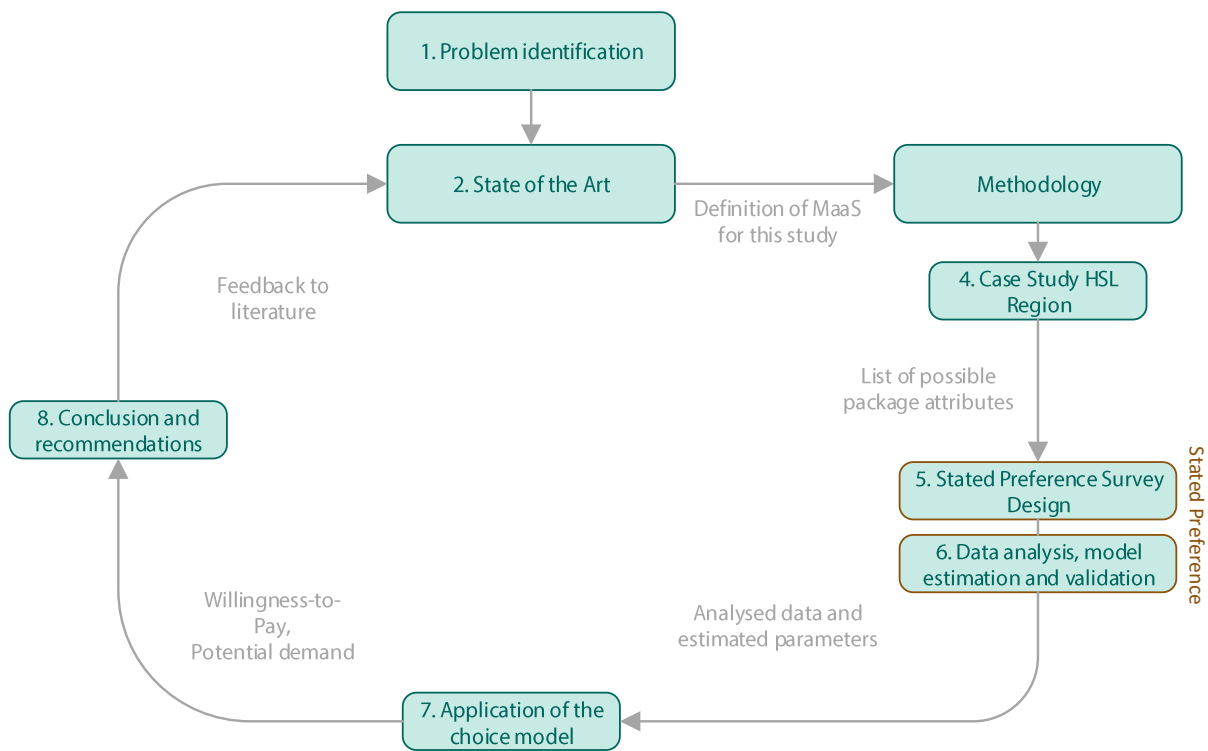


Figure 1.1: Visualisation of the research structure.

2

State-of-the-Art

This chapter will present state of the art with regards to service design (2), the current design of MaaS (2.2) and consumers' behaviour in terms of choosing services to buy (2.3). These sections will be used as input for section 2.4 that answers the first subquestion: "What is the preferred definition for MaaS in terms of maximising consumer satisfaction?"

2.1. Designing a Service

Roth and Menor (2003) state that the first steps of designing a new service include the consideration of all elements of the intended service from the perspective of both the buyer and the seller. Moreover, it has been argued by Ortt and Schoormans (2004) that technologies that can be applied within existing infrastructure, and can profit from existing procedures and operations, are the ones that will experience quicker breakthrough. This section will explore literature on service design by looking into key service attributes (2.1.1) and bundling of services (2.1.2),

2.1.1. Key Service Attributes

Key service attributes are the qualities of the service that influence service use and user experience. Karlsson et al. (2016) state that the key service attributes for MaaS are simplicity, improved access, convenience and economy as well as 'transportation smorgasbord' concept¹.

The authors (ibid.) also state these attributes have to be carefully considered in order to implement MaaS successfully in the future because they are directly linked to the usage of the service. This study will focus on the provision of various modes under the same service.

2.1.2. Bundling Services

As stated above, packages are the core service of MaaS. They have the opportunity to redefine current passenger transport by 'arranging the most suitable transport means' and combining them in a bundle of flexible travel service solutions (Kamargianni, et al., 2016). The assumption is that consumer will then value the bundle more than the individual items (Bakos & Brynjolfsson, 1999).

The most common reason for a consumer to choose a specific bundle is its cost (Adams & Yellen, 1976; Schmalensee, 1984; McAfee, et al., 1989) while other drivers include variety-seeking needs (McAlister, 1982) and product interrelatedness in terms of substitutability and complementarity (Venkatesh & Mahajan, 2009). These reasons can be also applied in the case of MaaS.

Additionally, offering transport modes as part of a bundle, customers might be exposed to modes that they do not use regularly which, consequently, has the potential to affect their mode choice (Kamargianni, et al., 2015). When the packages are built correctly, potential exists for an increased

¹ The provision of a wide range of available modes

promotion and use of sustainable modes (e.g. bike sharing).

As stated earlier, flexibility is one of the key characteristics of MaaS which can be achieved through bundling by considering the modes included in them. For instance, Jittrapirom et al. (2017) state that the possibility of using sharing services (i.e. bike and car sharing) for one way trips makes them ideal for MaaS due to their flexibility. However, Kamargianni et al. (2015) have proposed that traditional bundles do not create enough flexibility that is required to meet the needs of today's travellers.

Making sure that the heterogeneity in customers' needs is met, both users and service providers will gain greater overall benefits. Hence Kamargianni et al. (ibid) propose that the service should be customised in collaboration with the users. In 'collaborative customisation', the individual customers are allowed to articulate their needs based on which services/products will be customised for them. In the case of this research, the product refers to a MaaS package. Generally, many sectors avoid such approach as it results in the demand for a large variety of products which may lead into difficulties in the production process (ibid.). However, as MaaS packages are intangible products, this is not an issue. Results by Mayas and Kamargianni (2017) show that the utility of a package increases considerably when the provision of each mode is made flexible. Additionally, consumers were willing to pay more for flexibility in packages (ibid.).

In order to create MaaS packages on the basis of collaborative customisation, it is crucial to be able to extract as much information as possible from the user of the service in order to tailor the bundles to their needs (Kamargianni, et al., 2015). However, consumers have a limited capacity of answering questions before they start to get irritated with the process which may lead into discontinuation of ordering the service. Although customisation has benefits, collaborative customisation is out of the scope of this study.

Hence, it is vital to understand the target market prior to the creation of questions that will assist package creation. Consequently, research establishing the key market segments and factors that place individuals in each of these segments is needed (Kamargianni, et al., 2015). Additionally, more research is needed on taking into account user groups segments as well as their acceptance criteria based on user attitudes and behaviour (Giesecke, et al., 2016). When such knowledge is gained, it is possible to sketch rough packages that can be customised and, consequently, offered to consumers.

2.2. Current Design of MaaS

Distinguishing the various services that fall into MaaS is not an easy task. The most important aspect and enabler of MaaS, however, is the utilisation of digitalisation of society (Holmberg, et al., 2016). This section will map out the services and different levels of integration in MaaS to provide the reader with an idea of the complexity of the topic. More complete summaries on the varying levels of MaaS have already been accomplished by past work (Kamargianni, et al., 2015; Holmberg, et al., 2016; Kamargianni, et al., 2016; Giesecke, et al., 2016; Jittrapirom, et al., 2017) and this report will merely provide a summary of the aforementioned pieces of work.

2.2.1. Basic level: Alternative to Ownership

In its narrowest form, MaaS provides its users with simplified car ownership or an alternative to occasional car trips. The most problematic aspect of constricted integration is its sustainability aspect: although users of such services share a car with other travellers, these cars continue to contribute to congestion (Giesecke, et al., 2016).

All examples mentioned in this section work separately and create a complex network of operators. From end-users' perspective, they do not provide a true alternative to the use of a private car due to the complexity of using transport modes that are unconnected from one another (Kamargianni, et al., 2015). They all require their own tickets, payments, booking and apps. Hence, many travellers are discouraged to use them.

Simplified car ownership program – Audi Unite

Simplified car ownership refers to a service in which customers are provided an opportunity to own a vehicle together with other users. Such service is generally provided by automobile manufacturers (Holmberg, et al., 2016). For instance, Audi Unite calculates and divides the costs involved in owning and running a vehicle co-owners based on everyone's usage (Audi Unite, 2017).

Peer Transport Services – Uber and Lyft

Peer transport service controls excess capacity on the roads by allocating people to empty car seats during trips. The service provider does not own the vehicle but merely provide a platform that enables vehicle owners to be matched with travellers. For the end-user, such services do not offer much difference from conventional taxi services, except in terms of the hailing process, tipping and lower usage costs (Giesecke, et al., 2016). Uber is the most well-known peer transport service today: its platform lets users to submit a trip request that will be routed to drivers who use their own cars (Uber, 2017).

Car-sharing – Car2Go, DriveNow and City Car Club

From the end-user perspective, car sharing can be considered a hybrid between taxi and rental car. Within such services (e.g. Car2Go, DriveNow, City Car Club), users pick up and leave cars at any legally possible parking spot without worrying about parking fees (Giesecke, et al., 2016). However, a downside of such services is their range: in order to prove successful, the service requires a high degree of population density. This limits the service to large urban centres but ignores suburbia and the countryside. Giesecke et al. (ibid.) argue that the service lacks the versatility to be considered a type of mobility as a service but that it qualifies as a good part of MaaS services.

2.2.2. Simple Integration

Some cities have realised the importance of cooperation when trying to encourage their inhabitants to the use of more sustainable transport modes. Through collaboration between various parties, it is possible to create a system that meets the needs of today's city dwellers: the system must be flexible, convenient and easy to use.

Discount on Combined Subscriptions

In its most simple form, integration can mean providing discounts for combining subscriptions. For instance, in Canadian cities, a car sharing service has partnered up with a bike sharing company, local taxi and public transport providers to encourage subscription to various services. The deals include saving on the regular public transport and bike sharing passes when subscribed to a certain package deal (Kamargianni, et al., 2015).

Ticketing Integration

A step ahead from the aforementioned integration is taking place in Brussels where a car sharing company cooperates with the combined mobility operator for public transport, bike sharing and taxes (Hubert, et al., 2008; Loose, 2010). They use a smart card that can be used for all the services which has stimulated an increase in the usage of public transport. Although the card can be used for all services, the user has to make separate payments from which they can get discount.

2.2.3. Advanced Integration

While section 2.2.2 concentrated merely on the collaboration of various mobility providers, more advanced services are available. They are built on a mobility platform that combines, although to a varying extent, ticketing, payment and ICT integration. In such a service, one ticket can be used to access all the modes part of the service and one account is charged for the use of those services. In addition, the service uses merely one online interface that can be used to access information about the modes (Kamargianni, et al., 2016). Advanced integration of mobility services exists in cities around the globe (for instance, Oyster Card in London and OV-chipkaart in the Netherlands) and they have proven to show popularity among their users (Smart Card Alliance, 2003). Blythe (2004) has conducted a survey with 160 passengers in Tampere, Finland. The results show the advantages of smart cards: 90% of passengers perceived the use of an integrated travel card to make transactions easier and faster as well the boarding process smoother.

Furthermore, Moovel takes its advanced integration a step further. The service operates currently in 8 countries, including Germany, USA and Madrid. The service operates via a single smartphone platform and it brings together public transport, car sharing, national rail, taxi which all provided by separate operators. Through the mobile application, users can plan intermodal journeys, book and pay for the services (Moovel, 2017). Additionally, the mobile app provides service alerts and deals at nearby retailers. Payment has been integrated through NFC technology that enables handsets to be used as virtual bank cards (Moovel, 2017).

Moreover, Tuup (Tuup, 2017) is a MaaS-operator from Finland that brings together public transport, taxis, car and bike sharing, parking, etc. into one mobile application. In addition, the application collects high-quality mobility data from its user. This can be further used to optimise the mobility services' recommendations and users travel behaviour which may, in long run, benefit not only the travellers but also society (Giesecke, et al., 2016).

2.2.4. Comprehensive Integration: Mobility packages

With mobility packages, consumer pre-purchases usage of modes for a set period of time as one product (Kamargianni, et al., 2016). Past research (Kamargianni, et al., 2015; Holmberg, et al., 2016; Kamargianni, et al., 2016) suggests that combining mobility packages with the other levels of integration is the most comprehensive way of combining mobility services.

While Moovel operates with a fixed monthly fee for public transport and access to other services, accompanied with a pay-as-you-go function for the usage of other modes (e.g. bike), the final level of integration provides combined services by constructing packages tailored towards the needs of the user. From consumers' perspective, this is preferred as the higher the level of integration, the more convenient the alternatives to car use become.

Such services are not necessarily organised by the local public transport authority although some research discusses this (Kamargianni & Matyas, 2017). Holmberg et al. (2016) refer to these third party, commercial companies as 'extended multimodal planners'. They combine all the available transport options and confront them with real-time transport data in order to help users plan the most efficient route to their destination. They provide users with packages that can be used to meet their daily transport needs. The service works via an app where the customer can modify their subscription and plan for journeys. Currently, two types of subscription packages are provided: packages with points and travel plans.

Point Plan - Whim

Currently operational, Whim in Helsinki, Finland provides an example of providing point plans. Introduced by Hietanen (2014), the service claims to truly remove the hassle of planning and one-off payments. The packages bring together public transport, taxis, rental cars as well as car and bike sharing (Maas Global, 2017). When subscribing to the service, consumer purchases a package with points (ibid.). The purchased points can further be used to be spent on any included modes of transportation. The cost of each point decreases as the package grows which gives consumers an incentive to purchase larger packages as seen in Figure 2.1:

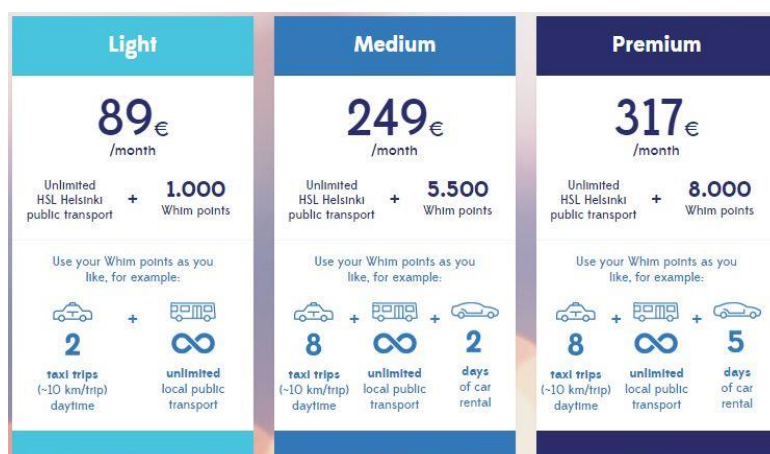


Figure 2.1: Example of packages provided by Whim (Maas Global, 2017).

Similarly to Tuup (Section 2.2.3), the application learns from the consumer's usage and suggests preferred modes for each journey. Interestingly, the service also syncs with one's calendar and suggests ways of getting to the events. As the user receives a monthly bill of all the modes, they do not need to worry about payments for each trip. However, that is only as long as they stay within the set number of points.

Travel Plans

Travel plans work similarly to abovementioned point plans. Instead of credits to be used, however, the packages of travel plans include a set amount of each mode.

This type was introduced by UbiGo project (Sochor, et al., 2015b) in Gothenburg, Sweden. A pilot study was operational for a six month period in 2013-2014 by GO:SMART and its results (Sochor, et al., 2015a) show that 93% of the 195 participants were satisfied with the service and wanted to keep using the service after the pilot study. UbiGo service combines the same modes as Whim with the difference of rewarding the user for the use of sustainable modes and providing the possibility to serve the whole household (UbiGo, 2013).

When subscribing to the service, a household pre-purchases transport with regards to their monthly travel needs: each mode is purchased separately either in terms of time or distance (Sochor, et al., 2014; Sochor, et al., 2015a). For example, public transport is registered in days in a number of zones, car sharing as hours, rental vehicles as days and taxis as a distance. Each member of household have access to the mobile application to book trips. In case of running out of credit for a specific mode, extra hours/days will be registered and billed afterwards (UbiGo, 2013). Currently, UbiGo is not operational but the operator is planning on launching an upgraded version of the service in some Nordic cities.

Moreover, MaaS has also become a topic of discussion in North America. ITS Canada (Schweiger, 2016) introduces a concept in which user purchases minutes for local, regional and international travel that

is divided over each mode. The concept describes the service as a more versatile than aforementioned ones: packages consists of rideshare, car sharing, public transport, bike sharing as well as flights. This shows that MaaS can be used to provide both mid- and long-distance mobility services (Giesecke, et al., 2016).

House Plans

Moreover, Holmberg et al. (2016) introduce a concept of 'Mobility Brokers' where mobility subscription packages are offered as part of one's rent. Realisation of this concept would require mobility services to be included in the planning process of apartment complexes and city areas from the very beginning. The goal of this service, though, is to enable densification of cities without having to plan more space for private cars as they would not be needed any longer. Currently no such developments have been established but Vinnova is planning on realising a working concept in Gothenburg, Sweden in the future (ibid.).

2.3. Choosing a Service

Adopters of new innovations can be divided into varying categories based on their innovativeness: while the first adopters are nearly obsessed with venturesomeness, the late majority approaches innovations with scepticism (Rogers, 1983, p. 247). Therefore, this section will look into the different market segments that MaaS can have (2.3.1) together as well as the theories based on which consumers choose services (2.3.2 and 2.3.3).

2.3.1. Market Segmentation

On top of the rate of adoption, companies identify different groups of potential customers with the purpose of offering them with the most appropriate product. This is done by market segmentation. The most common way to do this is based on demographic data and within the segments, marketers may refine the offerings based on the customer's lifestyle or usage (Wilson-Jeanselme & Reynolds, 2006). Segmentation by socio-demographic variables is much-used method in transport research as the socio-economic status of the traveller will heavily affect the MaaS package that is needed by them.

While the younger generation may be the main target group of MaaS due to their general usership-lifestyle, the elderly cannot be ruled out. Research by Schaie and Mollenkopf (2005) points out that the older generation is a heterogeneous group in terms of mobility needs. All subgroups have lifestyle differences (e.g. stimulation-seeking, intellectually curious and passive) as argued by Rudinger et al. (2004). As a result, some of the elderly groups can be a large potential user group of MaaS. In addition, the needs of elderly and disabled people can be vastly different.

Moreover, the difference of genders cannot be forgotten. Although the travel patterns of men and women are converging in Europe, the trips of men tend to have a single purpose whilst women have the tendency to create trip chains from all the obligations throughout the day (Schintler, 2005). In addition, different genders also experience commuting differently: women in the UK are significantly more stressed than men (Roberts, et al., 2011). Hence, Giesecke et al. (2016) point out that gender effects have to be taken into consideration in MaaS-related research. This can also have an impact on the choice of packages.

While researchers have explored various aspects of mobility across age groups, genders and nationalities, Wilson-Jeanselme & Reynolds (2006) claim that there is a problem with this standard method of market segmentation. Their argument is that this method does little to identify buying intentions across demographic variables. By using this method, it is not possible to identify the strength

of interrelationships between demographic variables and buyer intentions (ibid). Therefore, it is not possible to compute utility values which are needed to understand buyer behaviour.

A study conducted in the UK (Transport Systems Catapult, 2015) has tried to address this by creating market segments based on people's mobility needs. It identifies 5 main traveller groups (*Table 2.1*) which have been created based on two dimensions related to mobility. Firstly, the mobility lifestyle of the person: how much they travel, purpose of the travel (e.g. work/leisure) as well as the scale of the travel (local, national, international). Secondly, the travellers' mobility situation: what transport choices do they have available, where they live and work and whether they are restricted by personal or family situation.

Table 2.1: Main traveller segments in the UK based on their travel needs (Transport Systems Catapult, 2015).

#	Group Name	Demographics	Income	Travel Demand	Choice of Mode	Type of Journey
1	Progressive Metropolitans	Young professionals	High	High	PT, multi-modal transport, private	Work and leisure
2	Default Motorists	Smaller urban centres/suburbs, 26-65-year-olds	Middle	High	Private car	Work
3	Dependent Passengers	Young people, elderly, travellers with impairments	Low	Medium	Car (passenger), bus, walking	Work and leisure
4	Urban Riders	Students, home keepers, retirees and unemployed	Low	Low	Walking, bus	Work and leisure
5	Local Drivers	Suburban/rural, older people	Non-working	Very low	Private car	Leisure and personal

Based on the study (Transport Systems Catapult, 2015), the first segment, namely Progressive Metropolitans, is the clear target group for MaaS services as they are 'technology-savvy' and keen on trying new technologies also in mobility. This is also supported by Dias et al. (2017) who showed that the users of car sharing and ride sourcing services tend to be young, well-educated, higher income, working individuals residing in higher density areas. However, it has been argued in the Catapult study (Transport Systems Catapult, 2015) that all these groups have potential for adopting MaaS. For instance, providing MaaS-services to Group 3 could provide them with more independence and enable better access to travel. Additionally, Li and Voege (2017) state that MaaS might play an important role in meeting the mobility needs of the elderly.

Although it would be possible to create packages for these pre-defined consumer groups, it may still occur that their choice behaviour will be heterogeneous. For example, student and retirees (although both under group 4), may have a completely different preferences for packages. Therefore, it would be preferable to perform Latent Class Analysis on the output from the discrete choice analysis. Latent Class Analysis extracts from the data homogeneous consumer segments that possess similar preferences for MaaS package functionalities and allows for comparison on whether these segments' characteristics are similar to the ones of the Catapult Study.

Moreover, Hinkeldein et al. (2015) point out that there are three groups who are particularly prone to adopt integrated mobility services. Hinkeldein et al. (ibid.) have named these groups ecological public transport and bike lovers, flexible car-users and innovative technology-loving multioptionals. Study by Li and Voege (2017) support this by stating that these groups are often familiar with the various modes available in their region as well as their costs, and they are accustomed to use internet to compare their options.

Furthermore, results by Holmberg et al. (2016) show that travellers who can travel by public transport, but also need other modes on a regular basis, will experience MaaS as a price-worthy alternative to owning a car. Conversely, families with a high dependency on a private vehicle as well as consumers whose mobility needs can be met by public transport might not be able to reap the benefits of the service and, therefore, have a low willingness to pay for it (ibid.).

2.3.2. Customer Value Concept

Generally speaking, customers wish that all their needs are satisfied at once; in the case of MaaS an extreme case would be gaining access to unlimited travel for free. Nonetheless, it is the company's responsibility to understand which needs are the most important ones for the customer to be fulfilled (Kuzmanović, et al., 2011).

By doing this, the company is able to create the most value for the customer with an optimal use of its resources. In the case of MaaS, this means creation of optimal packages in terms of value for the customers. Value for the customer is created by certain attributes of the product which ultimately motivate the customer to buy the product and enhances their lifestyle (Walters & Lancaster, 1999). Literature (Mizik & Jacobson, 2003; Spriteri & Dion, 2004; Kuzmanović, et al., 2011) agrees that taking customer value into consideration is one of the most substantial success factors and it is a source of competitive advantage. When looking into MaaS, the source of value for the customer can be varied: while current public transport passengers might find unlimited public transport the reason to purchase a package, for car users the source of value might be in more private modes. For instance, Li and Voege (2017) state that including automated vehicles in MaaS would offer a good alternative to personal cars.

Customer value concept mainly concerns the trade-offs between the benefits the product offers to the customer and the sacrifices that the customer has to make in order to obtain it (Kuzmanović, et al., 2011). In the case of MaaS, the customer sacrifices comprise of the monetary costs (price of the package) and non-monetary costs (e.g. effort of obtaining the package and using it). On the other hand, the benefits of MaaS can be affected by, for instance, the product quality (does the package offer enough of those modes that they need), service quality (is the service promise met) and experience based quality (is the service convenient). In general, customer goes for the package that provides them with the highest Benefits-Cost ratio. In the case of MaaS, it remains unclear how much customers are willing to pay for the service.

However, Mulley (2017) argues that one of the most significant barriers that MaaS faces, especially in the US, is the culture of private car ownership. Moreover, Pankratz et al. (2017) show that customers overvalue current benefits and undervalue the gains. When moving from car ownership to MaaS, the change becomes even more difficult as the change is towards an intangible product (Koglin, 2017). While the change is difficult for car-owners, Li and Voege (2017) claim that the barrier to accepting MaaS is not as large for regular public transport users as they are already familiar with the various mobility options as well as their costs.

2.3.3. Willingness to Pay (WTP)

The objective of the Willingness to Pay (WTP) assessment is to explore the consumer's willingness to pay for different types of services under alternative levels of charges. Literature (Li, et al., 2010) shows that people place high value for travel time savings and the reliability of arrival time. Therefore, travellers are generally willing to pay more for reliable services.

However, in terms of mobility solutions, travellers are very cost-sensitive and they value convenience (Giesecke, et al., 2016). Therefore, MaaS packages need to be an economically viable option: end-users need a solution that enables them to save costs while keeping the level of convenience equal or increase convenience while keeping the cost level equal. Convenience refers to the perceptions of comfort as well as accessibility of the service, and a range of further factors that differ between all individuals. Although convenience is a fuzzy concept, it helps one to understand how, for example, trip costs and trip distance will affect consumers' behaviour (ibid.). Figures 2.2 and 2.3 give an example of convenience for some of the current MaaS offerings on different trip lengths. MaaS packages offering higher convenience should have a better business potential than others for the same costs.

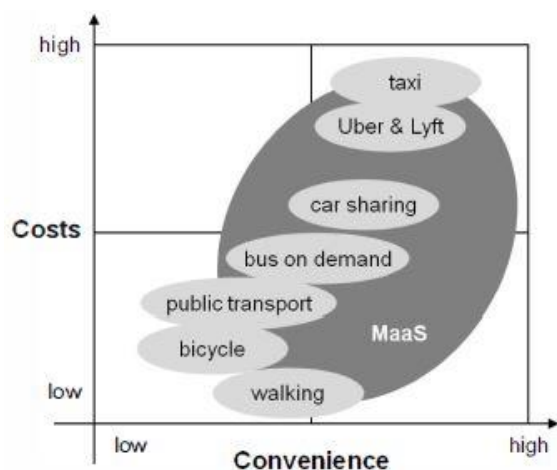


Figure 2.3: End-user perspective on convenience in relation to cost when travelling short distances (Giesecke, et al., 2016).

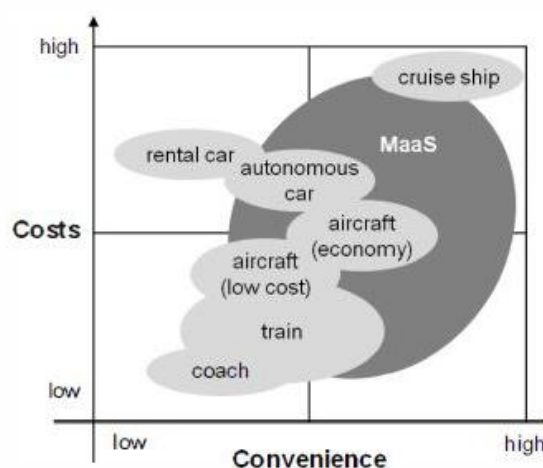


Figure 2.2: End-user perspective on convenience in relation to cost when travelling long distances (Giesecke, et al., 2016).

The figures portray MaaS' strong point. By design, MaaS does provide its user with increased convenience in comparison to purchasing single modes: for instance, it can integrate all transport means and systems, payment and booking systems as well as trip planning by using real-time data. Research on journey planning systems (Zografos, et al., 2012) shows that the system is user friendly and it reduces travellers' uncertainty together with the cognitive effort and time required for journey planning. The results also suggest that users are willing to pay more for obtaining real-time travel information. Therefore, it is important to make sure that the cost of the service provides a viable transport solution to the potential customers.

Conversely, travel cost sensitivity decreases with higher income (Schmid, et al., 2016). Interestingly, though, conservative and car-loving attitude (as with group 2, in Table 2.1) generally leads to a higher cost-sensitivity (ibid.). This may be explained by the correlation of average travel cost and mode, as well as the disrupted set of habitual travel modes (ibid.). Hence, as an alternative to owning a car, car-lovers might see bike and car-sharing as the only relevant options. As car-users are not used to high out-of-pocket costs related with car-sharing, they will choose bicycle alternative when travel costs increase (ibid.).

2.4. Proposed Definition of MaaS for this Study

As Section 2.2. shows, MaaS is a concept that lacks a concrete definition. European MaaS Alliance (2016) has given the goals of the service without really providing a concrete description: "the higher the level of mobility integration becomes, the more appealing it will become to travellers due to the

easy access to the most appropriate transport modes or services". In order to guide this research, a definition was created based on the concepts introduced in Section 2.2.

The definition takes into consideration the statement by Maas Alliance and the research will look into the highest level of integration. Although Pay-as-you-Go and flexible packages are interesting to look at, the majority of research has concentrated on fixed packages and, therefore, it is preferable to continue from that. Therefore, this study will look into comprehensively integrated mobility services and fixed mobility packages. The service that is introduced in the SP survey, and discussed in the rest of the report, can be visualised in Figure 2.4 which shows how the system works from the user's perspective.

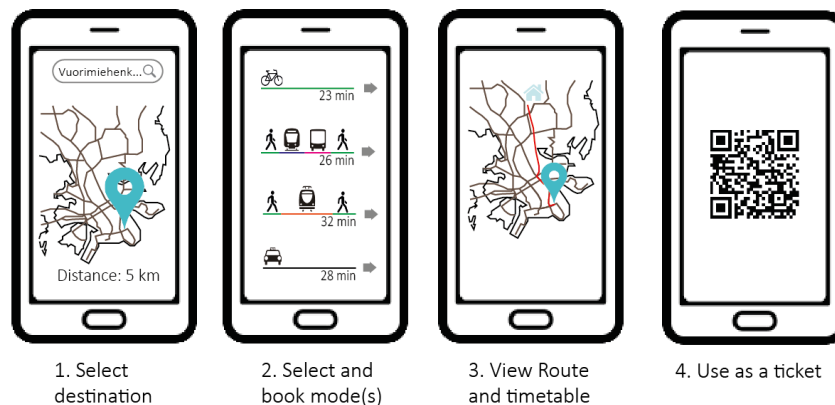


Figure 2.4: Conceptual framework of MaaS for this study.

By using the service, consumers can cover short- and mid-distance transport needs as the service brings together various modes of transportation. The service offers subscription-based monthly travel packages that consists of pre-determined amounts of each mode. When using the service, physical tickets or travel passes become unnecessary as they can be attained through the mobile platform. The mobile application allows the user to search for a route and timetables, choose between the suggested modes and book the preferred one, find live information on their trip with regards to delays and gain travel tickets.

2.5. Conclusion

This chapter has looked into literature concerning service design and bundling of services. It shows that people are mostly concerned with the price of the service when choosing a bundle although bundling also offers an opportunity to discover new attributes.

Moreover, the chapter explored how MaaS has currently been designed around the globe. As MaaS does not have a solid definition, the service has been broken down and graphed in terms of different integration levels of services.

Based on theories on consumers' choices of services, the definition of MaaS for the purposes of this study was drawn. Because consumers value the most convenient services, the highest level of integration was chosen to be used for this study. This means that the service includes trip planning, payment, live information on the trip, booking of modes as well as tickets. Moreover, the type of integration is fixed mobility packages.

In addition, it was explored what different consumer segments for MaaS look like and what their drivers for adapting to MaaS were. Literature shows that young people are more likely to accept and start using MaaS.

3

Methodology

In order to analyse which attributes indeed lead consumers' choice in terms of MaaS packages and how much they value these attributes, data was collected. Firstly, this chapter will provide the motivation for the use of quantitative research and stated preference data (3.1). This section will also give an introduction to the analysis of the data through explanation of discrete choice theory, choice modelling and model validation (3.2). This methodology will be applied in the subsequent chapters.

3.1. Data Collection

This section will first explain the role that interviews played in the research (3.1.1) after which it will look into quantitative research (3.1.2) and the choice of stated preference survey for data collection (3.1.3). This will be followed by explaining the choice of alternatives (3.1.4) and recruitment of participants for the SP survey (3.1.5) as well as ethical considerations with regards to data collection (3.1.6).

3.1.1. Interviews

Interviews had numerous goals in this research. Firstly, they were used to find out which attributes were important for Finnish consumers when choosing whether or not to purchase a MaaS-package. Together with the literature review, these sessions were used to determine the attributes for the design of the SP survey.

Secondly, the interviews were used to determine prior values for the parameters by asking the interviewees to rate the importance of each attribute they mentioned on a scale from 1 to 3. As literature review had been conducted prior to the interviews, the interviewees were also asked to rate a set of pre-selected attributes. These ratings were used to create prior estimates for the pilot survey.

Lastly, the interviews served as a way to establish the way in which the packages and the attributes should be presented to the survey participants. For instance, taxi trips were preferred in terms of distance rather than travel time.

A group of 10 people were interviewed separately for 45 minutes on the factors that affected their choice of choosing a MaaS-package. The participants represented all age groups as well as occupations. They came from 4 municipalities within the case study region: Helsinki, Espoo, Vantaa and Kerava. Appendix A gives more details on the participants and their socio-demographic characteristics.

3.1.2. Quantitative Research

Quantitative approach was ideal to the execution of the data collection due to its goal of understanding the opinions of large groups of people. Doing quantitative research enables testing whether people are fundamentally interested in the use of MaaS and, if so, which segments of the population are willing to adapt to the service.

So far, MaaS has been studied (Sochor, et al., 2014; Sochor, et al., 2015a; Sochor, et al., 2015b) through various qualitative and quantitative methods, such as questionnaires, in-depth interviews, focus groups, and travel diaries, as well as workshops and logging of questions to and problems addressed by customer service. However, only one discrete choice experiment has been conducted on the topic (Mayas & Kamargianni, 2017). This research will provide a way to explore the importance of each attribute to the selection of a package and their interdependencies as well as consumers' willingness to pay for the service which is something that has been stated as necessary research by Kamargianni et al. (2016).

3.1.3. Stated Preference vs. Revealed Preference

Typical quantitative research methods include, for instance, survey- and internet questionnaires, structured interviews, telephone interviews and systemic observations (Bryman, 2015). For the purposes of this survey, the chosen method was a combination of a paper and an internet survey as it enables maximising the received responses.

There are various ways to develop an SP-survey. For example, these include best worst-ranking, frequency data, conjoint-analysis as well as stated choice from which the two latter are the most commonly used ones (Hess & Rose, 2009). Both conjoint- and stated choice – surveys include profiles that are presented to the respondent. In this research, these profiles resemble possible MaaS-packages and variance is created by altering the levels of each attribute in the package. For instance, car sharing services are 4 and 8 hours for packages 1 and 2, respectively.

In conjoint-analysis, respondents are asked to tell their opinion on each profile on a certain scale (e.g. 1-10) from which it is possible to conclude how much each attribute affects respondents' opinion on the profile. This is a commonly used method in the planning phase of products and services (Green & Srinivasan, 1990). However, some disadvantages remain. Firstly, it is unclear whether each grade means the same to each respondent. Secondly, it is debatable whether the gap between each grade is equal: for instance, whether the difference between grades 0 and 2 is as much as between 8 and 10. Thirdly, it stays unclear whether the customer would actually purchase the tested product or service.

Hence, Stated Choice-surveying was chosen for this study. Stated Choice confront respondents with profiles from which the respondent needs to choose the one they would be ready to purchase (if any). This is the most realistic situation as people are born traders; they make decisions by comparing alternatives every day (Hensher, et al., 2005). This also makes responding to the survey less heavy on the respondent. Based on the choices, it is possible to draw conclusions on people's preferences towards different attributes as well as the compromises they are willing to make between the costs and extent of the service.

For this study, both literature and semi-structured interviews were used in order to define the attributes that were included in the SP surveys. On the other hand, the length and structure of the survey was tested with a pilot survey.

3.1.4. Alternatives

After refining the problem of the research (the preference of monthly subscription MaaS packages), Hensher et al. (2005, p. 102) mentions refining the list of alternatives as the next step in the creation process of an experimental design.

For the purposes of this stated choice experiment, respondents were asked to choose between three alternatives: two MaaS subscription packages and the "no-choice" alternative (opt-out). The choice of keeping the packages unlabelled means that none of the attributes are strictly associated with only one

of the attributes. Therefore, alternative specific constant (ASC) cannot be estimated for them. However, this can be done for the no-choice alternative.

The base alternative in the SP design is the option for choosing neither of the packages which assumes that the respondents would still be using their current mode(s). Including makes the choice decision more realistic and gives a better prediction of market penetration (Haaijer, et al., 2001). Whether this leads respondents to avoid difficult choice tasks, and thus detracts from the validity of estimated market shares, has been argued against by Johnson and Orme (1996). However, Dhar (1997) shows that increase in choosing for the opt-out alternative can be caused by two things: either none of the alternatives appears attractive or all alternatives are close to each other in preference. This causes a conflict as Huber and Zwerina (1996) show that utility-balanced alternatives are more informative and efficient in comparison to sets where one of the alternatives is clearly dominant.

3.1.5. Recruitment of Participants

A random sample was sought for with this study amongst the 15-70-year-old inhabitants in the HSL service area. The age of 15 was set as a limit as people from this age onwards can be regarded as 'independent travellers'. Although some of the services provided by Maas require a driving license, and thus age over 18, it is interesting to look into the preferences of potential future car users (15-17 years old) as well.

In order to achieve a random sample, the list of potential participants was gathered from the Finnish Population Register Centre (FPRC). Although it is possible to get a scalable, random sample from FPRC, its downside is that people can only be contacted via phone and paper from which paper surveying was selected as the preferred option. The survey was made available online via a link in order to speed up the data collection process. Link to the online survey (Appendix D) was sent with the paper survey.

The survey was sent to a group of people that was representative in terms of age, gender, area, income and household size with the hope of achieving a representative sample of the study area population. The survey was sent to 2,000 people living in the cities and municipalities within the study area in order to recruit participants. With the average response rate of 25% for surveys, it was expected that the survey would gain approximately 500 responses which was expected to be sufficient for establishing reliable parameter estimates.

3.1.6. Ethical Considerations

As generally with survey methods, certain ethical considerations had to be accounted for. Firstly, the participants ought to understand that they are not required to take part in the study, and that they are allowed to withdraw at any given time.

Secondly, they were provided with the basic details of the study as well as the identity of the researcher in order to gain an informed consent. Any possible questions the responders' had, were answered. Additionally, the respondents were not asked to fill in their names while taking the survey to assure that their anonymity was protected.

3.2. Data Analysis

This Section explains the theory and methodology used for data analysis. The analysis is based on discrete choice theory (3.2.1) and modelling choices with multinomial logit model (3.2.2) which included interaction terms. Moreover, the estimated model was validated (3.2.3).

3.2.1. Discrete Choice Theory

As mentioned earlier, in a stated choice experiment, R respondents are presented with a number of choice sets each consisting of alternatives. Moreover, the respondents are asked to indicate which

alternative they prefer in each choice set (Hensher, et al., 2005). In the case of this research, the preference refers to the mobility package they would purchase.

There are both unobserved and observed influences on the behaviour of people when choosing between packages. In other words, there are attributes that are the sources of utility (satisfaction) for each alternative (Hensher, et al., 2005). Alternative i (e.g. mobility package) has the following utility U_i :

$$U_i = V_i + \varepsilon_i , \quad (2.1)$$

where the utility U_i can be divided into two types of contributions: those observed by the analyst (V_i) and those not observed (ε_i) which is also called the error term. Observed contribution, V_i , represents a set of attributes that can be observed and measured. They are accompanied by weights that show how much each attribute contributes relatively to the observed relative utility of the alternative (Hensher, et al., 2005). This can be expressed as the following:

$$V_i = \sum_m \beta_m * x_{im} , \quad (2.2)$$

where x_{im} refers to attributes (e.g. included modes and cost) and β_m refers to the taste/weight associated with their respective attributes. While the observed attributes are mentioned in the utility function, unobserved variables (e.g. privacy and flexibility) end up in the error term, mentioned in equation 2.1. The average of all unobserved sources of utility ends up in the Alternative-Specific-Constant (ASC) β_o (Hensher, et al., 2005).

Each respondent derives an amount of utility for each of the alternatives within the set of alternatives. Anas (1983) states that people seek to have the highest utility and, thus, choose the alternative with the highest utility. Hence, the probability of the respondent choosing alternative i is equal to the probability that the utility of alternative i is greater than (or equal to) the utility associated with alternative j after evaluating every alternative in the choice set (Hensher, et al., 2005). Because utilities provide the popularity of an alternative in relation to the other alternatives within the same choice task, only differences in utilities matter.

3.2.2. Multinomial Logit Model

Multinomial logit model (MNL) is the most common model to analyse the data from stated choice experiments (McFadden, 1974). If the number of alternatives within a choice set is denoted by J , the probability P_i that alternative i is chosen from choice set n is the following:

$$P_i = \frac{\exp(V_i)}{\sum_{j=1}^J \exp(V_j)} ; j = 1, \dots, j, \dots, J. \quad (2.3)$$

In the case of this research, two of the three alternatives are packages which, ultimately, have the same utility functions as there has been no separation of various packages types (e.g. family package). The third alternative is opt-out in order to allow for more realistic choice sets (people can choose to not buy any of the packages if they wish).

MNL model form is the result of imposing the I.I.D. condition on the random components of the set of utility expressions. This has the assumption that all relevant variation in utility across individuals and alternatives is captured in V_i (Chorus, 2016). For years, this has been the only easily estimated model

in the sense of both available software and ease of interpretation and application (Hensher, et al., 2005).

Interaction Terms

Terms x_{im} from function 2.2 refer to the so-called main effects in the attributes of packages. However, it is of importance to also consider if any interaction terms will be included in the model. They are estimated in order to deduce how one independent variable depends on the magnitude of another independent variable (Corton, et al., 2004).

Interactions can be assessed by first specifying a parameter estimate and then nominating two attributes of the design to generate the interaction for them (Choice Metrics, 2014). Estimating a two-way interaction can be included in the utility of an alternative as follows:

$$U = \dots + i_i * x_1 * x_2 \quad (2.4)$$

where i_i refers to the interaction coefficient (weight of the combination) and x_1 and x_2 refer to the variables for which interaction is tested for. This interaction has to also be specified in the utility function of the model property. Considering to include interactions is important as the combination of the interactions might be more valuable than the coefficients on their own.

Interaction terms can be divided into two categories: firstly, it can be explored whether the combination of two or more attributes in a package create extra value to the consumer and, thus, increase the overall utility of the package. For instance, it might be that bike sharing is not perceived valuable on its own but when included in the package together with public transport, its value increases. Secondly, it can be tested whether interaction exists between coefficients and socio-demographic variables. For the purposes of this research, looking into interaction effects is of particular interest because it allows to explore the socio-demographic variables that affect the choice of a package.

3.2.3. Model Fit and Validation

Model fit, the explanatory power of the model, can be expressed in terms of rho-square value (Morrison, et al., 1999). However, because the choice analysis of MNL model is non-linear, it differs from the R^2 statistic associated with linear regression models. Hence a model fit between the range 0.3 and 0.4 for a discrete choice model can already be considered a good fit as it equals R^2 between 0.6 and 0.8 for the linear model equivalent (Hensher, et al., 2005).

Although the rho-square statistics tells something about the model's capability of explaining the data, it is not necessarily the best way to determine a model's fit. Therefore, other methods, such as hit-rate and log-likelihood tests are used as well. Hit rate, percentage of correctly predicted choices, refers to the fit between the actual choice of an alternative (in this case, a MaaS package) and the predicted choice, obtained by using the model how well the model predicts the choice (Chen, et al., 2015).

Moreover, log-likelihood (LL) tells about the model's capability to determine optimal values for the estimated coefficients (β 's). Because these weights constitute towards the utility of the alternative, LL tells about the model's accuracy at estimating choice probabilities. In the case of hit-rates, higher values are preferred while in terms of LL, values closer to null mean better model fit.

Validation of a choice model is often overlooked although it is a crucial step in producing an accurate and credible model. Model validation has been defined by Schlesinger et al. (1979, p. 104) as: "substantiation that a computerised model within its domain of applicability possesses a satisfactory range of accuracy consistent with the intended application of the model".

For the purposes of this study, out of sample validation was used in which part of the sample data is withheld from the model estimation process. The model is then tested by forecasting the systems' behaviour for the hold-out data in order to see whether the model is accurate or merely fitted the estimation data (Sargent, 2005). The accuracy of the predictions was tested in two ways: i) hit-rate and ii) log-likelihoods. The data were split three times in the following way:

Table 3.1: Use of data for model estimation and validation.

	1 st	2 nd	3 rd
Estimation	I + II	I + III	II + III
Validation	III	II	I

As can be seen in Table 3.1, for each round of validation, 2/3 of the data were used to estimate the model and 1/3 was used to validate the model fit. This validation process was done three times because the sample was relatively small and a lot of differences existed between responses.

3.3. Conclusion

This chapter has looked into the different ways of gathering data and the choice of stated preference survey for data collection was justified. Literature shows that there are varying ways to research people's preference on the mobility packages. However, as no revealed preference data is available, stated preference data was left as the method of collecting information. Moreover, stated choice experiment was selected as the preferred methodology within SP research.

MNL model will be used to estimate the choice model as it provides a good starting point for quantitative analysis and insights on the importance of the attributes. Moreover, the model will be validated with out-of-sample methods.

Interviews were carried out in order to get an idea for the service and people's needs for the service. Moreover, interviews were used in order to evaluate prior values and to select the attributes.

4

Introduction to Case Study Area

This chapter described the chosen case study area for this research: HSL Service Area in Finland. Data on the demand for MaaS packages can be researched in any city in the world. However, the service is dependent on the local transport supply and this study will use the transport supply of the greater capital region of Finland as the case study area. This chapter will provide an introduction to the study area (4.1) and the current transport supply in the region (4.2). This information will be used to list the possible attributes to be included in the packages (4.3) that will be used further in Chapter 5 to create the SP experiment.

4.1. HSL Service Area

The SP experiment was conducted in the HSL Service Area in Finland which includes the Finnish capital Helsinki as well as cities of Espoo, Vantaa, Kerava and municipalities of Kauniainen, Kirkkonummi and Sipoo. The service area (*Figure 4.1*) comprises the home of over 1.2 million people with the service area counting for 22% of the country's population (OSF, 2017). Finland and HSL Region provide an interesting study area due to number of reasons.

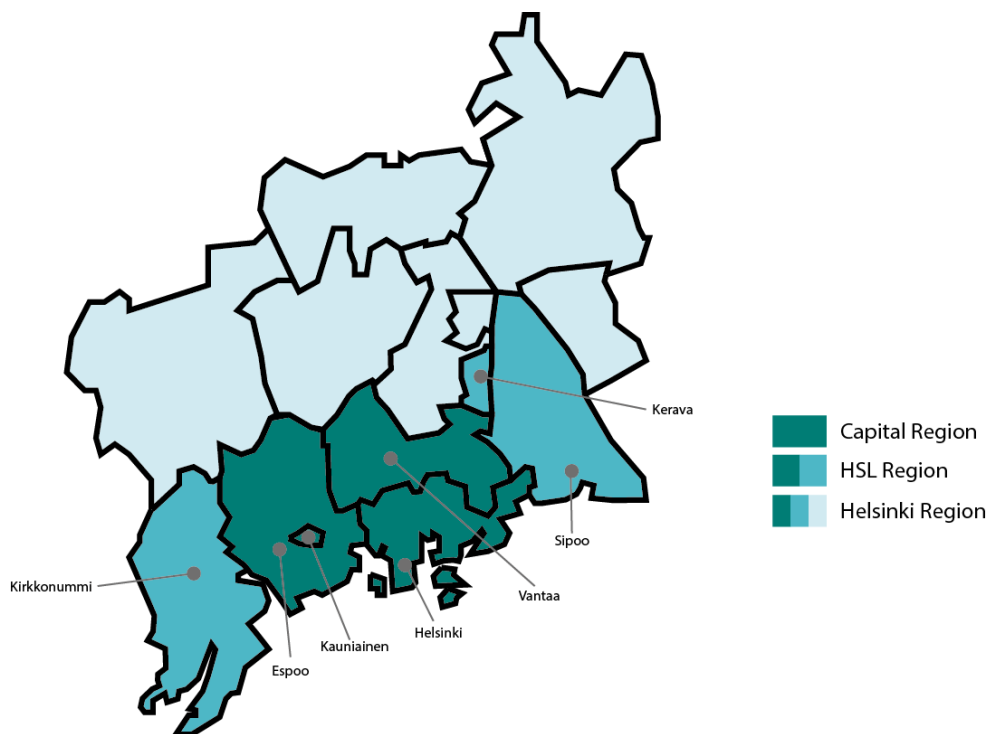


Figure 4.1: Visualisation of the study area in relation to the rest of the Helsinki Region

Firstly, the service area consists of some of the largest cities in the country and has one public transport system covering the whole area, making the cities in the area already interlinked. Secondly, commuting occurs within the area on a daily basis and various modes of transportation are available in the area with separate fees.

Moreover, Finland is the first country where the government attempts to bring all transport modes under the same regulation. The aim of this is to enable the establishment of new, innovative door-to-door mobility services, such as MaaS, in the country (Ministry of Transport and Communications, 2016a). Conducting a research in the region provides a better understanding of the Finnish attitudes towards MaaS which may be used to guide the development of the service in other parts of Finland as well as abroad.

As mentioned in Chapter 2, innovative products and services are most likely adopted when they are based upon the current infrastructure. Variety of transport options already exist in the greater capital region. Together with the governments' pursue to change the legislation into more accepting of MaaS, the region is an ideal ground for exploiting the market opportunities of MaaS. As one MaaS provider has already been established in the area, it is evident that the service has opportunities in the region.

4.2. Transport Supply

Firstly, the supply side of transport will be introduced by identifying the main transport providers in the study area. Secondly, the intermodal journey planners will be discussed.

4.2.1. Operators

This subsection will provide an overview of transport operators within the study area as well as a description of the services they provide. The analysis is based upon three elements: i) geographical coverage of the service, ii) available payment methods; and iii) mobile applications available for their users.

As can be seen in Figure 4.2, availability of modes is concentrated to the capital region, especially Helsinki. The same trend can also be seen within the provision of public transport throughout the area: while all the modes of public transport are available in Helsinki, Sipoo offers only bus transportation. As MaaS depends on its supply of modes, it can be expected that demand for MaaS-packages is also dependent on the geographical location of the customers.

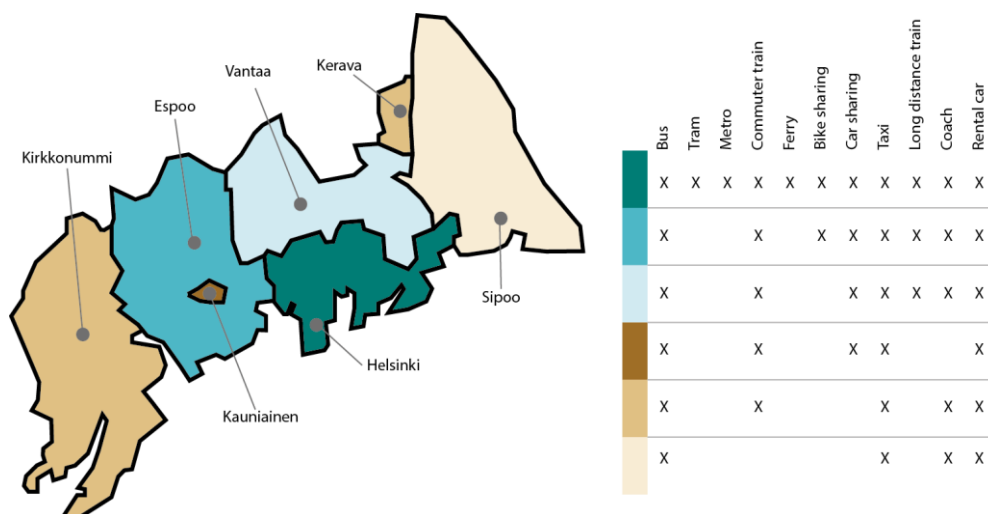


Figure 4.2: Availability of modes within the study area.

Public Transport

Helsinki Region Transport Authority (HSL) is a joint local authority whose member municipalities are Helsinki, Espoo, Vantaa, Kauniainen, Kerava, Kirkkonummi and Sipoo. HSL is responsible for planning and organising public transport in the region and improving its operating conditions. The public transport system, procured by HSL, includes bus, tram, commuter train, metro and ferry. The operation of the system has been divided by HKL (metro, trams and ferry), VR (commuter trains) and various bus operators (e.g. Veolia and Pohjolan Liikenne) (HSL, 2017).

As a body, HSL approves the public transport fare and ticketing system as well as ticket prices. They are responsible for public transport marketing and passenger information. Lastly, they organise ticket sales and are responsible for ticket inspections (HSL, 2017a). Currently, HSL provides services within the seven municipalities that are part of the joint authority. In the future, however, HSL may be planning on expanding to all the 14 municipalities in the Helsinki region (HSL, 2017).

Table 4.1 portrays the current fare system which is based on municipal boundaries. Passengers will pay extra if they leave the boundaries of the municipality they start the trip in with two exceptions: Kauniainen and Espoo which are part of the same fare zone as well as Kerava and Sipoo. The next level fare zone, Region, covers travel within the capital region: traveller pays once for travel within the municipalities of Helsinki, Espoo, Vantaa and Kauniainen. This can be expanded to Region 3 where one payment covers the whole HSL area whilst Region 2 covers the area but excludes Helsinki. Plans by HSL (2017c) include making the length of the journey affect the price more than at present with the use of a zone system which will be introduced by the end of 2017.

Table 4.1: Fare zones and the municipalities included in them.

Fare Zone	Helsinki	Espoo & Kauniainen	Vantaa	Kerava & Sipoo	Kirkkonummi
Internal	X	X	X	X	X
Region	X	X	X		
Region 2		X	X	X	X
Region 3	X	X	X	X	X

There are various ways to pay for public transport (HSL, 2017). For single trip and day tickets, four methods are offered: purchase on board, from ticket machines, via a mobile application or SMS. For more frequent travel, people can purchase two types of travel cards: seasonal tickets (season ranging from 14 to 30 days) and value tickets (with a pay-as-you-go function). Travel cards can be purchased for personal use as well as multi-user purposes.

Whilst the travel cards can be purchased and topped up with cash, debit and credit card, HSL also provides a mobile application for ticketing where travellers can purchase single tickets onto their mobile phones. From there, the actual payment happens with either debit or credit card, or having the ticket charged on your phone bill.

On top of the mobile tickets, HSL provides a journey planner, Reittiopas², that takes into consideration all the modes managed by HSL as well as bike sharing and a private car. It has not been provided via a mobile application but the website has also a mobile-friendly version. The planner is pretty customisable as it allows its user to state which HSL provided modes they prefer as well as state how much they are willing to walk and what their speed is. Moreover, the choice on the number of transfers

² www.reittiopas.fi

as well as minimum transfer margin can be stated together with accessibility needs and points via which the traveller wants to travel. The planner provides also information on the cost of the trip.

Bike Sharing

The bike sharing system of Helsinki is under the jurisdiction of Helsinki City Transport (HKL) while the operation of the scheme has been outsourced to CityBike Finland. Moreover, HSL is responsible for taking care of the bike sharing extension of Reittiopas (HSL, 2017). The bike sharing scheme is a self-service scheme.

Helsinki Bike Sharing Scheme (Kaupunkipyörä) is operative for 5 months (from early May to late October) annually. The scheme is closed down in winter due to poor weather conditions. The scheme was launched in May 2016 with 500 bikes at 50 docking stations within the city of Helsinki. However, the cities of Helsinki, Espoo and Vantaa have committed themselves to increase the modal share of cycling to 15 per cent by 2024. In 2015, the plans included expanding the system by 1,000 new bikes with the network expanding to Espoo and Vantaa by 2017 (HSL, 2015). For upcoming cycling season 2017, though, HSL is advertising 1400 bikes and 140 docking stations in Helsinki as well as 10 docking stations and 100 bikes in Espoo; leaving Vantaa and the rest of the HSL service area without any bikes. Because of the limited network, it can be expected that including bike sharing in MaaS-packages will not have significant weight in choosing for the package unless if the travellers are from Helsinki or Espoo.

Hiring and payment of bikes both can be done by debit and credit card although HSL travel card can be used for identification. The selected bike can be unlocked by entering a pin code and traveller ID on an electric screen on the bike's handlebar. At the end of the trip, the bike can be returned to any docking stations.

The pricing scheme is two-fold, meaning that the price of using the bike consists of price of a pass that includes 30 minutes of bike use at a time, and potential charges for extra time. Users can buy subscription passes for a day, week or whole seasons which include trips up to 30 minutes of use at a time. In case the user wants to use bike for a longer period of time, additional charges apply with five hours of use being the maximum time allowed without a fine. This does not compare to the OV-fiets system of the Netherlands where the user can hire a bike for as long as needed. Bike sharing has been included in HSL's journey planner.

Taxi

Currently, one needs a permit in order to have their own taxi service. In Finland, there are approximately 9,500 taxi entrepreneurs who use approximately 10,000 vehicles (Taksiliitto, 2017b). Approximately 55% of the cars operate in cities while 45% cover the rural areas making the network cover the whole of the country.

Moreover, competition is regulated by legislation. However, the Finnish Government has made a decision on lifting the legislation in order to allow for free-er competition (Ministry of Transport and Communications, 2016b). Once this happens, permits will still be required but the legislation for pricing and quantities will dissolve.

Payment methods for taxis include cash as well as debit and credit cards. The tariffs are complex and various estimators exist. Annually, the Finnish Council of State confirms the maximum taxi tariffs. The allowed maximum price for a taxi ride consists of four parts: base rate, travel rate and waiting rate as well as possible additional costs. The base rate is dependent on the time of the day (i.e. evenings, nights and Sundays hold higher base rates) whilst the travel rate is dependent on the number of people that have been transported with a higher number of people yielding a higher rate. Lastly, waiting rate is

used when waiting for the customer, whilst at traffic lights or congestion, and instead of travel rate when the speed is less than 28.5 km/h. Possible additional costs yield from pre-booking the service, transporting goods, entering the airport as well as requirement for special aid (Taksiliitto, 2017a).

Although mobile applications exist for booking taxi trips, they have not been included in trip planners. However, Uber and other person-to-person platforms are disruptive for the taxi sector. The service connects a free driver with the push of a button. The difference between these two types of services is, however, that the service does not own its fleet: it merely serves as a platform connecting people.

Car Sharing

Car sharing services have the potential to contribute to the reduction of private car ownership as they complement other modes of transport. In England and Wales, for instance, each car sharing vehicle has removed 8.6 privately owned cars from the roads in addition to leading to 19.8 cars not being purchased (Gleave, 2015). However, such an impact may be questioned in Finland, where the infrastructure and population have spread sparsely. The benefits of joining a car sharing service include the pros of owning a car without needing to worry for the costs of parking and repairs, to name a few. Nevertheless, research shows that consumers perceive car sharing as a negative thing (Mayas & Kamargianni, 2017).

The use of car sharing has been steady in the Finnish Capital. In 2010, then the only operator, City Car Club, had approximately 3,000 users with an annual growth of approximately 20 % (Volti, 2010). According to Nikula (2015), there are approximately 40 car sharing vehicles in Finland with the most important car sharing service providers in the area for this study being City Car Club, GoNow, Weegos, Shareit Blox Car, Smart Travel, 24Rent and Ekorent. Research by HSL (2013) shows that the difference between these organisations is whether the company rents out their own fleet of vehicles or do they work as dealer between privately owned vehicles.

City Car Club operates within the Capital Region (Helsinki, Espoo, Vantaa, Kauniainen) with a fleet comprising of cars, vans and minibuses. In order to use the service, customer joins the membership and books a car online or through a mobile app, unlocks the car and drives. They offer various pricing plans for different user groups. Also the car type will affect the price of usage.

GoNow, on the other hand, provides service only within Helsinki. The Service does not have a subscription fee and the consumer pays only for the time they use the service (GoNow, 2017). Each customer tops up their account that holds usage time for the car. The price includes all fees related to car usage: petrol, insurance, parking and maintenance. Cars can be booked via a mobile application. Moreover, Smart Travel, operating in Helsinki, provides the sharing service for both privately and company owned cars (Smart Travel, 2017).

While the aforementioned operators serve individuals, Weegos, Ekorent and 24Rent provide car sharing services to communities and housing associations. Ekorent offers electric cars to which the 'community' pays for a monthly subscription fee and users pay based on their individual usage (Ekorent, 2017). Each car provided for a housing association by 24Rent has the potential to aid the removal of 8-25 cars (VVO, 2017). Shareit Blox Car has been excluded in this section as it does not have its own fleet of cars but it merely brings together car owners and drivers in the need of a vehicle.

Ride Sharing

Table 4.2 shows the different ride sharing platforms available in the study region. As can be seen, not all platforms offer an application for use. Ridefy provides a platform connecting people wishing to take a ride with drivers who can offer them. During the process, a person finds a driver who will be travelling on the same date and route, contacting the driver and agreeing on a price, and finally, travelling

together. It also includes the possibility for both the driver and rider to rate their experience so that future users can make decisions on who to ride or drive with.

Furthermore, there are websites (e.g. kimppa.net, and kyydit.net) that offer a ride sharing platform. The process is similar to Ridefy but these platforms do not, however, offer a way to evaluate neither the driver nor the passenger making the service rely on trust. All the ride sharing services operate without professional drivers.

Table 4.2: Ride sharing platforms.

Name	App Availability	Rating of experience
Ridefy	Yes	Yes
Kimppakyyti.fi	No	No
Kimppa.net	No	No
Kyydit.net	No	No

Long Distance Transport

Long distance transport can be separated into two main modes: rail and coach. Neither of them are included in the Reittiopas nor can be paid for with HSL travel card. Although long distance transport does not create a major part of travellers' daily needs, can its availability be seen as an important part in people's decision to go for a service such as MaaS as they meet travellers' needs of leaving the area by other means than a private car.

Rail

The Finnish national rail company, VR oy operates also within the study area. Although the majority of rail operations are done by commuter trains, it operates partly within the same infrastructure as the national network. Intercity rail is also a convenient way for people living outside of the HSL Service area to commute to their workplace within the area. Additionally, people living within the area for this study use rail in order to reach the rest of the country.

Currently, rail travel can be paid for with debit and credit cards as well as cash but HSL travel cards cannot be used in the intercity trains. The cost depends on the distance travelled, discounts that are applied for specific populations (e.g. students and elderly) as well as how much in advance the tickets have been purchased. Additionally, multi-tickets are available that provide a discount for travel in both directions between two predefined stations (VR, 2017).

Coach

Currently, another method of reaching the regions outside of HSL service area is by coaches. Different coach operators include both regular and budget operators, for instance, ExpressBus and OnniBus respectively. The difference between these companies lays mainly in the ticketing. While regular coach tickets can also be bought on board, budget coaches accept only pre-booked online tickets. Regular coaches also accept a wider variety of paying methods: tickets can be purchased on board with debit and credit card or cash whilst online tickets can be purchased via online banking or a credit card. The only mobile application available for coaches is the one by OnniBus, called Onni Rider. However, the application is available for only limited routes and therefore will not be discussed further.

Rental Cars

Similarly to long distance transport, rental cars are not required on a daily, or not even a monthly, basis by most people. Taken into consideration the culture and geography of Finland, rental cars are an important factor to be included in MaaS in order to provide a real alternative to one owning their own car.

There are various companies providing car rental services within the study area (*Table 4.3*). All the companies require a deposit and the price of the rental will depend on the type of the car, length of rental, additional features (e.g. child seat), distance traveller, age of the driver and so on.

Table 4.3: Car Rental Services within HSL service area.

Name	App Availability
Auto Alex	No
Avis	No
Budget	Yes
Europcar	Yes
FiRent	No
Hertz	Yes
Lacara	No
Scandia Rent	No
Sixt	Yes
24Rent	Yes

4.2.2. Intermodal Journey Planners

Intermodal journey planners refer to IT systems that propose to its user a set of one or more transport services to get a person from point A to point B. It is able to optimise the trip taking into account arrival and departure times, dates and other factors (Kamargianni, et al., 2016).

The most popular journey planner for HSL service area, besides HSL's own Reittiopas, is Google Maps. However, Reittiopas will not be discussed further in this section as it covers only modes managed by HSL, and it does not have a mobile application.

Google maps can be accessed both on computer as well as a mobile app for free of charge. It provides route options which combine public transport, rail, coach, driving, cycling and walking as well as the locations for public transport stops and stations. Additionally, on-demand services, such as Uber are given as an option. It is possible to optimise the route in terms of travel time, number of transfers or distance that needs to be walked. Additionally, in case of travelling by public transport, the user can state which mode they prefer. The results can be further explored based on the main mode: walking, driving, cycling or public transport. Google maps also shows the cost of the trip.

4.3. Factors Influencing Choice of Packages

The aim of this section is to list all the factors that might influence consumers' choices of fixed MaaS packages. This list is based on literature (Chapter 2) as well as current supply of transport in the HSL region (Section 4.2.1). Moreover, interviews (4.3.2) were conducted with potential consumers in order to identify more factors. An overview of these attributes is shown in Table 4.4 together with the expected influence of the attribute. Positive influence means that consumer is more likely to choose a package while negative influence has the opposite effect. Moreover, neutral influence refers to the attribute having neither a positive nor negative impact.

4.3.1. Literature

Based on Chapter 2 and Section 4.2, there are various attributes that have an influence on consumers' choice fixed MaaS packages. It can be seen that all the modes are expected to have a positive impact while price is expected to have a negative impact on the choice of a package. This is logical as whatever is provided to the consumer in a package would have a positive impact as they are getting value for

their money. Moreover, literature mentions that socio-demographic characteristics might have an impact on the choice of the package.

4.3.2. Interviews

Generally, the participants were unfamiliar yet portrayed a positive attitude towards the service. However, some of the interviewees were emphasising that they would not be interested in being part of the first wave of users. They wanted to first see it running and have it proved that the system indeed works.

With regards to the attributes affecting their package choices, a full list of the attributes mentioned during the interviews as well as their scores are shown in Table A.2 in Appendix A. The attributes that were considered most influential (receiving total of 10 points or more) in the decision-making process are listed below in the order of importance:

1. Public transport (HSL)
2.
 - i) Price
 - ii) Pick-up time guaranteed
3. Sanction for a failed promise
4. Car Sharing
5.
 - i) Ride Sharing
 - ii) Transferring unused credit for the next month

Numbers 2 and 5 contain multiple attributes because they scored similarly by the participants. It is surprising to notice that only 3 out of the 7 attributes were related to modes while the others (excluding price) were rather concerns relating to the reliability of the service.

Public transport organised by HSL (bus, tram, metro, commuter train and ferry) were perceived to be the most important due to the systems existing infrastructure. As the participants were willing to give up (and in some case not to buy) their car in order to use the service, they needed a transport mode that could make up for the accessibility of places by private car. Car sharing was seen as the mode that would replace public transport in case of having to transport bulky or heavy objects while taxi trips were seen as a mean of emergency transportation. Car sharing was also preferred over car rental to cover short distances.

With regards to the package price, the interviewees were not willing to pay for the novelty of a package. To them, the convenience of the service was appreciated but not perceived as worth anything else than a “good marketing strategy”. Choice of attributes and their levels for the SP experiment will be discussed in Chapter 5.

Table 4.4: Attributes found in literature and interviews that could have an influence on the choice of buying a MaaS package.

Attributes		Expected Influence	Source (e.g.)
Modes	Taxi	Positive	Maas Global, 2017
	Ride Sharing	Positive	Maas Global, 2017
	Public Transport	Positive	Maas Global, 2017
	Rental Car	Positive	Maas Global, 2017
	Bike Sharing	Positive	Maas Global, 2017
	Car Sharing	Negative	Mayas & Kamargianni, 2017
	Airplane	Positive	Schweiger, 2016
	Long distance train	Positive	Interviews
	Automated vehicles	Positive	Li & Voegelé, 2017
	Coach	Positive	Maas Global, 2017
Features	Price	Negative	Maas Global, 2017
	Sharing the package with household	Positive/Neutral	Sochor, et al., 2015a
	Reward for the use of sustainable modes	Neutral	Sochor, et al., 2014
	Promise of pick-up speed	Positive	Hietanen, 2014
	Pay-as-you-Go function	Positive/Neutral	Maas Global, 2017
	Operator sanction for failed promise	Positive	Interview
	Package included in rent	Positive/Neutral	Holmberg, et al., 2016
	Unused saldo transferred to next month	Positive	Interview
	Extra bill for overrunning package	Positive	Interview
	Choice of car size	Positive/Neutral	Interview
	Luxurious car	Positive/Neutral	Interview
	Child seats	Positive/Neutral	Interview
	Shorter billing periods	Positive	Interview
	Monthly customisation	Positive	Interview
	Hybrid packages	Positive	Interview
	Sharing the package with non-household members	Positive	Interview

4.4. Conclusion

This chapter has discussed the chosen case study area of this research: HSL Region in Finland. Due to the positive legislative attitude towards MaaS and an already-established MaaS operator in the region, it is evident that MaaS has potential in the area. Therefore, it is beneficial for not only potential MaaS-providers but also government to study the effects of this service.

Although it is possible to examine people's preferences towards MaaS packages, the service is at the end of the day dependent on the local supply. Therefore, this chapter has looked into the current supply of transportation in the study area and listed the possible modes that can be included in the packages.

Moreover, the chapter discussed interviews that were carried out with local consumers in order to expand the list on the factors that impact consumers' choice on mobility packages. The qualitative results suggest that people are not as concerned on the included modes as they are on the reliability of the service.

5

Design of Stated Preference Experiment

This chapter will discuss the creation of the stated preference survey. The aim of the SP survey was to investigate the factors of influence on travellers' choices of mobility packages. This was done through a discrete choice experiment that asked people to choose their preferred package from choice tasks. Firstly, the chapter will explain the selection of factors for the choice experiment (5.1) followed by the creation of the pilot study (1.1). Based on the pilot survey, a more efficient discrete choice experiment was designed and carried out. Creation of the final SP survey will be explained in Section 5.3.

5.1. Selection of Factors

The selection process of features that have the most impact in the choice of MaaS packages is explained in this section. These factors can be divided into two categories: package attributes (5.1.1), and socio-demographic factors (5.1.2).

5.1.1. Attributes and Levels

In Arentze and Molin (2013), the issue of task complexity and manageability is pointed out: while some studies show that respondents can handle relatively complex choice tasks, it is only possible when the alternatives are "meaningful and can be easily imagined". Considering that MaaS packages are a relatively new concept and not known by the majority of consumers, a selection of attributes presented in the experiment had to be made. In order to establish the attributes with most importance for the choice of a mobility package, Multi Criteria Analysis (MCA) was used. Attributes were selected based on the following three criteria:

1. Is it *currently* realistic to include this attribute in the package?
2. How many points did the attribute receive during the interview?

As this study looks into mid-range travel, third criterion was selected for the modes:

3. Does the mode contribute to everyday mobility?

Appendix B provides the entire MCA table and the points given for each attribute. Finally, the following seven attributes were selected to be included in the stated choice experiment and they can be divided further in two categories: modes and features.

Features

- Price
- Pick-up speed
- Sharing with the family

Modes

- Public Transport
- Car Sharing
- Taxi
- Bike Sharing

In order to carry out the SP experiment, the selected attributes had to also be quantified which will be explained below. The attribute levels are a result of the quantification and are shown in Table 5.1. All of the seven attributes have been varied in three levels in order to test for non-linear effects.

Table 5.1: Attributes and levels used for the SP pilot survey.

# Attribute	Levels
1 Price	1. 105 € 2. 210 € 3. 315 €
2 Transport (HSL)	1. Not included in the package 2. 15 trips within one zone 3. Unlimited trips within one zone
3 Car sharing	1. Not included in the package 2. 4h 3. 8h
4 Bike sharing	1. Not included in the package 2. 4h 3. 8h
5 Taxi	1. Not included in the package 2. 3 x 10 km 3. 6 x 10 km
6 Sharing within household	1. Not included in the package 2. Included in the package
7 Pick-up speed	1. No promise of pick-up speed 2. 30 min 3. 15 min

Features

- **Price.** Price refers to the monthly subscription cost to the service. With the payment of the price, it is possible to obtain the modes and features included in the package. On average, one Finnish adult spends approximately 230 euros on monthly transportation (Tilastokeskus, 2012a) while the count for a Helsinki region households is 565 euros (Tilastokeskus, 2012b). During the interviews, however, the willingness to pay for MaaS varied between 100 and 300 euros which affected the chosen levels.
- **Pick-up speed.** This attribute refers to the time it takes for the mode to become available for one's use after placing a booking for a trip. During the interviews, respondents were repetitively mentioning the speed of 15 and 30 minutes when asked 'how should the mode be available for you to use'. When the package does not include a pick-up speed, there is no promise of how fast the mode is ready to use.
- **Sharing with the family**-feature refers to being able to share the content of the package with your household. This means that everyone has the possibility to benefit from the package. For instance, when the package includes an unlimited amount of public transport, everyone in the family can travel by public transport unlimitedly. As the service available on a mobile platform, multiple family members can be travelling with the same subscription at the same time.

Modes

The attribute levels for modes are based on the data from travel behaviour within Helsinki Region so that the mid-level in attributes refers to an average amount of travel per passenger in the region.

- **Public Transport.** To account for the varying needs of travellers, public transport offered in the choice experiment included travelling within 1 zone (\approx one municipality), and the respondents were offered an extra option to expand the travel area.
Within Helsinki region, each inhabitant makes approximately 0.8 trips per day equalling an average of 16 trips per month (HSL, 2013). The interviewees thought that making the count dividable by 5 was preferred and, hence, the chosen count was 15.
- **Bike Sharing.** Bike sharing has been provided so that consumers can choose a number of days that they can use the service on. On those days, they can use the bikes an unlimited number of times as long as the trip length is less than 30 minutes or less. Users pay extra for time past those 30 minutes but so that each bike can be taken out for a maximum of 5 hours. Hence the chosen levels were determined in terms of time going over 30 minutes. Hence, they were given unlimited travel and 4/8 hours saldo for trips exceeding 30 minutes.
- **Car Sharing.** Based on the interviews, interviewees stated that they would want it on average for 4 hours per month.
- **Taxi.** As stated by interviewees, taxi in the packages is for emergency trips (=trips that cannot be covered by public transport or car sharing due to their hasty nature). Therefore it was assumed that not many trips were needed on a monthly basis. Additionally, the count was kept low due to the high cost of taxi trips in the region.

5.1.2. Personal Characteristics

Socio-demographic factors cannot be included in the packages yet they have a significant impact on consumers' preferences and, therefore, whether one chooses any of the MaaS packages. Moreover, current behaviour has an impact on the willingness to adapt to MaaS. Therefore, the following characteristics variables were selected to be tested in the SP survey:

- | | |
|----------------------------------|---------------------------------------|
| ○ Gender | ○ Disposable Household Income |
| ○ Age | ○ Occupation |
| ○ Municipality of Residence | ○ Household size |
| ○ Current travel behaviour | ○ Number of children in the household |
| ○ Current mobility subscriptions | |

5.2. Pilot Survey

This section will describe the process of creating the pilot SP survey by looking at the design (5.2.1), sample (5.2.2), results of the pilot survey (5.2.3), including the parameter estimates.

5.2.1. Designing SP Pilot Survey

The following three steps have to be taken in order to create a stated choice experiment (Choice Metrics, 2014): i) specifying a model, ii) generating the design, and ii) constructing a questionnaire. This section will explain these steps.

Step 1: Model Specification

Model specification is the first step when creating a stated choice experiment. This includes choosing the alternatives for the experiment as well as the attributes that need to be included for each alternative (Choice Metrics, 2014). As explained in Chapter 3, three alternatives were chosen for the experiment: two MaaS-packages and no-choice (aka "opt-out"). As the purpose of a stated choice experiment is to estimate a specific model, the complete specification of the utility functions for each alternative needed to be stated.

As the goal of this study was to find a general preference for attributes within packages rather than preference between specific packages, the alternatives were unlabelled and had the same utility

functions with generic attributes. At the beginning of the experiment, no interaction effects were included in the utility functions. Finally, nonlinear effects were tested for the modes and pick-up time. This was done by using dummy-coded variables which introduced extra parameters to be estimated. Equations 5.1. and 5.2. introduce the specified utility functions for the packages and opt-out:

$$U_{Package} = \beta_{Price} * Price + \beta_{PT_T} * PT_T + \beta_{PT_U} * PT_U + \beta_{BikeS_4} * BikeS_4 + \beta_{BikeS_8} * BikeS_8 + \beta_{CarS_4} * CarS_4 + \beta_{CarS_8} * CarS_8 + \beta_{Sharing} * Sharing + \beta_{PickUp_{30}} * PickUp_{30} + \beta_{PickUp_{15}} * PickUp_{15} + \varepsilon_{Package} \quad (5.1)$$

$$U_{OptOut} = ASC_{OptOut} + \varepsilon_{OptOut} \quad (5.2)$$

where:

- $U_{Package}$ = utility of alternative: package (1 and 2)
- U_{OptOut} = utility of alternative: opt-out
- β_{Price} = general parameter for price
- β_{PT_T} = generic parameter for the first component of alternative “public transport”
- β_{PT_U} = generic parameter for the second component of alternative “public transport”
- β_{BikeS_4} = generic parameter for the first component of alternative “bike sharing”
- β_{BikeS_8} = generic parameter for the second component of alternative “bike sharing”
- β_{CarS_4} = generic parameter for the first component of alternative “car sharing”
- β_{CarS_8} = generic parameter for the second component of alternative “car sharing”
- β_{Taxi_3} = generic parameter for the first component of alternative “taxi”
- β_{Taxi_6} = generic parameter for the second component of alternative “taxi”
- $\beta_{Sharing}$ = generic parameter for sharing
- $\beta_{PickUp_{15}}$ = generic parameter for the first component of alternative “pick-up speed”
- $\beta_{PickUp_{30}}$ = generic parameter for the second component of alternative “pick-up speed”
- ASC_{OptOut} = alternative specific constant for opt-out
- $\varepsilon_{Package}$ = random error component for package
- ε_{OptOut} = random error component for opt-out

Next, the model type was chosen. As discussed in Section 3.2.2, MNL model was chosen for the study. The next section will explain the next step in the process: generation of the experimental design.

Step 2: Generation of the Experimental Design

Experimental design is used to describe the hypothetical choice situations that will be presented to the respondents (Choice Metrics, 2014). Two types of experimental designs exist: orthogonal and efficient designs. While an orthogonal design minimises the correlation between attributes, an efficient design aims to result in data that generates parameter estimates with as small standard errors as possible (ibid.). The use of efficient designs is preferred as they are able to outperform orthogonal designs by maximising the information gathered from each choice task. Efficient design is also preferred for this study as it allows including constraints to the design. This way, the packages can be made more realistic: for instance, sharing should not be included in the cheapest package and the most expensive packages should always provide unlimited public transport. However, efficient designs require prior parameter estimates. Hence, the design efficiency relies on the accuracy of the prior parameter estimates (ibid.). The estimation of prior values for the purposes of efficient design is described in Appendix C.1. The prior estimates are presented in Table 5.2:

Table 5.2: Parameters and prior estimates for the pilot survey.

#	Attribute	Parameter	Prior estimate
1	Price	β_{Price}	-2.5
2	Public Transport	β_{PT_T}	2
3		β_{PT_U}	2.4
4	Car Sharing	β_{CarS_4}	0.8
5		β_{CarS_8}	1
6	Bike Sharing	β_{BikeS_4}	0.2
7		β_{BikeS_8}	0.3
8	Taxi	β_{Taxi_3}	0.5
9		β_{Taxi_6}	0.6
10	Sharing	$\beta_{Sharing}$	0.2
11	Pick-up speed	β_{PickUp_30}	0.8
12		β_{PickUp_15}	1

After having the prior estimates, software package Ngene was used to create hypothetical choice tasks for the SP survey. Because efficient designs do not need to be orthogonal, small number of choice situations are required in comparison to orthogonal designs. This is preferable also from the respondent fatigue perspective. The number of required choice situations can be determined with Equation 5.3. (Choice Metrics, 2014):

$$\# \text{ choice situations} = \frac{\#parameters}{(\#alternatives \text{ per choice tasks} - 1)} = \frac{13}{(3 - 1)} \approx 7 \quad (5.3)$$

When linearity is assumed for parameters, the number of parameters equals the number of attributes. However, that was not the case for all the attributes in this study and some attributes had two parameter values. Hence, the number of parameters is 13: 2 attributes have 1 parameter, 5 attributes have 2 parameters and opt-out has ASC as a parameter.

Due to the unreliable prior values, it was preferable to increase the number of choice tasks for the pilot survey to 14. This enabled gaining more information on the respondents' decision making process and, hence, better prior estimates for the final SP survey. The syntax used to generate the 14 choice situations together with the final choice tasks results from running the software is presented in Appendices C.2 and C.3, respectively.

Step 3: Constructing the Questionnaire

Each row refers to a choice task which needed to be transformed into a question understandable by respondents. The pilot SP survey was conducted online and it was created with Google Forms. The survey was created in Finnish and it had four sections. The first section provided participants with an introduction to MaaS. They were told how the service worked and which modes were included in it. The second part comprised 14 on-screen choice tasks to provide mobility packages from which the respondents were asked to choose.

Section three collected information on underlying socio-demographic features as well as information on current travel behaviour (e.g. household size, disposable income, frequency of usage of transport modes). Finally, section four was used to gather opinions on the structure of the survey that could be used to improve the design of the final survey. Additionally, open ended questions were asked on the service.

5.2.2. Sample

The pilot study sample was gathered through the snowball method in which the survey was first distributed to a couple key persons who then distributed the survey further to people they knew (Goodman, 1961). It was distributed via social media to family and friends of the author after which they were encouraged to pass the survey link forward to their acquaintances. It was explicitly stated that the survey is meant for people living within the HSL service area. People were asked to continue the distribution of the survey until a sufficient sample size was gained. Based on the feedback from the pilot survey, it was possible to form the main survey.

5.2.3. Results of the Pilot Survey

In total, 46 respondents completed the pilot survey. Socio-demographic characteristics of the pilot survey respondents are presented in Table C.2 in Appendix C. The majority of respondents understood the concept of MaaS and some were familiar with it already. In the feedback section with regards to the structure of the survey, respondents indicated that the introduction was too long and that they would prefer a short film that explained the concept instead of text. Additionally, they stated that the order of presenting additional features and choice tasks should be changed so that “one can get the choice situations out of the way”.

With regards to the choice tasks, majority of respondents stated that 14 choice situations was too much and 33% of the respondents never chose a package. The majority of these non-traders reasoned this by stating that the packages were too expensive. Additionally, the task of choosing between packages was not clear to everyone. Many perceived it difficult to choose between packages and the presentation of the attributes was difficult to understand. Some respondents specified that this was due to the table presentation of the alternatives. Especially bike sharing was perceived to have a confusing explanation and its provision was seen as excessive.

Parameter Estimates

MNL model was estimated by using an open source freeware *BioGeme* for which data and model files were needed. Appendix C.45 shows the *BioGeme* files used for the model estimation and the results of the model estimation are presented in Table 5.3. These parameter values were then used as priors in the creation of the main survey.

Table 5.3: Parameter estimates for the pilot SP survey with an MNL model.

#	Attribute	Parameter	Parameter value	Robust Std error	Robust t-test
1	Price	β_{Price}	-1.26	0.188	-6.85
2	Public Transport	β_{PT_T}	0.833	0.361	2.32
3		β_{PT_U}	1.97	0.343	5.75
4	Car Sharing	β_{CarS_4}	0.318	0.245	1.23
5		β_{CarS_8}	0.589	0.224	2.6
6	Bike Sharing	β_{BikeS_4}	0.03	0.236	0.1
7		β_{BikeS_8}	0.287	0.221	1.1
8	Taxi	β_{Taxi_3}	0.35	0.236	1.78
9		β_{Taxi_6}	0.711	0.228	3.27
10	Sharing	$\beta_{Sharing}$	0.527	0.22	2.48
11	Pick-up speed	β_{PickUp_30}	0.381	0.234	-0.55
12		β_{PickUp_15}	-0.129	0.218	1.72
13	Opt-out	ASC_{OptOut}	1.87	0.443	4.01

Significant parameter estimates (at 5%) have been marked with **bold**.

Negative values have a deterring influence on the choice of a package and positive values have an encouraging influence on the overall utility of the package. The attributes' influence is of expected sign for every attribute except car sharing which was predicted to be negative. However, the extent of the influence was expected for the parameters: while unlimited public transport has the largest positive influence on the choice of the package, the price of the package is a major deterrent. This seems logical for a MaaS-package.

Although not all parameters were found to have significant values (CarS_4, bike sharing, Taxi_3 and pick-up speed), they are not dropped from the design of the final survey as this would mean dropping majority of the modes out of the packages. Moreover, although the estimates are not statistically significant, they provide better estimates for the weight of each attribute than making them zero. It may also be that the insignificance of some of the parameters can be caused by the low number of respondents or because the choice tasks were too complex for the participants in which case not all the attributes are taken into consideration when making a decision between the packages. Hence all the values gained from the pilot study will be used for the final survey.

No significant interactions were found between the attributes and, therefore, interaction effects are not included in the design process of the final survey.

5.3. Final Survey

As explained earlier, the final SP survey was designed based on the results of the pilot survey. This section will describe the changes made to the pilot survey (5.3.1) and the design of the final survey (5.3.2).

5.3.1. Adjustments from SP pilot survey

Design of the main survey was updated with accordance to the given feedback from the pilot SP survey with the following main categories:

SECTION 1: Introduction and structure of the survey

A short introduction film was added to the beginning of the survey for those who responded to the survey online. This was used to replace the written explanations of MaaS. For the paper survey, the written introduction kept but it was made shorter. Also, the order of sections was changed so that the choice tasks were presented to the respondents first in order to have the most demanding part of the survey first. Its purpose was to ensure that respondent fatigue was minimised during the choice tasks and, therefore, to have as good quality data as possible.

SECTION 2: Attributes

In order to attract more respondents to choose for packages, the package prices were reduced to 79,158 and 237 euros. Additionally, bike sharing attributes was changed to be simpler so that the mid-level for bike sharing was 6 monthly trips of 30 minutes (the average number of bike sharing trips performed by each user) and highest level was unlimited number of trips of 30 minutes or less. However, the priors received from the pilot survey were kept for the new bike sharing variables as no prior values were known.

SECTION 3: Choice Task Design

In order to limit respondents' fatigue, the number of choice tasks was reduced to 10. Although it would be doable to collect data with 7 choice situations, 10 choice tasks provide more information on the preferences and was thus favoured. Moreover, the presentation of packages was made more visually appealing.

5.3.2. Final SP Survey Design

Table 5.4 shows the attributes and attribute levels which were used in the final SP experiment. More detail on the coding of parameters for Ngene can be found in Appendix D.1. As mentioned earlier, the number of choice situations was reduced to 10 and D-efficient design was used. To deal with the uncertainty about prior estimates, the choice tasks were created using a Bayesian efficient design. This efficiency type optimises the expected efficiency of the design by making use of random priors that have been described by random distributions (Choice Metrics, 2014). This was accounted by introducing also the standard deviations to Ngene.

Table 5.4: Attributes and attribute levels included for the final SP survey.

#	Attribute	Levels		
	Name	Low	Middle	High
1	Price	79 €	158 €	237 €
2	Public transport (HSL)	Not included in the package	15 trips within one zone	Unlimited trips within one zone
3	Car sharing	Not included in the package	4h	8h
4	Bike sharing	Not included in the package	6 trips of 30 minutes	Unlimited trips of 30 minutes
5	Taxi	Not included in the package	3 x 10 km	6 x 10 km
6	Sharing within household	Not included in the package	Included	-
7	Pick-up speed	No promise of the speed	30 min	15 min

Moreover, with every choice task, question “Why did you not choose either of the packages?” was added that the respondent was required to answer in case of opting for no-choice. This question was included to gather preliminary information on the potential reasons why respondents did not want to buy any of the packages.

The resulting design was checked for dominant packages and MNL utilities were calculated by hand. Table 5.5 shows the resulting 10 choice situations. The design does not have attribute level balance which means that not all attribute levels are shown an equal number of times to the participants. Therefore, the standard errors of some parameters might be higher or lower. No interaction effects were included in the design beforehand. This is because no interactions between different attributes were found during the pilot study.

Table 5.5: Experimental design of the final SP survey.

Choice Task	Package 1							Package 2							Opt-out
	Price	Public Transport	Car Sharing	Bike Sharing	Taxi	Sharing	Pick-up speed	Price	Public Transport	Car Sharing	Bike Sharing	Taxi	Sharing	Pick-up speed	
1	3	3	3	3	2	1	2	1	1	2	2	3	1	1	
2	1	1	3	3	3	1	3	3	3	2	2	2	2	2	
3	2	3	3	2	2	2	3	1	2	3	1	1	1	3	
4	2	3	2	3	1	2	1	2	3	2	1	2	1	1	
5	2	3	2	2	3	1	3	2	3	3	1	1	2	2	
6	3	3	2	1	2	2	2	1	3	2	3	2	1	2	
7	3	3	2	3	3	2	2	3	3	3	2	3	1	3	
8	1	2	3	1	3	1	2	3	3	1	3	3	2	3	
9	1	2	2	2	2	1	3	2	3	2	1	3	2	3	
10	1	3	1	2	3	1	1	1	2	3	3	3	1	1	

Appendix E shows the full final survey presented to respondents. The approximated time to complete the survey was 15 minutes. The survey consisted of five parts: i) introduction to MaaS, ii) 10 choice tasks between packages (example choice situation in Figure 5.1) and no-choice, iii) corresponding questions in the case of opt-out, iv) 3 questions with regards to interest on additional features, v) questions on socio-demographic characteristics, and vi) questions on current travel behaviour. Additionally, a raffle was organised in order to attract a larger number of respondents: the respondents had a chance of winning one of three travel gifts cards for HSL when fully completing the survey.

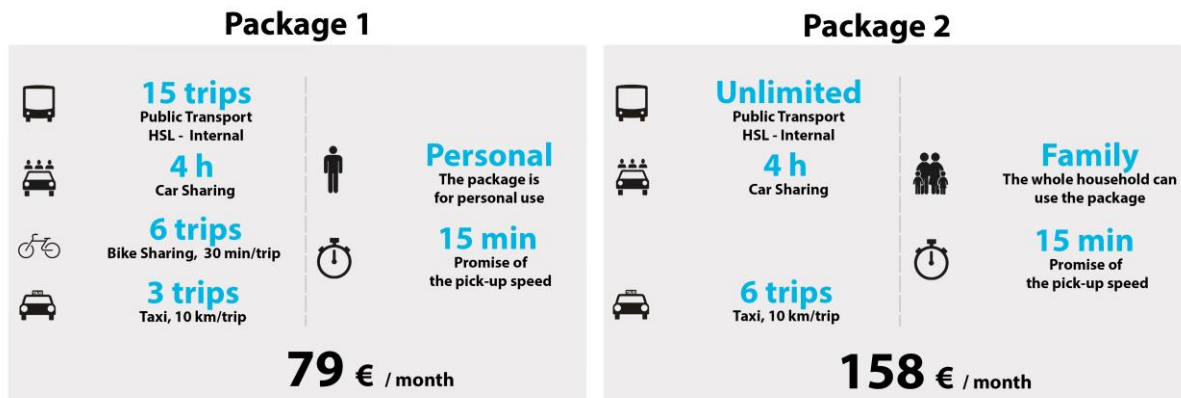


Figure 5.1: Example choice task from the final SP survey.

5.4. Conclusion

This chapter has explained the design of the D-efficient pilot and final surveys. Seven attributes were selected for the designs of the discrete choice surveys based on interviews, literature, current supply in the study area, and the attributes' importance in terms of daily mobility. Because linearity could not be assumed for all the attributes, the attributes were divided into total of 13 parameters that were used to design the choice tasks. Another set of interviews were conducted in order to generate priors for the pilot study.

The results of the pilot survey show that 7 out of 13 parameters were significant: price, public transport (both trips and unlimited), car sharing (highest amount), having a package, the sharing function and taxi (the highest amount). These make sense as public transport is in the heart of the service and the more of each mode has been added, the more people value them.

The pilot study's parameter estimates were used as priors for the final survey design. It is expected that the final survey will provide more reliable estimates to each parameter and, therefore, can give better insight to the influence of each attribute as the number of respondents will be higher. Chapter 6 will discuss the results of the final survey.

6

Data Analysis and Model Estimation

In this chapter, analysis of the data from the final survey will be discussed together with the estimation of a MNL model. This information will be used to answer the following sub-research questions: “How, and to what extent, do personal characteristics have an influence on preferences towards MaaS subscription packages?” and “What are the most significant reasons for travellers to want to use / not want to use MaaS packages?” The chapter begins with a descriptive analysis of the results (6.1) which is followed by a discussion of the participants’ attitudes towards the service (6.2). Lastly, section 6.3 will describe the choice model estimation and validation process.

6.1. Descriptive Analysis of the Results

The final SP survey gained 263 respondents. However, 11 of the respondents did not complete all the choice tasks and, therefore, their responses were disregarded. Hence, the responses of 252 individuals will be used for analysis. SPSS software was used to conduct a statistical analysis of the characteristics of respondents. A differentiation is made between the socio-demographic characteristics (6.1.1) and the answers on the mobility-related characteristics (6.1.2). Lastly, the section will discuss the correlations between characteristics (6.1.3).

6.1.1. Socio-Demographic Characteristics of Respondents

Various questions were asked on the socio-demographics of the respondents and they will be explained below. Figure 6.1. shows the respondents’ home municipalities. It can be seen that all respondents were residents of the study area as intended. Additionally, majority of the respondents are from Helsinki which makes sense as it is the biggest municipality in the region in terms of population. Though the proportions of the municipalities are rather representative, the number of respondents from small municipalities (Kerava, Kirkkonummi, Sipoo) is so small that no sound conclusions can be drawn for the residents’ attitudes from these municipalities.

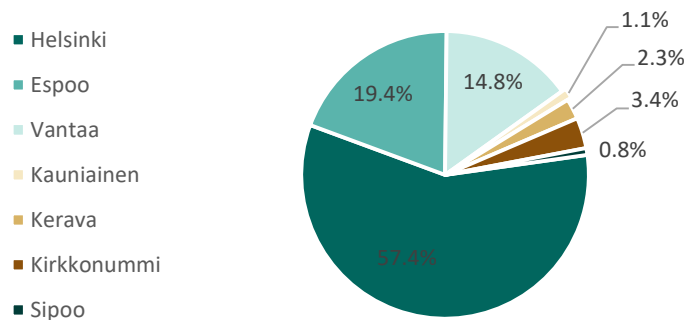


Figure 6.1: Distribution of the final survey respondents' home municipalities (N=252).

Although all age groups are represented in the sample, the over 65's have been overrepresented as can be seen in Figure 6.2. The high count of elderly people causes the sample's average age to be considerably higher than the general population of the study area: 49 and 41 years respectively. In addition, the sample was unrepresentative in terms of gender as males were unrepresented. Whilst the survey gained 42% male and 58% female respondents, in reality, the study areas population comprises of 49% male and 51% female.

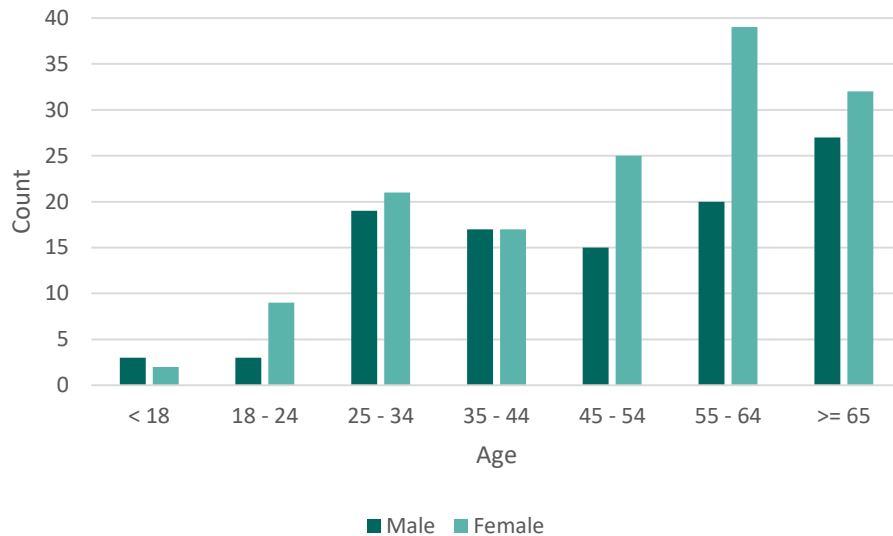


Figure 6.2: Age and gender distribution of the 252 survey respondents (42% male, 58% female).

Figure 6.3 shows the disposable household income and occupations of the respondents. Average household income of the sample is 34,000 € while in reality, the mean disposable income for households in the capital region in 2013 was 44,000 € (OSF, 2014). Although the study area was larger than the capital region, majority of the respondents were from those municipalities which makes the sample to have considerably lower income than the general population. This can be explained by the large number of elderly and student respondents who generally have lower incomes. However, the stated income might be faulty as the participants were asked to state the whole household's disposable income which they may not have known accurately. Lastly, the average household size of the sample is slightly smaller than the one of the actual study region at 1.88 while the mean is 1.96 (OSF, 2016).

Therefore, the sample is not representative of the inhabitants of the study area in terms of gender, age and disposable household income. The general population has lower average age (OSF, 2017) and the average annual disposable household income is higher on average. However, the sample is representative in terms of municipality sizes, household sizes.

Although the sample does not represent the general population on average, each age, municipality and income group has been presented within the sample. Therefore, the results are not automatically generalizable to the population but they do provide a decent picture of the Finnish capital area's attitudes towards MaaS.

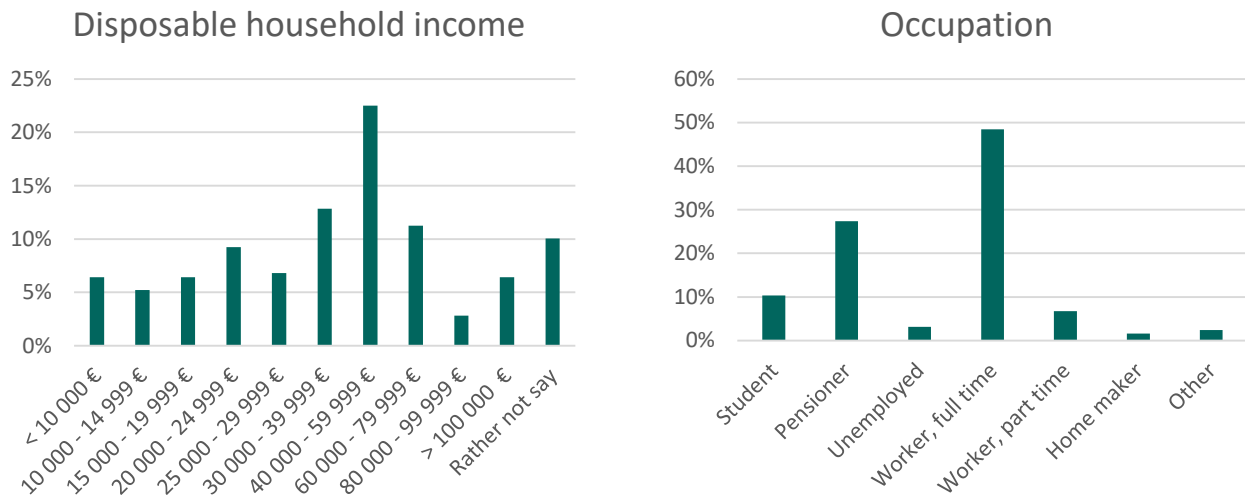


Figure 6.3: Frequencies of annual disposable household income and occupation of respondents. (N=252).

6.1.2. Mobility Characteristics

In this section, mobility characteristics will be explored from three perspectives: i) the ownership of existing subscriptions, ii) current travel behaviour, and iii) interest in add-ons for the packages.

i) Subscriptions

Figure 6.4 shows some MaaS-related items and subscriptions, including travel subscriptions, driving licences and smart phones.

Majority of the respondents own a licence for the operation of a motorised vehicle with 7% owning a moped licence and 78% owning a driving licence. However, none of the respondents in age group 15-17 owned a licence of any kind. Although the sample of the youth was too small to draw concrete conclusions, this may be an indication of the generational shift in terms of acquiring a driving licence.

Moreover, HSL travel cards were popular amongst the participants with only 12% of the respondents owning neither the season nor value travel cards while 15% of the respondents owned both. In terms of having only one subscription, it is more common to own a travel card with Value than a Seasonal ticket. Besides, every other respondent owned a HSL Value ticket but no Season pass while the opposite count was 23 per cent. Meanwhile, other travel subscriptions did not appear popular with a total of 3 per cent of the participants owning a bike sharing, car sharing or VR season ticket.

Following this, a smart phone might be argued to be the most important item in terms of MaaS taken into consideration that the whole platform is designed to be used on a mobile phone. Nevertheless, 85% of the respondents owned a smart phone which is a good indicator of the people having using the service.

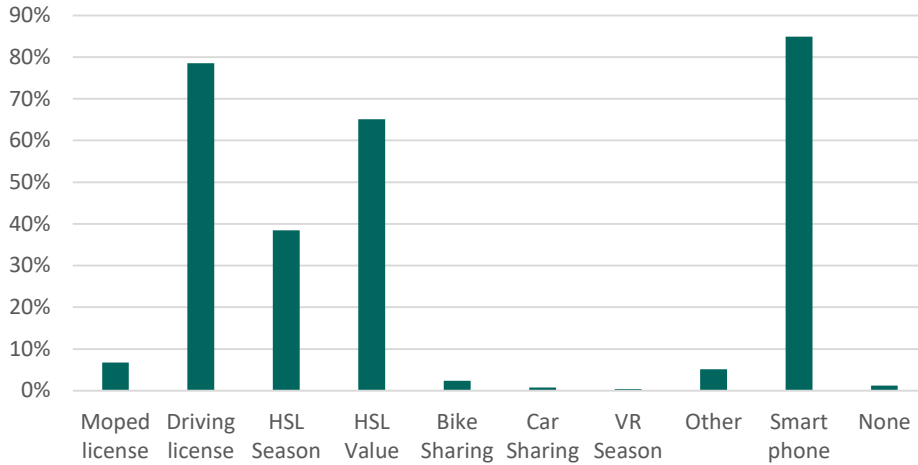


Figure 6.4: Frequency of subscriptions amongst the respondents (N=252).

ii) Travel Behaviour

Figure 6.5 shows the respondents' stated travel behaviour currently. Approximately $\frac{2}{3}$ of the respondents used public transport at least once a week. This goes hand-in-hand with the findings above with regards to the majority of people owning at least one type of a subscription to HSL services. Additionally, respondents were regularly driving a car or travelling as a passenger at 52 and 35 percent, respectively.

The usage of bicycle shows interesting yet expected results for MaaS. During summer, every fifth person travels by bike on a daily basis and every other at least once a week. During winter months, however, the counts fall to 4 and 9 percent during winter months. This is expected with heavy snow fall and icy roads during the winter months. However, this may have an implication on the demand for bicycle sharing within MaaS packages making it desirable only in summer. On the other, this has already been taken into consideration by HSL that provides the city bikes only between May and October each year.

Furthermore, respondents' usage of public transport and rental cars support the decision of omitting these modes from the packages presented in the survey. While 65% used long distance transport rarely (16% never), the numbers were 22 and 77 percent for rental car.

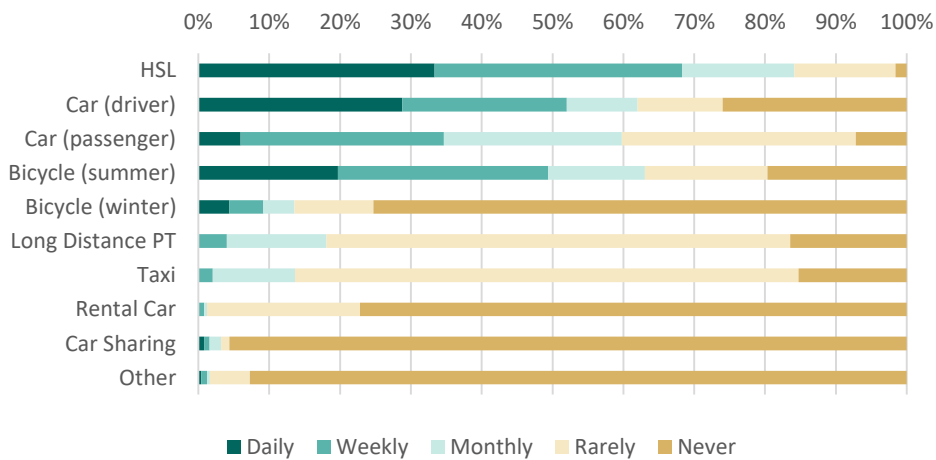


Figure 6.5: Travel behaviour of the respondents (N=252).

iii) MaaS-package Extensions

The number of attributes had to be limited for the choice tasks in order to reduce respondent fatigue. Therefore, the modes mentioned in the packages were modes that can be used to meet people's daily mobility needs. Subsequently, respondents were confronted with questions on possible extensions to the mobility packages. The questions on additional modes and their responses are shown in Figure 6.6.

Generally, people were interested in the add-ons. The most popular one was for public transport. It needs to be noted that the question with regards to public transport was the only one of the three questions where respondents were given a cost for the add-on. Therefore, the negative responses to this question can be interpreted in more than one way: either the respondents are not interested in travelling within more than one zone or they are not willing to pay for the extension the amount set in the survey.

What is more, train was the most important factor in purchasing long distance travel. From the extension options, 9% of the respondents wanted the combination for train and bus, 8% were interested in purchasing only train travel and merely 4% wanted to purchase only bus trips in addition to their mobility package.

Rental cars were the least wanted extension out of the three with 20% stating that they were interested in purchasing the add-on. This behaviour can have multiple explanations: either people can cover their long trips with other modes or they do not have interest in renting a car for longer trips.

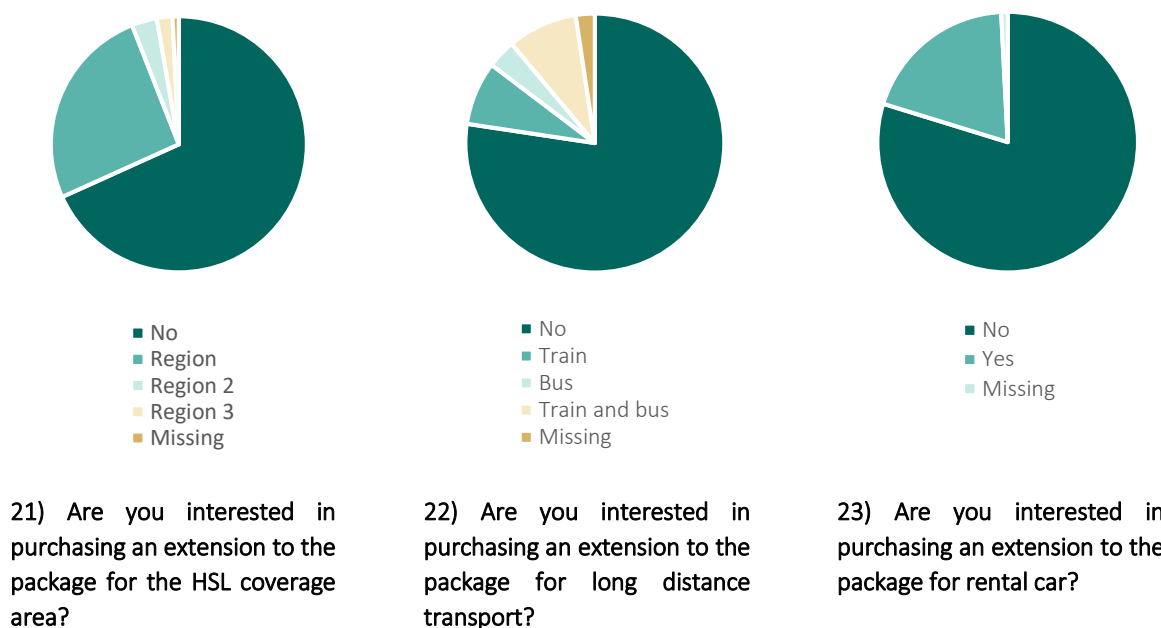


Figure 6.6: Responses to questions 21, 22 and 23 on mobility package add-ons (N=252).

6.1.3. Correlations

This paragraph will discuss the correlations that were found in the survey and it is divided into correlations between characteristics, and correlations between characteristics and interest in MaaS packages. The used correlation measured is the bivariate Pearson correlation.

Characteristics

Firstly, Table 6.1 shows the most important correlations between socio-demographic characteristics and mobility subscriptions of the respondent. Characteristics that did not have any significant correlations with any of the variables, were omitted from the table. Significant correlations have been marked bold in two different levels, namely 1 and 5 per cent. Consequently, it can be observed that some significant correlations can be found between characteristics. The most significant correlations (at 1%) have been explained below and Appendix D.3 will provide their cross-tables.

As Table D.2 shows, gender has a significant correlation with people's travel subscriptions. While 46% percent of the female respondents hold a HSL Season ticket, only 27% of the males have one. On the other hand, both gender and the choice of a HSL Travel card are correlated with the ownership of a driving licence. Those respondents with a driving licence have mainly purchased a value ticket while those with no driving licence have mainly chosen for a season ticket. This is logical considering that without a driving licence, one cannot drive and, therefore, need to rely on other modes of transportation.

Moreover, family's disposable income is correlated with the purchase of a seasonal ticket (*Table D.3*). 55% percent of the participants with a HSL Season Pass earned less than 40,000€ which is less than the study area's average. Nonetheless, this can partly be explained by the fact that 21 percent of the Season pass owners are either 15-24 –year-olds or above 65. Generally, these age groups have lower income. Additionally, 91% of the respondents from age groups 15-24 and 65-70 were from households of maximum 2 people while 45% of 18-24 and over 65-year-old respondents were living alone.

As discussed earlier, smart phone is one of the most crucial aspects of MaaS. The service has a mobile platform and therefore requires the ownership of one. However, the ownership of a smart phone is correlated with age (*Table D.4*). While 98% of the respondents younger than 44 owned a smart phone, the count was 77% for the older respondents while only 29% of the over 65-year-olds owning a smart phone. This can have an implication on the attractiveness of the service to the older generation.

Strangely, the results show a substantial correlation between the respondent's home municipality and the size of the household they live in. Although it is accurate that Helsinki has the highest portion of single person households within the study area, the rest of the municipalities have somewhat a crooked distribution of households. This might be explained by the small sample size from other municipalities than Helsinki.

Characteristics and Interest towards MaaS Packages

Respondents were also asked to answer 10 multiple choice questions on preferred MaaS monthly subscription packages. Chapter 5 explains how the packages were created and provides the full list of choice tasks presented to the participants. Moreover, results of the choice tasks will be examined in more detail in Section 6.3. For now, Table 6.1 presents the correlations between the socio-demographic and mobility-related characteristics of the respondents in relation to trading behaviour.

For the purposes of this study, trading behaviour relates to people's attitudes towards MaaS packages. Respondent has been identified as a package optimist if they chose a mobility package at least during the SP experiment. Contrariwise, a participant has been labelled a package-pessimist in case they always opted for the no-choice alternative. As can be seen in Table 6.2, significant correlations exist between characteristics of the participants and their trading behaviour. Such significant correlations have been marked bold in the table.

Table 6.1: Correlations of the socio-demographic- and mobility-related characteristics of the respondents.

		Gender	Age	Municipality	Occupation	Household	Income	Smart phone	Moped licence	Driving licence	HSL season	HSL value
Gender	Pearson Correlation Sig. (2-tailed)	1	0.024	0.051	0.059	0.052	-0.037	-0.109	-0.111	-.127*	.193**	-0.112
			0.703	0.424	0.349	0.414	0.565	0.086	0.080	0.044	0.002	0.076
Age	Pearson Correlation	0.024	1	0.038	-0.093	0.034	0.081	-.277**	-.196**	0.025	-.270**	-0.055
				0.547	0.142	0.591	0.203	0.000	0.002	0.691	0.000	0.384
Municipality	Pearson Correlation	0.051	0.038	1	0.026	1.00**	0.018	-.152*	-0.015	0.032	0.075	-0.087
					0.683	0.000	0.782	0.016	0.815	0.608	0.234	0.166
Occupation	Pearson Correlation	0.059	-0.093	0.026	1	0.032	.238**	0.039	0.038	.159*	0.032	0.013
						0.615	0.000	0.537	0.550	0.011	0.612	0.839
Household size	Pearson Correlation	0.052	0.034	1.00**	0.032	1	0.021	-.147*	-0.016	0.035	0.079	-0.084
					0.615		0.742	0.019	0.804	0.577	0.212	0.182
Income	Pearson Correlation	-0.037	0.081	0.018	.238**	0.021	1	.141*	-0.014	.129*	-.164**	0.038
					0.000	0.742		0.027	0.831	0.042	0.009	0.551
Smart phone	Pearson Correlation	-0.109	-.277**	-.152*	0.039	-.147*	.141*	1	0.069	.266**	-0.031	.157*
					0.537	0.019	0.027		0.274	0.000	0.621	0.013
Moped licence	Pearson Correlation	-0.111	-.196**	-0.015	0.038	-0.016	-0.014	0.069	1	.140*	0.015	0.064
					0.550	0.804	0.831	0.274		0.026	0.815	0.310
Driving licence	Pearson Correlation	-.127*	0.025	0.032	.159*	0.035	.129*	.266**	.140*	1	-.223**	.287**
					0.011	0.577	0.042	0.000	0.026		0.000	0.000
HSL season	Pearson Correlation	.193**	-.270**	0.075	0.032	0.079	-.164**	-0.031	0.015	-.223**	1	-.430**
					0.612	0.212	0.009	0.621	0.815	0.000		0.000
HSL value	Pearson Correlation	-0.112	-0.055	-0.087	0.013	-0.084	0.038	.157*	0.064	.287**	-.430**	1
					0.839	0.182	0.551	0.013	0.310	0.000	0.000	

Significant correlations are marked bold.

*Correlation is significant at the 5% level (2-tailed).

**Correlation is significant at the 1% level (2-tailed).

From respondent characteristics, interest in MaaS packages is significantly correlated with age, HSL season ticket ownership and income. As shown in Table 6.1, season ticket ownership is correlated with age and income and, therefore, they can be seen as an explanatory variable of the public transport use. Hence, this section will only look into age and disposable income from now on.

The older the respondent is, the less likely they are to be a package-pessimist and instead choose to use their current mode (Table D.5). However, there is a dip in choice for the packages amongst the age group 15-17. This may be explained by the lack of funds for purchasing a package rather than a lack of interest towards the service. Although package optimists exist in all income groups, interest towards MaaS-packages decreases when the household's disposable income increases (Table D.6). While 69% of respondents with disposable income of less than 10,000€ were interested in using the service, the same count for household income of more than 100,000€ was 44%. Moreover, age and income do not correlate together significantly. Therefore, the young people's interest in MaaS-packages cannot merely be explained through their low income rates but with genuine interest in the service.

Although Sochor et al. (2015a) state that MaaS is meant for consumers who live within a sufficient proximity to the infrastructure of various transport modes, no significant correlation was found between respondents' municipality of residence and their interest towards the packages. This could suggest that although accessibility varies throughout the study area, the level of service is enough to cover the needs of travellers. However, more plausible reason for not finding a significant correlation is the small number of respondents from the municipalities furthest away from Helsinki.

Respondents' interest towards the packages has been visualised in Figure 6.7 which shows that the majority of Helsinki residents were interested in the packages while the demand decreases when moving outwards from the capital. Although Espoo and Vantaa show lower levels of interest for the packages, still every third person in those cities expressed interest towards the service. As was seen in Chapter 4, these cities have relatively high service levels together with Helsinki.

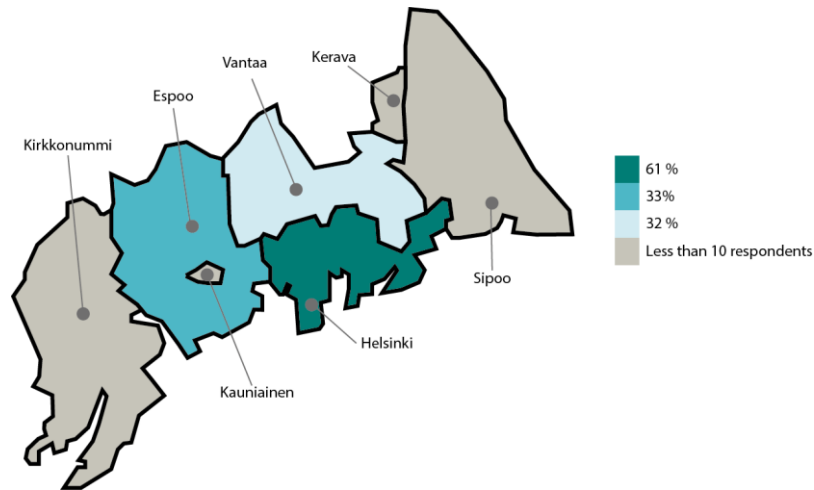


Figure 6.7: Demand for packages within each municipality.

Add-ons

Not surprisingly, trading behaviour is heavily correlated with interest in the add-ons. This is only logical seeing that respondents who did not choose for a package, are not likely to choose for an add-on either. In addition, those interested in the long distance add-on were also interested in the additional rental car with 39% choosing for both options. This is an interesting finding as people are interested in various modes to get out of the region. This has the potential in being a solution for whole trip chains in terms of, for example, summer trips out of the capital region.

Similarly, the correlation between a participant's home municipalities and additional travel zones is a logical one. While 81 percent of respondents in Helsinki chose for travel only within one municipality, the number of additional travel zones grows the further away from Helsinki the respondent lives. In Vantaa, for instance, only 45 percent of the respondents chose for internal travel. This is reasonable taking into consideration that Helsinki is the centre of the region and has the highest concentration of employment opportunities and therefore having the pull for people to possess tickets that they can use to travel to the city.

It is also rational that those respondents who travel by long distance trains or busses on a frequent basis are likely to purchase the complementing add-on to their package. Nearly $\frac{2}{3}$ of respondents who travel by long distance transport on a weekly basis were interested in purchasing the comparable addition while only 19 per cent of those who rarely travel by long distance transport would choose for the add-on.

Table 6.2: Correlations of the socio-demographic- and mobility-related characteristics, and trading behaviour of the respondents.

		Gender	Age	Municipality	Disposable Income	Smart phone	Moped license	Driving license	HSL season	HSL value	Interest in MaaS packages	Extended zones	Additional long distance transport	Additional rental car
Gender	Pearson	1	0.024	0.051	-0.037	-0.109	-0.111	-.127*	.193**	-0.112	-0.095	-0.108	-0.010	-.223**
	Correlation Sig. (2-tailed)		0.703	0.424	0.565	0.086	0.080	0.044	0.002	0.076	0.136	0.091	0.879	0.000
Age	Pearson	0.024	1	0.038	0.081	-.277**	-.196**	0.025	-.270**	-0.055	-.241**	-0.100	-0.066	-0.106
	Correlation	0.703		0.547	0.203	0.000	0.002	0.691	0.000	0.384	0.000	0.115	0.305	0.094
Municipality	Pearson	0.051	0.038	1	0.018	-.152*	-0.015	0.032	0.075	-0.087	-0.066	.232**	-0.045	-0.034
	Correlation	0.424	0.547		0.782	0.016	0.815	0.608	0.234	0.166	0.296	0.000	0.481	0.591
Disposable Income	Pearson	-0.037	0.081	0.018	1	.141*	-0.014	.129*	-.164**	0.038	-.159*	0.021	-.158*	-0.013
	Correlation	0.565	0.203	0.782	0.027	0.831	0.831	0.042	0.009	0.551	0.012	0.747	0.014	0.844
Smart phone	Pearson	-0.109	-.277**	-.152*	.141*	1	0.069	.266**	-0.031	.157*	0.057	-0.014	0.015	0.069
	Correlation	0.086	0.000	0.016	0.027		0.274	0.000	0.621	0.013	0.372	0.829	0.813	0.279
Moped license	Pearson	-0.111	-.196**	-0.015	-0.014	0.069	1	.140*	0.015	0.064	0.022	.183**	0.101	0.027
	Correlation	0.080	0.002	0.815	0.831	0.274	0.026	0.815	0.310	0.725	0.004	0.115	0.674	0.674
Driving license	Pearson	-.127*	0.025	0.032	.129*	.266**	.140*	1	-.223**	.287**	0.026	-0.019	0.051	.157*
	Correlation	0.044	0.691	0.608	0.042	0.000	0.026		0.000	0.000	0.678	0.766	0.423	0.013
HSL season	Pearson	.193**	-.270**	0.075	-.164**	-0.031	0.015	-.223**	1	-.430**	.239**	-0.036	0.080	0.004
	Correlation	0.002	0.000	0.234	0.009	0.621	0.815	0.000		0.000	0.000	0.568	0.212	0.952
HSL value	Pearson	-0.112	-0.055	-0.087	0.038	.157*	0.064	.287**	-.430**	1	0.049	0.018	0.031	.191**
	Correlation	0.076	0.384	0.166	0.551	0.013	0.310	0.000	0.000		0.437	0.774	0.629	0.002
Interest in MaaS packages	Pearson	-0.095	-.241**	-0.066	-.159*	0.057	0.022	0.026	.239**	0.049	1	.199**	.205**	.248**
	Correlation	0.136	0.000	0.296	0.012	0.372	0.725	0.678	0.000	0.437		0.002	0.001	0.000
Extended zones	Pearson	-0.108	-0.100	.232**	0.021	-0.014	.183**	-0.019	-0.036	0.018	.199**	1	.128*	0.027
	Correlation	0.091	0.115	0.000	0.747	0.829	0.004	0.766	0.568	0.774	0.0015378		0.045	0.668
Additional long distance transport	Pearson	-0.010	-0.066	-0.045	-.158*	0.015	0.101	0.051	0.080	0.031	.205**	.128*	1	.245**
	Correlation	0.879	0.305	0.481	0.014	0.813	0.115	0.423	0.212	0.629	0.001238	0.045		0.000
Additional rental car	Pearson	-.223**	-0.106	-0.034	-0.013	0.069	0.027	.157*	0.004	.191**	.248**	0.027	.245**	1
	Correlation	0.000	0.094	0.591	0.844	0.279	0.674	0.013	0.952	0.002	0.000	0.668	0.000	

Significant correlations are marked **bold**.

*Correlation is significant at the 5% level (2-tailed).

**Correlation is significant at the 1% level (2-tailed).

6.2. Attitudes towards Mobility Packages

This section will explain the findings from the qualitative data gained from the respondents' via voluntary emails. In total 26 participants gave feedback through email. This section is divided into respondents' general feedback with regards to the packages (6.2.1) and their main deterrents towards adopting the service (6.2.2).

6.2.1. Overall Feedback

While some respondents found mobility packages an excellent idea, they still perceived them to be expensive. Interestingly, a respondent (also a regular car driver) stated it, it is not enough for the packages to be the same price as the use of a private car in order to attract them to change: they wanted a service that was considerably cheaper in order to make up for the lack of convenience which supports the argument by Li and Voegel (2017). However, for those respondents who used public transport frequently, the packages seemed to be a more convenient alternative:

"Some of the packages were too expensive but I liked the idea of them! I have never heard of car sharing but it seems also like an interesting concept: I could definitely see myself using it rather than buying a car."

– Female, 25-34 years

While some of the package optimists were not concerned about the price, their concerns were related to the type of cars that were included in the car sharing services. If vans and minivans were included in the service, they would gladly buy the package.

Furthermore, an overlapping theme between package pessimists and optimists was the fixed nature of the packages. Package optimists stated that they would have wanted to propose their own ideal fixed

package. This shows that they are in the use of various modes but indeed want flexibility and collaborative customisation as stated by Kamargianni et al. (2015). On the other hand, package pessimists saw fixed packages merely as an impediment: they did not want to pay for modes that they were not going to use.

This suggests that people are not interested in purchasing MaaS to try out new modes but to make their travel cheaper overall. Therefore, it is logical that frequent users of public transport were the most optimistic about MaaS packages: they have already found a way to navigate through the city without a car as also stated by Li and Voegelé (2017). Hence, it is possible that the importance of taxi trips and car sharing included in the packages would be different for those who were not as accustomed to travelling by public transport. Indeed, some respondents stated that the amount of car sharing and taxi was too low to cover monthly needs and wished to see more of them in the packages:

“The idea is good but the number of taxi trip is as good as nothing! Visiting a couple stores or friends can easily make the total journey 50 kilometres even within the capital region.”

– Female, Helsinki

6.2.2. Reasons for Package Pessimism

It comes as no surprise that the most popular reasons for package pessimism were those provided for the respondents (i. “The packages do not fit my needs” and ii. “The packages are too expensive”) as well as the combination of these two.

Although many of the elderly respondents were labelled as package pessimists, there is potential for them to be drawn into the service through adjustments in pricing. This could, for instance, be done by altering package prices based on travel times which has potential to increase demand substantially: Cervero (1990) found the introduction of off-peak discount to increase travel demand by 10%. This is further supported by Paulley et al. (2006) who state that personal business and leisure trips, common for the elderly, tend to have greater flexibility in terms of travel time. However off-peak discounts can be seen to benefit all those whose schedules are not tied to the regular ‘office hours’:

“Many of us pensioners are still working part time and even more of us are involved in voluntary work which requires moving between different locations during the day. However, the packages seemed surprisingly expensive. For example, it would be good if travelling outside of peak hours was made cheaper.”

– Female, 65-70 years

Moreover, some of the participants did not see any reason for buying the service. While some cycled everywhere, others perceived the combination of a car and a HSL-travel card to be enough for them. However, those who chose none of the packages because of access to a company car are still potential customers. This can be achieved in a couple ways: for instance, companies refunding their employees’ MaaS-travel instead of company cars or government providing a tax benefit for the use of MaaS.

Nevertheless, there are people who would never be interested in the service as shown by the Transport Systems Catapult study (2015). Although some of the pessimists have a true need for a car (for instance working in service jobs in which long distances are travelled), for others it was the case of *status quo* bias as stated by Pankratz et al. (2017). These so-called “Car lovers” are generally from higher income groups and have generally a negative attitude towards public transport:

“I would never choose any of the packages. I would not travel by bus even if it was free! I do not want to use car sharing as I believe a car is a personal thing and I want it to be my own. Bike sharing? I see no reason to cycle.”

– Male, 35-44 years

While the cost of a package is a rather clear reason for disregarding a package, the reasons behind package being unsuitable are manifold. For instance, for optimists, unsuitability meant a lack of a specific package attribute, or an excess thereof. While the provision of public transport and a time promise were important to the potential customers, they were not interested in taxi trips. One of the respondents explained the lack of interest in taxi trips as follows:

“Although it is nice to have available taxi trips, they are useless if they raise the price of the packages considerably. Most of the time, you can replace the taxi with public transport anyway.”

– Female, 35-44 years

This shows that those who are used to travelling by public transport might perceive MaaS as a price-worthy alternative to owning a car as showed by Holmberg et al. (2016). Being accustomed to using public transport, however, seems to make travellers also more aware of the cost of the alternative modes as stated by Li and Voegelé (2017) and, hence, they seem to be more aware of what the price of MaaS packages consists of.

6.3. Choice Model Estimation of Survey Data

Section 6.1.3 has shown that socio-demographics and travel subscriptions have an influence on the interest of the ten choice tasks on MaaS packages. However, they cannot explain the participants' choices between packages. Hence, this section will focus on elaborating on the choice tasks. The section is divided into discussions of the choice task results (6.3.1), MNL model estimation (6.3.2), linearity of attributes (6.3.3), and model validation (6.3.4).

6.3.1. Choice Task Results

In each choice tasks, the respondent had to make a choice based on pictures of packages, each of a potential mobility subscription package (see *Chapter 5*). The answers of these decisions were analysed with BioGeme-software. The goal of the performed analysis was to find the level of influence for each attribute in the decision making process. In the case of MaaS-packages, the model aims to explain as accurately as possible the factors based on which respondents choose a package. As shows in the previous section, certain socio-demographic characteristics (e.g. age) affect the response pattern to the choice tasks. Hence, some of these were also included in the choice model as interaction effects.

Table 6.3 shows the answer distribution of all 252 respondents. The response frequencies show a high popularity of opting out amongst the respondents. Although MaaS is not a new technology, it is a new kind of service and therefore, such rates can be expected. Additionally, the fact that not everyone wants a set package is a factor to be taken into consideration together with the limitations of the study.

It can be seen that the percentage of opting out reduces as the respondents go through the survey. This can have two possible explanations: either the packages became more appealing along the survey or respondents started to get exhausted from thinking of reasons why they are not interested in the packages and therefore opting to choose a package. The first explanation seems plausible as choice sets 6 and 10 hold the highest shares for individual packages. In these packages, the mostly chosen

packages were such that they had the lowest price yet they offered the most for the respondent. Choosing such a package goes hand in hand with the hypothesis that people want unlimited travel for as cheap as possible. Therefore, the survey results seem valid.

Table 6.3: Distribution of all respondents' answers on the 10 choice tasks (N=252). Darker green refers to higher portion of respondents.

Choice task	All (N=252)		
	Package 1	Package 2	Neither
1	5%	5%	90%
2	8%	7%	85%
3	15%	13%	72%
4	11%	8%	81%
5	11%	10%	79%
6	3%	30%	67%
7	8%	4%	88%
8	16%	7%	77%
9	12%	15%	73%
10	27%	8%	65%

The least sought-after packages were those that cost 237 euros. Moreover, the most expensive packages always lost to the cheaper alternative. This can be seen as people perceiving the packages of 237 euros to not offer enough content with regards to their price. However, when the choice questions paired packages of 79 and 158 euros, the more expensive package was always chosen. This shows that respondents were in general willing to trade with regard to price.

Figure 6.8 presents the packages presented in choice task 10 which is the most popular pairing in terms of respondents choosing for one of the packages. Package 1 (left photo) shows unlimited public transport within one zone, 6 bike sharing and 6 taxi trips. On the right side, Package 2 offers 15 public transport trips, 8 hours of car sharing, unlimited bike sharing and 6 taxi trips. Both of the packages are meant for personal use and do not offer a time promise for car and bike sharing, and taxi).

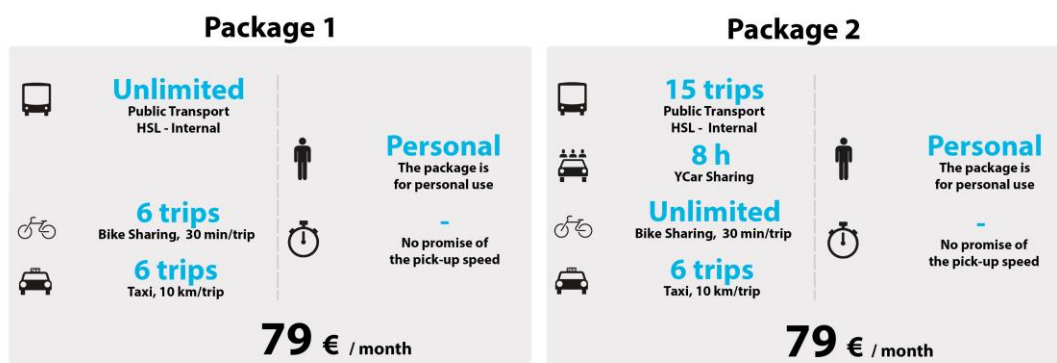


Figure 6.8: Choice task 10.

Firstly, the popularity of choosing either one of the packages can be explained by the low price in relation to the rather substantial offerings of the packages. Even so, what is interesting is the high popularity of Package 1 although package 2 can be considered to offer more with an additional mode (car sharing). However, this can also be interpreted in the way that unlimited public transport has been valued considerably more than car sharing. The choice model estimations will quantify this claim.

6.3.2. MNL Model Estimation

Table 6.4 shows the results of the two estimated MNL models: model 1 is with main effects only and model 2 represents the best fit model with included interaction effects. Both of the models have a high

explanatory power with an adjusted rho-square statistics of 40.9% and 42.2%. Moreover, both models are overall significant at 0.1%. However, when comparing the models, including interaction effects in the model improves the goodness-of-fit of the choice model. Hence, from now, on the discussion will focus on the second model.

Table 6.4: Final SP experiment MNL model estimation results.

Attribute	Parameter	Model 1: MNL without interactions			Model 2: MNL with interactions		
		Value	Robust Std err	Robust t-test	Value	Robust Std err	Robust t-test
Price	β_{Price}	-0.0138	0.00121	-11.35	-0.014	0.00122	-11.46
Public Transport	$\beta_{PT,T}$	0.766	0.221	3.47	0.791	0.224	3.53
	$\beta_{PT,U}$	1.6	0.236	6.76	1.64	0.24	6.81
Car Sharing	$\beta_{CarS,4}$	-0.305	0.176	-1.74	-0.304	0.177	-1.72
	$\beta_{CarS,8}$	-0.356	0.198	-1.8	-0.349	0.199	-1.75
Bike Sharing	$\beta_{BikeS,4}$	0.0199	0.146	0.14	0.0168	0.147	0.11
	$\beta_{BikeS,8}$	0.0916	0.123	0.74	0.0931	0.124	0.75
Taxi	$\beta_{Taxi,3}$	0.152	0.177	0.86	0.162	0.178	0.91
	$\beta_{Taxi,6}$	0.213	0.162	1.32	0.224	0.163	1.38
Sharing	$\beta_{Sharing}$	0.315	0.145	2.18	-0.353	0.202	-1.75
Pick-up speed	$\beta_{PickUp,30}$	0.391	0.14	2.8	0.392	0.141	2.78
	$\beta_{PickUp,15}$	0.424	0.159	2.66	0.419	0.16	2.61
Opt-out	ASC_{OptOut}	1.63	0.328	4.97	0.445	0.36	1.23
Interaction effects	i_{age}				0.186	0.0293	6.33
	i_{income}				0.0476	0.0185	2.57
	$i_{sharing}$				0.998	0.184	5.44
	Number of observations		2520			2520	
	Final Log-Likelihood		-1623.258			-1584.37	
	Rho-square		0.414			0.428	
	Adjusted rho-square		0.409			0.422	

Values marked with blue and bold were found to be statistically significant.

As expected, the cost parameter is found to be negative and its standard error is small. Small standard error tells that the estimate for the mean parameter value is certain. In order to draw conclusions with regards to heterogeneity amongst respondents, Mixed Logit analysis is needed. The estimated parameter value for price is rather small due to the actual price of the package being used in the estimation process to allow for WTP-estimations. However, this suggests that higher prices lead to considerably lower utilities for the respondents.

Similarly to the findings by Mayas and Kamargianni (2017), public transport was found to have highly positive values. Not only can this be linked to the high public transport usage by the respondents but also to further support the claim by Koglin (2017) that public transport is the backbone in mobility packages.

Furthermore, car sharing was the only attribute for which the sign of the attributes changed between the pilot and final surveys. While it received a positive estimate (0.319-0.589) from the pilot SP, during the final SP experiment, it was found to have a negative value which could be expected based on Mayas and Kamargianni (2017). Moreover, the standard error is fairly high in comparison to the parameter value indicating large heterogeneity within the sample. As the average age from pilot to final SP survey grows by 13 years (from 36 to 49 years), it might be possible that the attitude towards car sharing is dependent on the respondent's age.

As Mayas and Kamargianni found (ibid.), the coefficient for car sharing is negative when it has been fixed to the package while making it flexible, car sharing receives a positive value. This is logical seeing that some of the respondents had a very negative opinion towards the individual service while others were interested in testing it out.

Also the results for estimations on bike sharing and taxi trips were found to be similar to the findings of Mayas and Kamargianni (2017). Although it has small values, bike sharing is perceived to be a positive addition. While both of the estimates are small, an unlimited number of bike sharing trips has a significantly higher value. This can be explained by the fact that those who cycle, do it regularly and, therefore, only some bike trips do not make much of a difference for the respondents. This is supported by Mayas and Kamargianni (ibid.) who found that fixed bike sharing counts have a negative value while flexibility has a considerably positive count.

Promise of a pick-up speed received a significant parameter estimate. Interestingly, though, the option of 30 minutes received a larger value than 15 minutes. This suggests that having a promise of some sort is the most important factor to the respondents instead of the speed. On the other hand, this may be related to the fact that 15 minutes is not active waiting while in 30 minutes, people can still do things while waiting for their mode. Moreover, this may be caused by respondents knowing that public transport is frequent enough to arrive within 15 minutes and, therefore, they related pick-up speeds to be relatable to the other modes. As travellers tend to think about trips with other modes further ahead than 15 minutes, the pick up speed was not perceived as vital.

Lastly, the results with regards to sharing are not surprising. In the first model, possibility to transform the plan to cover the whole household was found to have a significant value. However, when adding an interaction effect to the model between household size and the sharing function, the generic sharing parameter becomes negative and the interaction considerably significant. This shows that sharing is significantly important to those whose households consisted of more than 1 person while those from single-person households have no interest in purchasing such a package: this is rational as they have no need for such a plan.











6.3.3. Linearity of Attributes

When looking into the parameter estimates for each attribute, it can be concluded that none of the parameters are linear. This make sense as the two levels were not always equidistance from each other. Therefore, it is difficult to draw conclusions on the generic parameter values. The changes in utilities between different attribute levels are shown in Table 6.5. The lowest level of each attribute (“not included/no promise”) is assumed to have the value of zero.

For car sharing and taxi, it is possible to evaluate part-worth utilities as they have an equal change in terms of dummy-coding and real attribute levels. However, this is not possible for bike sharing, public transport and pick-up speed as it is not clear what is meant by unlimited trips.

As a conclusion, it can be shown that changes in utilities for car sharing and taxi trips does not suggest linearity and thus it is not preferable to replace these two parameter values with single parameter for the attribute. Moreover, for public transport and bike sharing it is not possible to evaluate linearity as it is naive to assume that ‘unlimited number of trips’ has an equidistance with the other attribute levels. However, it is possible to evaluate willingness-to-pay for these different levels. Similarly, evaluating linearity of pick-up speed is disturbed by the lowest level: no promise of pick-up speed refers to unreliable times which can theoretically be infinite

Table 6.5: Linearity of attributes.

Attribute		Parameter value	Change from previous level	Change in utility
Name	Amount			
 Bike sharing	0 trips	0		
	6 trips	0.0168	0.017	
	Unlimited trips	0.0931	0.076	
 Car sharing	0 h	0		
	4 h	-0.304	-0.304	
	8 h	-0.349	-0.045	
 Public Transport (HSL)	0 trips	0		
	15 trips	0.791	0.791	
	Unlimited trips	1.64	0.849	
 Taxi	0 trips	0		
	3 x 10 km	0.162	0.162	
	6 x 10 km	0.224	0.224	
 Pick-up speed	No promise	0		
	<30 min	0.419	0.419	
	<15 min	0.392	-0.027	

* When the attribute includes an 'unlimited' level, the graphs are only suggestive of the curve shape.

6.3.4. Model Validation

Throughout the model validation process, no difference could be observed between the hit rates of the two models as shown in Table 6.6. The equal hit rate average of 78% can be explained by the high amount of respondents choosing for opt-out rather than one of the packages. This means that the models are equally good at predicting respondents' choices which is logical due to the high percentage of participants opting for the no-choice alternative.

Also the accuracy in predicting choice probabilities, log likelihoods, were computed for both of the models. Based on the mean-likelihood, it can be stated that the model with interaction effects is more accurate in terms of estimating the parameter values and, therefore, choice probabilities. Furthermore, likelihood ratio test (LRT) shows that the model fit of MNL model with interactions is significant at 0.1%.

Table 6.6: Model validation - multinomial logit model with (Model 2) and without (Model 1) interactions.

Estimation data set	Validation data set	HIT RATE		LLB	
		Model 1	Model 2	Model 1	Model 2
1 + 2	3	77%	77%	-1109.498	-1084.333
1 + 3	2	79%	79%	-1063.829	-1041.836
2 + 3	1	77%	77%	-1116.26	-1089.79
Average		78%	78%	-1096.53	-1071.98

6.4. Conclusion

This chapter has gone into detail on the results of the final discrete choice survey, wherein questions were asked about the choices between mobility packages, the personal characteristics of the respondents as well as their current travel behaviour. Although the survey was sent to a representative group of the people living within the study area, it was found that the sample is (not) very representative of the study area's inhabitants: the average age of this sample is higher while the disposable household income is lower.

Moreover, half of the people portrayed MaaS-optimism and were interested at least in some of the packages. This is a sufficient result taken into consideration that the MaaS is a relatively new concept and, regularly, people are not keen on changing their mode choice.

The correlations tables showed that there age, income and household size were personal characteristics that influenced their choice of a mobility package the most. Hence, they were included in the MNL model estimation as interaction effects.

Next chapter will apply the estimated MNL model by calculating respondents' willingness to pay for the separate package attributes. Moreover, the model was used to predict potential demand for a new set of packages.

7







Application of the Choice Model

This chapter will concentrate on applying the estimated MNL model and by doing so, it will answer the last sub-question: “Given that we know consumers’ willingness to pay for MaaS packages, what could MaaS subscription packages look like and what is their potential demand?”. Firstly, the chapter will examine respondents’ Willingness-to-Pay for the service in section 7.1. Section 7.2 will explain the creation of potential packages based on the willingness-to-pay as well as knowledge on different travellers’ needs for the service. Lastly, the chapter will look into the potential demand for such packages (7.3).

7.1. Willingness-to-Pay

In order to give business advice with regards to MaaS plans, it is useful to illustrate the choice model (see Section 6.3.) by expressing it as respondents’ willingness to pay (WTP) for each attribute within the package. As Bakos and Brynjolfsson (1999) state, people value bundles more than individual items. Therefore, it cannot be assumed that when WTP is higher than current market price that consumers would be accepting of considerable rises to the individual prices. Results from the willingness-to-pay analysis are shown below:

Table 7.1: Respondents' Willingness-to-Pay (WTP) for MaaS-subscription package attributes.

Attribute		Model 2: MNL + interaction effects			Current services	
Name	Count	WTP	WTP for increase	Price	Difference to WTP	
 Bike sharing	6 trips	1.20 €	1.2 €	5.0 €	▼	-3.80 €
	Unlimited	6.65 €	5.5 €	4.2 €	▲	2.42 €
 Car sharing	4 h	-21.71 €	→ 0 €	40.0 €	▼	-40.00 €
	8 h	-24.93 €	→ 0 €	80.0 €	▼	-80.00 €
 Public Transport (HSL)	15 trips	56.50 €	56.5 €	32.7 €	▲	23.80 €
	Unlimited	117.14 €	60.6 €	52.4 €	▲	64.74 €
 Taxi	3 x 10 km	11.57 €	11.57 €	63.0 €	▼	-51.43 €
	6 x 10 km	16.00 €	4.4 €	126.0 €	▼	-110.00 €
 Pick-up speed	30 min	29.93 €	29.93 €	N/A		N/A
	15 min	28.00 €	→ 0 €	N/A		N/A
 Sharing the package	HH: 1 person	-25.21 €	→ 0 €	N/A		N/A
	HH: ≥ 2 persons	71.29 €	71.29 €	N/A		N/A

As can be seen in the table, people are most willing to pay for public transport with the amount being considerably higher than the current price for obtaining the same service. As stated above, however, this cannot be interpreted in the way that public transport could be made more expensive because the amount refers to the perceived value when public transport is included in the package.

Moreover, the table shows average WTP which may differ within user groups. For example, it can be assumed that those with private cars are willing to pay for public transport considerably less than those who use it frequently. However, results suggest that public transport should be the basis of MaaS plans as people perceive it to have the most value within the packages.

In comparison to the current market prices of bike sharing, survey respondents' WTP is only a fraction for a handful of bike sharing trips while they are willing to pay over the market price for unlimited monthly bike sharing. This supports the assumption that either people cycle frequently (and, hence, choose for unlimited bike sharing) or they do not want to cycle at all.

On the other hand, participants' unwillingness to pay for car sharing is linked to the dislike of the service yet the pilot SP experiment results suggest that younger people might be interested, and willing to pay, for car sharing. The dislike for car sharing might also be explainable through consumers' lack of experiences using the service and *status quo* bias' making people less willing to embrace new services. Additionally, the WTP for taxi has only a marginal value in comparison to its real market price. This can be explained with the feedback received from participants: taxis are a nice addition to the packages but only if they do not increase the price of the package as people will otherwise look for alternative modes.

Interestingly, people are not willing to pay for the increase in the speed of pick-up time: while they are willing to pay for both pick-up speeds, the respondents' perceived value for 30 minute pick up time was higher by nearly 2 euros. This is surprising as it directly affects the total travel time and is contradictory to the theory (e.g. Li et al., 2010) that people are willing to pay for travel time savings. Maybe the respondents do not care for pick-up times faster than 30 minutes as they are accustomed to plan their travel more than 15 minutes in advance. However, the cause may also be that the survey participants were confused about the meaning of pick-up time and, therefore, did not take into consideration or the respondents assuming that pick-up time referred only other modes than public transport.

As explained earlier, the survey participants were given 3 levels for pick-up speed: 15 and 30 minutes and no promise of the pick-up time. Therefore, the WTP curve is dependent on the assumption made about the meaning of 'no promise' as it can be anything between 0 minutes and infinity. In reality, however, it can be assumed that the traveller can have a mode available within a couple of hours. Figure 7.1 illustrates the change in WTP when the value of infinity is made more realistic. The figure shows the change when infinity is replaced by 60, 90, 120 and 150 minutes. With these different assumptions, the peak for respondents' WTP curve varies between 25 and 45 minutes.

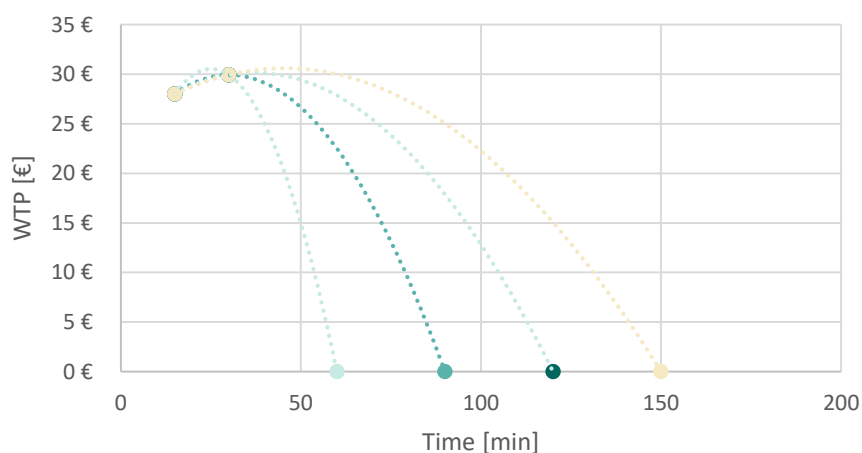


Figure 7.1: WTP curves with 4 different assumptions of the meaning of 'no promise'.

7.2. Package Design

In order to visualise the change in people's interest for MaaS packages, different exemplary MaaS plans were created. This section will explain the design by looking into the traveller groups (7.2.1) that affected the packages, the actual design of the packages (0) as well as how the add-ons were dealt with (7.2.3).

7.2.1. Traveller Groups

As the Catapult Study (2015) explained, there are different traveller groups and, therefore, varying needs for mobility solutions. However, as the results of this study show, heterogeneity exists within the Catapult Study traveller groups in terms of interest for mobility packages. Therefore, slightly modified traveller groups were generated as shown in the table below:

Table 7.2: Characteristics of the artificial consumers within their traveller group for Mobility-as-a-Service.

Traveller Group	Age	Disposable Income		Household size	Travel Purpose
			[€]		
Student	18-24		15-20K	Single	Work and Leisure
Young Professional	25-34		30-40K	Single	Work and Leisure
Middle-Aged	45-54		40-60K	2 or more	Work and Leisure
Pensioner	65-70		20-25K	Single	Leisure

As can be seen, four traveller groups, namely students, young professionals, pensioners and families, were selected for the analysis. The characteristics (age, disposable income and household size) of these groups were based on the population averages in the study area. As can be seen, all traveller groups but families live in single person households.

Due to the low number of responses from the outer regions of the study area (municipalities of Kerava, Kirkkonummi and Sipoo yielded total of 17 responses), it is not possible to draw robust conclusions on the choice process of the people based on their geographical location. Hence, geographical location has been left out of the choice model and the traveller segments are averages of the whole region. However, including the municipalities could be an interesting addition to the analysis that would, potentially, yield different results.

7.2.2. Packages

Based on the traveller groups' reasons to travel, different subscription packages were created to meet these varying travel needs. Packages were created in such a manner that the travel needs of the traveller groups were met by at least one the packages. Subsequently, the created packages are introduced in Figure 7.2. Car sharing has been left out of the packages as the analysis above shows that people were not willing to pay for it. Moreover, the price of all packages was varied between 79 and 237 euros as in the choice experiment.

7.2.3. Package Add-ons

Similarly to the choice experiment, it has been assumed that the public transport is applicable to one zone. As the survey results show, the package add-ons (extension to the travel zone, rental car, coach and long distance train) have demand and could therefore increase the demand for the packages. However, they have not been included in the demand analysis as they were not included in the experiment and it would endanger the robustness of the analysis.

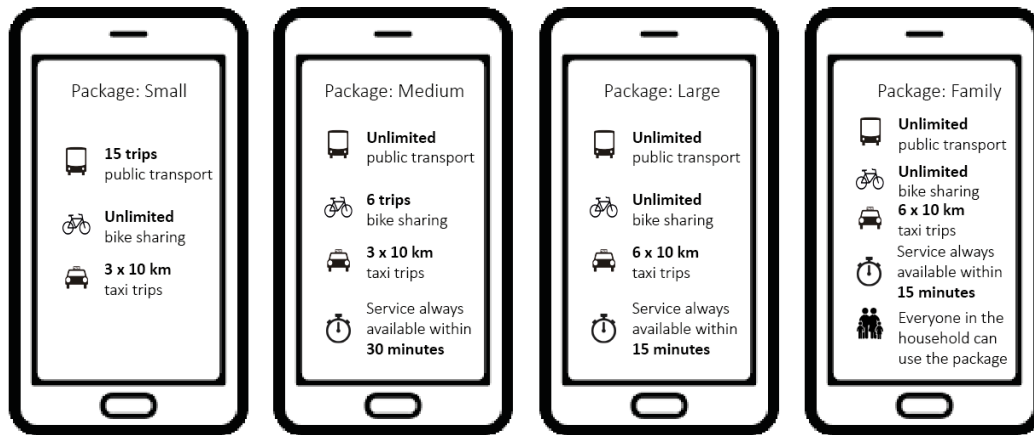


Figure 7.2: Created example packages.

7.3. Potential Demand of MaaS Packages

This section explains different estimates for the MaaS packages demand across different traveller groups. Firstly, relative package demand will be calculated when the packages have equal pricing (7.3). Secondly, the demand was calculated in a more realistic way so that a more extensive package had also a higher price (7.3.2).

7.3.1. Equal Pricing

The potential demand for the subscription packages was calculated for the four traveller groups mentioned above. The packages were given the same price and the relative demand was evaluated for each package based on that. Moreover, the price increased evenly amongst all packages throughout. Results of the demand analysis are presented in Figure 7.3:

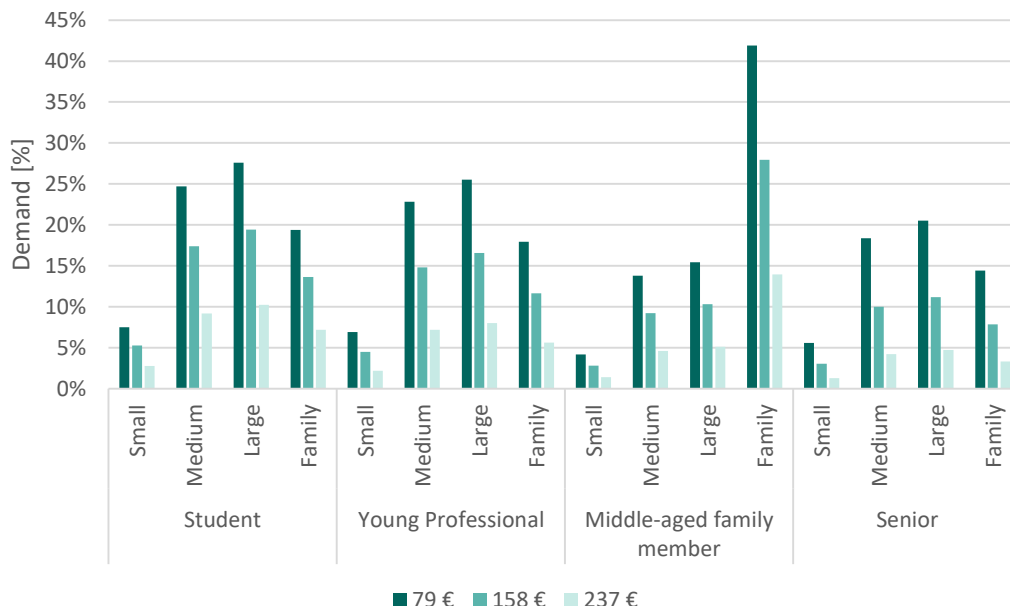


Figure 7.3: Consumer segments' demand for packages with respect to each other in three different price points.

In the first case, understandably, the demand of the packages grows as the content increases. However, an increase in the pricing brings the overall demand down. As can be seen in Figure 7.3, students appear

to have the highest demand for packages while families have the lowest demand with the exception of the family package.

Although it is indisputable that the differences in demand are great between the old and the young, it is questionable whether the demand would indeed be the highest for students rather than the young professionals. Such high demand can be explained with this group meeting the two main characteristics that are likely to choose for a package: low income and young age.

However, in reality, it may be that students have interest for the packages but no capability to pay high prices for them. Additionally, students currently receive a subsidised public transport card within the region which decreases the price of travelling by public transport significantly. As this restriction has not been taken into consideration in the model, the demand for packages by students might be lower in reality. Hence, high subsidies may be required from the government in order to provide packages that would truly attract students.

When exploring the package demand further, it is interesting to look into the generally most popular package, “Large”. The demand graph of this package is shown in Figure 7.4. The graph also includes a second demand line for a middle-aged traveller with a family; this line represents the demand for the ‘family’ package. The only difference between these two packages is that the family package includes an option to share the content of the package with everyone within the same household.

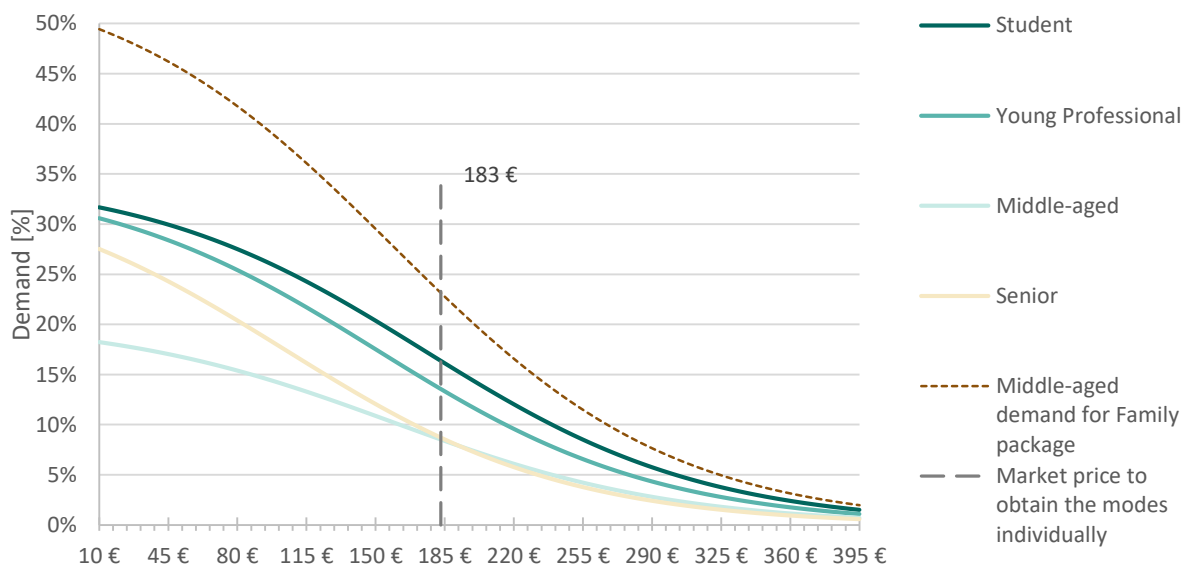


Figure 7.4: Predicted demand for plan “Large” over different traveller segments.

The graph demonstrates the importance of the package sharing function to members of households. While 9% of middle-aged travellers are predicted to have interest in the Large packages at 183€, the corresponding count for a family package is 35%. Therefore, it is an important factor to include in a package when the aim is to attract families to the service.

7.3.2. Varied Pricing

The demand analysis above has been based on equal prices for all packages. However, this is not realistic as packages that provide more to their users tend to also have higher prices. Because of lack of knowledge on the supply costs for the services, it was not possible to create comparisons based on true prices. Hence, two alternative methods were used: the use of pricing schemes from the experiment (79e, 158e, 237e) as well as the current prices of purchasing each part of the package separately as shown in Table 7.3.

Table 7.3: Two differing pricing Schemes for the experimental packages.

Package	Experimental price	Separate total price
Small	79 €	95 €
Medium	158 €	120 €
Large	237 €	183 €
Family	289 €	257 €

When comparing the experimental and more realistic prices, it can be noticed that the experimental pricing is higher for all the packages apart from the ‘Small’ plan. Visualisation of the analysis with these two pricing schemes is shown in Figure 7.5.

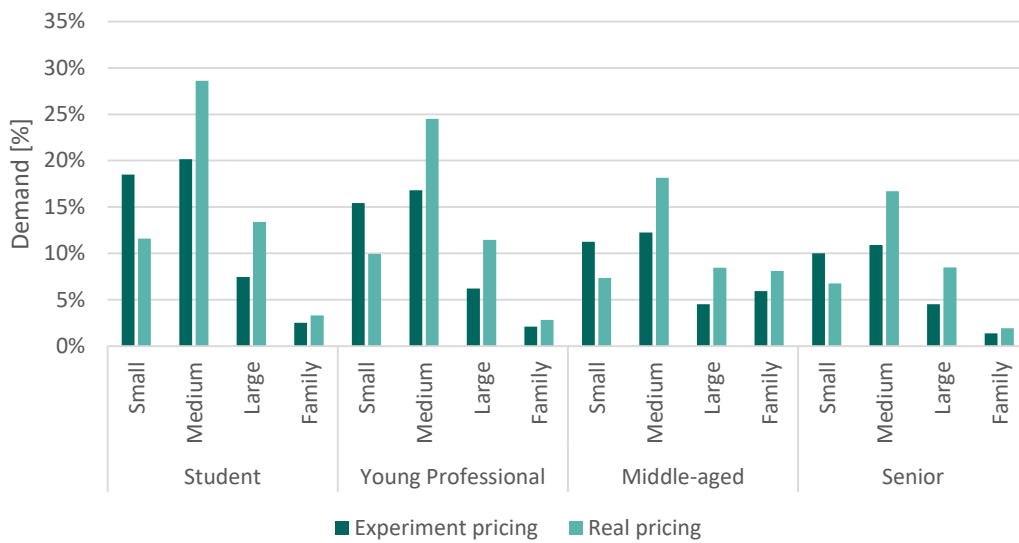


Figure 7.5: Difference in demand for packages between the two pricing schemes.

When comparing the demand between the pricing schemes, it can be noticed that in terms of the same package, the cheaper scheme is always more popular – this, however, was already expected. Thus, it is more interesting to look into the variance of demand within each pricing scheme separately. For both schemes, the Medium package has the most demand but its demand becomes increasingly popular when the prices are more realistic.

On the other hand, the considerably higher demand for Small-package over the Large-package within Experimental pricing shows how sensitive the consumers are to pricing in comparison to an increase of provided modes. The graphs shows a difference of nearly 20 percent between these two packages amongst the students. However, the difference evens out as the price difference halves.

Nevertheless, it is not surprising that the Family-package remains most attractive amongst middle-ages travellers with families although its share remains lower than expected. With the current pricing, family package has the expected demand of 8% while the Medium-package has the demand of 18%. This would suggest that although it is possible to design packages for families, it might still not become the most popular options amongst families due to varying reasons such as not meeting the needs of the family or it being cheaper to purchase multiple cheaper packages.

Therefore, it might be interesting to look into the change in demand for families when sharing becomes an add-on to any of the packages. For the calculations, it has been assumed that having a sharing 'add-on' costs 52 euros. The results of this are visible in Figure 7.6:

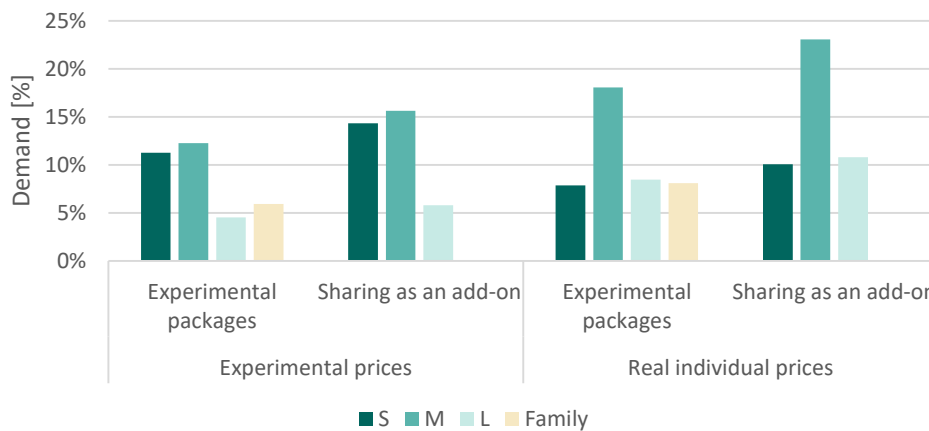


Figure 7.6: Difference in families' demand for packages between the exemplary packages and packages with sharing as an add-on.

Making sharing an add-on increases the total demand of MaaS-packages amongst families from 42 to 44% which does not provide a large increase in demand. However, change in the pricing for the sharing function can affect the demand significantly: when the price of sharing lowers to 30 euros, the demand of the packages increases to 48%.

Moreover, the analysis shows that the medium package remains clearly as the most popular package. This can be explained by its high provision of public transport and promise of pick-up speed in relation to a relatively low price. It is interesting to note, however, that the removal of family package has only a slight impact on the demand for Large package.

Instead, the demand from sharing is transferred onto the small and medium packages. This would suggest that it is recommendable to make the sharing function an add-on instead of a form of a package. Moreover, it supports the call from Kamargianni et al. (2015) to create packages that are as customisable as possible. However, including too many add-ons may cause the service to become too confusing to its user and, therefore, end up losing customers.

7.4. Conclusion

This chapter has applied the choice model in order to evaluate consumers' willingness-to-pay for Mobility as a Service packages. Results show that consumers' are willing to pay for public transport considerably more as part of the packages in comparison to the current prices of obtaining the same amount of services on the market.

Additionally, the model has been used to evaluate potential demand for mobility packages for different user groups. The results show that young people are more likely to buy the packages than senior citizens. While 29% of students are predicted to show demand for the Medium package, demand by seniors for the same package is 17%. Furthermore, travellers are most sensitive to the rise in pricing and public transport than an increase of other features included in the packages. Increase in the amount of public transport balances out the negative influence of price increase. However, other modes do not have similar effect.

Moreover, it has been shown that an increase for demand by middle-aged family members can be expected when the sharing function is offered as an additional feature to the packages instead of offering family packages. This also meets better the needs of families with different mobility needs.

8

Conclusion and Recommendations

In conclusion, this study has looked into literature concerning people's choice behaviour and new mobility services, and carried out a stated preference survey on consumers' preferences on MaaS-subscription packages in the Helsinki Regional Transport Authority Finland. This chapter will finalise the research by first discussing the main findings of the research (8.1). Afterwards, section 8.2 will discuss the limitations of the used methodology which will be followed by the practical and theoretical recommendations in section 8.3.

8.1. Conclusion

The following research question was formulated at the beginning of the research:

“Which factors, in terms of consumer preferences and willingness to pay, need to be taken into consideration in the design of fixed Mobility-as-a-Service subscription packages?”

Taking consumers' preferences and willingness to pay for the service into consideration, it is crucial that the design of MaaS packages concentrates around public transport. Additionally, it is important that the service promise includes an assurance of the pick-up speed in order to increase people's trust in the service. While the main potential for the service is in the youth as well as the users of public transport, it might be possible to attract elderly to the service by creating discount schemes for travel outside of peak hours. However, regional differences might occur and, therefore, these recommendations should not be applied to locations abroad without further study.

The rest of this section will concentrate on explaining and discussing the main findings of the research in more detail. The factors that influence consumers' choice of MaaS packages (through choice modelling) was in the centre of this research (8.1.2) but it is important to look into the preferred design of the service itself as well as the qualitative data on the attitudes towards MaaS (8.1.1.) as they lay the foundations for the service.

8.1.1. Qualitative Analysis

For this research, qualitative analysis consisted of interviews as well as voluntary feedback provided by the SP survey respondents. While others were ready to adopt MaaS, others were more hesitant towards it.

Service Design of MaaS

Based on the interviews, people wanted a service that comprises the highest level of integration. Nonetheless, they were not necessarily willing to pay extra for its convenience. This was also stated by Giesecke et al. (2016) who showed that people perceive a high level of service and convenience as a standard rather than a novelty.

Additionally, the perceived convenience of fixed packages differed based on whether the respondents were frequent public transport or private car users. While public transport users see MaaS as a highly convenient extension to public transport which enables them to better access the study area, car users see it as a downgrade in comparison to private car use. This can be explained by *status quo* bias as described by Pankratz et al. (2017). These respondents perceived that the packages should include more taxi and other 'private' modes in order to become an attractive alternative to owning a car whereas public transport users would rather use MaaS than purchase their own car.

Overall, it was perceived important that the packages were cheaper than current mobility solutions. Users compare the price of the package to their current travel budget: the novelty of the packages is assumed as also stated by Giesecke et al. (2016). However, for private car users the step to transfer from using private car is higher: this suggests that for them, the packages need to be considerably cheaper than their current expenses. Also, when comparing the prices between using a car and the packages, car users were also ignoring many of the hidden costs of car use: for example, parking and maintenance cost were often overseen.

Attitudes towards MaaS Packages

When establishing consumers' interest for MaaS packages through interviews and SP surveys, it became evident that the service does not work for everyone. Especially those, who lived far from an extensive transport infrastructure, did not see the benefits of abandoning a private car in order to adapt to MaaS. This supports the arguments set by Sochor et al. (2014) and Holmberg et al. (2016) who demonstrate that MaaS benefits the most those who live in urban centres.

Indeed, people from the municipalities with a denser network and supply of varying modes of transport were more interested in buying the packages: 61% of the respondents from Helsinki were package-optimists (willing to buy at least one of the packages during the SP experiment) while the rate for Sipoo, the municipality with the most sparse transport network, was zero. Due to the lack of data from Sipoo, however, there is need for more research before drawing conclusions.

Although interviewees, regardless of age, were genuinely interested in the service, the SP survey results show that the youth is most keen on the packages and, therefore, the biggest target group for the service as argued also by the Transport Systems Catapult study (2015). As age is the biggest influencing personal characteristic in terms of choosing for MaaS packages, the adaptation rate of MaaS cannot be expected to be fast. However, it does not mean that MaaS does not have potential. It might be possible to attract more elderly users for the service through discounts when travelling outside of peak hours as shown also by Cervero (1990).

Low income is another characteristic that was found to correlate with positive attitudes towards MaaS-packages. This is in contrary to the findings by Dias et al. (2017) who state that mainly young and high income individuals are interested in sharing services. As the levels of disposable income rose, respondents were keener to stick to their current mode which 60% of the time was a private car³. However, still 55% of households with annual income of over 60K euros were interested in the packages. These households consisted mainly of 2 persons and they had no children.

Furthermore, there were also consumers who did not see themselves using any other mode than their private car. These, "car lovers" cannot easily be convinced towards MaaS as they are not positive about car sharing services as also argues by Transport Systems Catapult study (2015). For package-pessimists (those who never chose any of the packages), the biggest barrier to adapting to the service was the

³ 60% of the respondents with an annual household income of 60K € or more used a car at least 3 times a week

issues surrounding public transport. They did perceive it to be impossible to travel within the studied area without a car, with concerns surrounding trips chains especially amongst families with children.

8.1.2. Quantitative Analysis

This section can be divided into two parts: factors and their influence on the choice of MaaS-packages, and potential demand for MaaS packages based on the application of the estimated MNL model. MNL model with the best model fit included the following interaction effects: age and income (interaction with opt-out) and sharing the package (interacting with household size). After validating the model, it can be said that the model fit is rather good (R-squared value 0.424).

Factors influencing choice of MaaS-packages

Based on literature, local transport supply and interviews, the chosen attributes for the SP survey were price, local public transport, bike sharing, car sharing, taxi, pick-up speed and sharing the package. From these attributes, public transport, pick-up speed, price and package sharing received significant parameter estimates. However, the estimated weights for the other attributes are kept in the model as they provide an educated guess on the real values of the attributes.

Moreover, the results on the attributes' influence on the choice were consistent and of expected sign. Price and sharing for people living alone have negative weights while bike sharing, public transport, taxi, pick-up speed and sharing when having a household have positive weights. Nevertheless, the results for car sharing were incoherent. The results of the final SP survey are along the lines of Mayas and Kamargianni (2017) by showing a negative value for car sharing. During the pilot survey, however, both parameters for car sharing received positive values which was supported by qualitative data showing that people were enthusiastic about car sharing. It might be possible to explain these findings with the low number and average age of pilot study respondents yet this raises a question on whether attitudes towards car sharing are changing amongst younger generations.

What is more, linearity was not assumed for the mode attributes and thus two parameters were estimated for them. Although linearity is difficult to test for due to many of the attributes having 'unlimited' as the third attribute level, results suggest that none of the attributes had linear relationships. However, calculating part worth utilities and testing for linearity was not done to support the claims further. Additionally, variables for car and bike sharing as well as taxi did not have significant values and therefore they were not tested for linearity.

Information on parameter values was used to estimate participants' willingness-to-pay for the separate package attributes. The results show that in comparison to the prices of currently acquiring the modes separately, respondents were willing to pay more for both unlimited public transport and public transport trips along with unlimited bike sharing. However, it needs to be pointed out that although WTP estimates may suggest that people are willing to pay double prices for public transport, it does not mean that the conventional pricing of public transport passes can be doubled as this value refers to the perceived value of public transport when included as part of a package.

In addition, willingness to pay for taxi is only marginal in comparison to current prices. This was supported by qualitative data that states taxis to be a nice addition to the packages, however they do not want them when their inclusion increases the price considerably. Additionally, SP experiment participants were not willing to pay for car sharing. This might be explained by a lack of experiences using the service or from great dislike for car sharing in general.

The results suggest that MaaS will not make public transport obsolete. Actually, the results suggest that public transport needs to be in the heart of the service. Study by Kamargianni and Matyas (2017) even discusses whether the organising body of MaaS should be a public transport authority or a private firm.

However, Hensher (2017) argues that MaaS plans might replace some of the public transport services and, therefore, shape the way in which public transport will be offered to end-users.

Furthermore, the results on willingness to pay for pick-up speed were surprising: respondents seemed to be willing to pay more for a promise of pick-up within 30 minutes than 15 minutes. This might be due to people trusting the public transport system to be already accessible within 15 minutes and therefore the pick-up speed is related to the remaining modes: bike sharing, car sharing and taxis. However, this is only a speculation. Lastly, families were willing to pay for sharing as part of a package.

Demand for MaaS Packages

Although WTP already gives an indication of people's interest in separate modes, it is not possible to draw conclusions from it for the potential demand of MaaS packages. Therefore, four experimental packages were created by combining the 7 attributes in different ways. These packages were created to cover different kind of travel needs while pricing was based on estimates of purchasing the packages separately. Consequently, demand for these packages was estimated in relation to other packages.

Demand for the packages was estimated for the following traveller groups: student, young professional, middle-aged family member and senior. Results from this analysis visualise that the young and low income user classes have the highest interest for the packages. Additionally, it visualises that people are sensitive to pricing and inclusion of unlimited public transport. Lastly, demand from family members is higher when sharing the package is turned into an additional feature of a package rather than a package on its own.

8.2. Limitations of the Research

This section elaborates on the uncertainties and limitations for data collection methods (8.2.1), collected data (8.2.2) and data analysis methods (8.2.3).

8.2.1. Survey Design

MaaS is still unknown for majority of people living in the study area. As explained earlier, the using SP survey as a data collection method has the limitation that people are asked to make choices from hypothetical MaaS subscription packages. Consequently, the findings of consumers' preferences are also hypothetical. Although the no-choice alternative was included in the choice sets to make the choice sets more realistic, it might still be questioned whether respondents would indeed choose any of the plans in reality.

For example, it is uncertain if the interested in the packages was the same had the other alternatives to the fixed packages (pay-as-you-go and flexible packages) been included in the choice sets. As some of the respondents are unfamiliar with the different options, in reality, it might be that respondents would have chosen for one of these alternatives rather than a fixed plan.

Moreover, the length of the survey should be considered. Although including 10 choice sets provides better estimates for the parameters, it may be that this decreased the respondents' level of attention to the choice tasks at hand. Also, there is always potential for hypothetical bias: it might be that respondents misunderstood the concept of MaaS and the choice situations. The risk of this was reduced by including an introduction film in the final SP survey in which MaaS and its packages were introduced to the participants. In addition, the information from the film was also presented in text as the survey was also provided in paper and it could not be assumed that everyone wanted to watch a film.

Furthermore, respondents may have made assumptions of how the service works. This could have been avoided, for instance, by conducting a second pilot survey. Moreover, the risk was reduced by providing

contact details of the author where respondents could email and tell their opinions as well as voice questions.

Additionally, the *status quo* bias together with respondents' difficulties to objectively estimate how much they spend on transportation in a month, may have caused a higher portion people choosing for opt-out. This is the case especially for car-users who did not seem to include all the hidden costs when comparing the price of using their cars vs. MaaS packages. Transforming the no-choice alternative into a base-case where the respondent sees constantly how much they spend currently on transportation, could help with this. However, it must be noted that it directly affects the length of the survey and, therefore, respondent fatigue.

Likewise, when including an additional question with regards no-choice, one of the alternatives should not be "does not fit my needs" as this adds to the length of the survey without providing much information to the researcher.

As stated earlier, approximately 51% of the respondents chose always to travel with their current mode instead of choosing a package. In reality, however, this count may be lower due to the survey structure. Based on the received respondent feedback, it is evident that the survey was not clear to all respondents; it was intended that people first choose the packages and then expand them to fit their travel needs. Taking the misunderstanding into account, it is understandable that without extensive enough public transport network, people are not keen on buying the service. In the future, it should be emphasised that especially the public transport travel area can be expanded.

Additionally, the use of efficient design to come up with realistic survey design has its limitations. As the definition of efficient designs, the method is not intended to be used to create realistic alternatives but alternatives with enough variation for the attribute levels instead. Therefore, set of constraints had to be set in the syntax which caused the survey design creation process to take much longer while the efficiency of the design stayed rather low.

Lastly, it may have been that unobserved factors and constraints were left out. Although the model fit was rather good for estimating the factors that influence consumers' choice of MaaS packages, the list of factors and attributes was by no means complete. Had more literature been read or more consumers interviewed, maybe other factors could have been included in the framework. Moreover, a selection had to be made with the listed factors in order to avoid respondent fatigue.

8.2.2. Data

In order to attract more respondents for the survey, all participants who filled in the survey took part in the lottery of 3 travel gift cards. However, this might have caused some of the respondents to complete the questionnaire only to participate in the lottery and did not fill in the questionnaire in a serious manner. This may have affected the quality of the data. Similarly, those people who filled in the survey just to be nice may have affected the quality of the data as well because maybe they did not care for the service.

Regardless of the efforts of attracting participants, many of the parameter estimates were statistically insignificant. Due to the small sample size, only some of the parameter estimates are significant and, therefore, somewhat reliable. With the estimated model, car sharing, bike sharing and taxi do not have significant results to draw reliable conclusions. In the future, this could be addressed by collecting more extensive samples by, for example, making the sample non-random or by sending the survey out multiple times.

It has been assumed beforehand that the pilot study, its prior values and the design with Ngene could yield an efficient design and create realistic choice sets. However, this was more difficult than anticipated and although Ngene was let to iterate over 200,000 times, not all choice sets were still realistic. Therefore, it can also be questioned how realistic the results are as well.

Finally, it must be remembered that the parameter estimates are based on data from Finland. As regional differences exist, results on consumers' preferences on set attributes cover only the population of the Finnish capital region. Although findings by Mayas and Kamargianni (2017) suggest similar preferences, the results might differ significantly if a survey was to be carried out in another country.

8.2.3. Data Analysis

Multinomial Logit Model is a great starting point for analysis thanks to its simplicity and quickness. However, it does have disadvantages. Firstly, the model does not take into consideration panel effects; instead, it treats each observation as an individual respondent. As such, it can therefore be assumed that each observation is equally important for parameter estimation (Chorus, 2016). However, this is not the case as all consumers' have preferences and once you know them, getting information from another consumer is more valuable.

For instance, because some respondents have a strong preference for a private car, they are likely to choose opt for no-choice in all choice tasks and, hence, information on 10 choice tasks from the same individual is not as valuable as from various individuals. Consequently, ignoring panel effects leads to too much certainty on the estimated parameters and their t-values may indicate that the estimates are significant while they are not (ibid.). This could be accounted for by estimating a more advanced choice model, such as Mixed Logit model.

Moreover, choosing an MNL model assumes that unobserved attributes are uncorrelated over the alternatives. However, this is not the case as two of the alternatives were unlabelled packages for the same service. It is also extremely difficult to prove that unobserved attributes are all uncorrelated over the alternatives. Using Mixed Logit analysis, however, the correlation in unobserved factors can be accounted for by introducing an additional error component (Train, 2009).

Although it was possible to estimate a model that is rather good at predicting consumers' choice of MaaS packages, more interaction effects could have been added to model. There is a link between travel behaviour and the location within the built environment as well as season. However, due to the small sample size and very unreliable parameter estimates, these interaction effects were not included in the model.

8.3. Recommendations

Based on the findings of this study, several recommendations can be given. This section will address the recommendations to MaaS providers (8.3.1) and future research (8.3.2).

8.3.1. Mobility-as-a-Service Providers

The results of this research suggest that the following factors should be taken into consideration when designing MaaS packages.

Pricing of MaaS packages

Logically, each MaaS package needs to have a price. However, MaaS providers should take the following factors into consideration when deciding upon pricing schemes:

- **People are sensitive to pricing.** Consumers compare their current modes with the pricing of MaaS-packages and they are not willing to pay extra for the novelty of packages. The results also suggest that for regular-car users, the packages need to be considerably cheaper in order to persuade them to change. Therefore, the package pricing should be cheaper in comparison to using the included modes separately.
- **Discounted packages may attract new users.** If the packages were given a discounted price when travelling outside of peak hours, the service might attract a larger variety of users, for instance seniors, who are not strictly tied to timetables.

Modes and Features Included in the Packages

This research focused on determining the factors that affect consumers' choices of fixed MaaS packages. The results of this research allow to conclude that the design of packages can be significantly improved by considering the following aspects:

- **Public transport at the heart of the service.** Within MaaS packages, consumers value public transport services the most and, therefore, the packages should be designed around public transport. Also, inclusion of public transport ensures maximised accessibility without the need of a private car. Moreover, from the consumer's point of view, it is important that the public transport service area (i.e. number of zones included) can be modified.
- **Promise of pick-up speed is important.** Consumers are willing to pay for reliability of the service and including it in the packages increases the demand of the service.
- **Consumers cycle either a lot or never.** Therefore, when bike sharing is to be included in the packages, its provision should be unlimited. This may also encourage consumers to try cycling.
- **Taxi trips should not increase the price.** Taxi trips provide only a marginal utility to consumers due to its currently high costs. Although the idea of 'emergency taxis' to be included in the packages is appreciated, people would rather skip them if they increase the total price of the package too much.
- **Consumers need experiences from car sharing.** For now, inclusion of car sharing services to the packages cannot be recommended as consumers are currently not willing to pay for it. This may be caused by the fact that majority of consumers lack experiences of using the service. Therefore, it is recommended that the car sharing service needs to be developed further and gain a wider usership. Once people have positive experiences from using the service, their inclusion in the packages could be reconsidered.
- **Families are willing to pay for the possibility of sharing the package.** While household members are willing to pay extra for the possibility to share the packages with their families, it is recommended that this feature is offered as an extra add-on rather than as a package. This way, the mobility needs of different kinds of families can be met.
- **Long-distance travel is well-received.** While majority of journeys are made in day-to-day travel, the addition of long distance modes has the potential to offer a real alternative to owning a car. This enables consumers to carry out, for instance, business and holiday trips. Therefore, the inclusion of long distance trains and coaches as well as car rental services should also be offered to the consumers.

Although other research has yielded similar results in terms of consumers' preferences for the package attributes, it must not be forgotten that MaaS is dependent on the local supply and, therefore, the application of these recommendations outside of Finland should be done after careful consideration.

Target group

Largest potential for MaaS is in young travellers, travellers with disposable income and users of public transport. If it is possible to get current youth to use MaaS, will they potentially stick to MaaS also when

their income grows. Currently, the youth receive public transport services with a discount and, hence, the package pricing needs to be competitive. Additionally, travellers with low disposable incomes as well as frequent public transport users are more likely to become customers of MaaS. Hence, the service should be aimed at them.

8.3.2. Future Research

This research has concentrated on looking into people's preferences and willingness to pay for MaaS subscription packages. However, there are ways to be more comprehensive and improve the knowledge. Firstly, it is recommended to find and estimate other variables for the choice model that would increase the model fit. This includes looking into the interaction effects of socio-demographic characteristics and their influence on the choice of packages as well as the influence of combinations of attributes within packages (e.g. taxi and public transport). Moreover, linearity of the attributes needs to be tested for.

More research is also required into the needs of people living in the periphery of the study area (Kerava, Kirkkonummi and Sipoo). As the survey gained only 17 responses from those municipalities, it is not possible to draw robust conclusions on the effects of geographical locations on the choice behaviour.

Another recommendation for improvement concerns further data collection on the attitudes of the youth (15-17-year-olds). Due to the limited sample size, it is difficult to draw conclusions on the attitudes of the future generations. However, in general young respondents were optimistic about the service and, this way, it would be possible to better estimate the impacts of MaaS on private car use in the longer term.

This research concentrated on daily transport modes as they cover 95% of consumers' mobility needs. However, when MaaS is expanded to cover also long distance travel, it has higher potential to replace private cars. Hence, it is important to look estimate parameters, and people's willingness to pay, for long-distance transport modes such as rail, coach and rental cars.

For this research, no-choice assumed that people will continue using their current mode. Because it is difficult for people to estimate how much they spend on transportation in a month, it would be preferred in the future if respondents were first asked to fill in their current mobility expenditure so that they can make more informed decision on their choice of package/no package.

Furthermore, the next steps include analysing the data with more sophisticated choice models, such as Mixed Logit and Latent Class. With such models, it is possible to get more insight into the different market segments and therefore pinpoint the design to meet the needs of the market segments.

As there already exists a MaaS operator in Finland, it would be desirable to gather revealed preference data on their choices and compare these results with the built models. Additionally, carrying out case studies in different regions across the globe is recommended in order to draw conclusions on international differences towards MaaS and its packages.

Moreover, it is recommended to look into the potential, and consumers' willingness to pay, for the Pay-as-you-Go and flexible MaaS plans as past research shows that people are indeed willing to pay more for flexibility in their packages. When such services are provided, they can have a significant impact on the demand of fixed mobility packages and, potentially, make them out-dated.

Lastly, research into how people would use the service (especially pay-as-you-go). By implementing the utility functions in a transport model, it is possible to look into the impacts of MaaS on infrastructure. For instance, to see how the results of this research would affect the current road network in the study area. This can provide insights on the traffic volumes and congestion.

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A

Interviews

10 semi-structured one-on-one interviews were conducted in order to guide the selection of attributes for the survey. This appendix will introduce the results from those interviews. Firstly, the idea of Mobility-as-a-Service was introduced to the participants who are described in section **A.1**. Secondly, they were asked to score a list of attributes (**A.2**). Finally, they were asked to mention additional features that have importance to their choice of packages (**A.3**).

A.1. Interviewee characteristics

All the participants live in the HSL Service area.

Table A.1: Interviewee Characteristics

#	Gender	Age	Household size (adults+children)	Willingness to spend on a mobility package	Preferred Pick-up Time Guarantee
1	Male	25-34	1+0	303 €	15 min
2	Female	35-44	2+2	200 €	120 min
3	Male	65-74	1+0	150-200 €	15 min
4	Male	25-34	1+0	250-300 €	20 min
5	Female	25-34	2+0	60 €	15 min
6	Female	25-34	1+0	50 €	30 min
7	Male	25-34	1+0	100 €	60 min
8	Female	25-34	1+0	100 €	10 min
9	Female	18-24	2+0	120 €	30 min
10	Female	35-44	2+2	200 €	60 min

A.2. Scoring the attributes

Each participant was asked to give a score from 0 to 2 for the attributes mentioned below based on how much they affect their willingness to purchase a mobility package. The scores translate to the following terms:

- 0 = Does not affect at all
- 1 = Attribute has some impact
- 2 = Attribute has a great impact

Table A.2: Attribute scores

Attributes	Score per respondent	Total Score	Ranking
Price	2 2 2 2 2 1 2 2 2 1	18	#2
Modes			
Public Transport (HSL)	1 2 2 2 2 2 2 2 2 2	19	#1
Bike Sharing	2 2 0 0 1 0 0 2 0 2	9	#9
Car Sharing	2 2 1 2 0 1 1 0 0 2	11	#5
Taxi	1 1 1 1 0 0 1 2 0 2	9	#10
Intercity Train	2 0 1 0 1 2 1 2 2 1	12	#4
Coach	0 0 1 0 1 0 1 0 0 0	3	#13
Rental Car	1 2 0 1 0 1 2 0 0 0	7	#12
Ride Sharing	0 1 2 2 2 1 1 0 0 1	10	#7
Other Features			
Possible to share with family	2 1 0 0 0 0 1 1 2 2	9	#11
Sanction for failed promise	1 2 2 2 2 1 1 0 2 2	15	#3
Unused saldo transferred to next month	2 1 2 1 2 1 1 0 0 0	10	#8
Pick-up time guarantee	2 1 2 2 2 2 1 2 2 2	18	#2

A.3. Failed Service Promise

Secondly, people were asked to identify what kind of sanction should be given to the operator for a failed service promise. Generally, all sanctions were seen as compensations to the respondents.

Table A.3: Proposed sanctions for failed service promise

#	Sanction	Explanation	x Times Mentioned
1	Discount in the future	Getting a discount from next month's bill based on how many times the promise has been failed	3
2	Level-up	Getting a free level-up to the bigger package for month	2
3	Immediate replacement	Having an alternative mode to replace the failed mode immediately (within 15 minutes)	9
4	Money back	Getting back the money/credit for the failed trip	3
5	Compensation for alternative	Compensation for the extra costs of taking an alternative mode, e.g. taxi	2

A.4. Additional Features

After ranking the aforementioned attributes, respondents were asked to list other attributes that had not been mentioned and that would affect their choice to get a mobility package. They are shown in Table A.4.

Table A.4: Additional features mentioned during interviews

#	Attribute	Explanation	x Times Mentioned
1	Choice of car size	Possibility to choose the car type	3
2	Luxurious car	Possibility to choose the car brand	1
3	Child seats	Does the service provide a child seat	2
4	Dividing payments	Paying multiple months with one bill/paying every 2 weeks	3
5	Monthly customisation	The package can be changed every month based on travel needs	5
6	Hybrid packages	Being able to travel for cheap between A and B and on top of that, having saldo that can be used for other travel	1
7	Sharing	Sharing the package with people that do not belong to your household (e.g. taxi)	2

B

Choosing Attributes

This appendix shows how the final attributes were selected for the survey. The method used was Multi Criteria Analysis (MCA). Attributes from both literature and the semi-structured interviews are brought together and graded on the following three criteria: **1.** is it realistic to include this feature in the package (0=no, 1=yes); **2.** points given during the interview; and **3.** does it affect everyday mobility (0=no, 1=yes). After weighing the attributes, the top 7 were chosen for the survey in order to avoid making the survey too exhausting to the respondents.

B.1. Complete List of Attributes

Table B.1: Complete list of attributes that affect potential users' choice of a package

#	Attributes from Literature	Attributes from Interviews	Criteria 1. 2. 3.	Score 1*2*3	Chosen
Modes					
1	Taxi		1 - 9 - 1	9	x
2	Ride Sharing		0 - 10 - 1	0	
3	Public Transport		1 - 19 - 1	19	x
4	Rental Car		1 - 7 - 0	0	
5	Bike Sharing		1 - 9 - 1	9	x
6	Car Sharing		1 - 11 - 1	11	x
7	Airplane		0 - 0 - 0	0	
8	Long distance train		1 - 12 - 0	0	
9	Automated vehicles		0 - 0 - 0	0	
10	Coach		1 - 12 - 0	0	
Features					
15	Price		1 - 18 - 1	18	x
16	Sharing package with household		1 - 9 - 1	9	x
17	Reward for the use of sustainable modes		1 - 3	3	
18	Promise of pick-up speed		1 - 18 - 1	18	x
19	Pay-as-you-Go function		0* - 11	0	
20	Package included in rent		0 - 0	0	
21		Operator sanction for failed promise	0 - 15	0	
22		Unused saldo transferred to next month	0 - 10	0	
23		Extra bill for overrunning package	0* - 15	0	
24		Choice of car size	1 - 6	6	
25		Luxurious car	0 - 1	0	
26		Child seats	1 - 2	2	
27		Monthly customisation	1 - 6	6	
28		Hybrid packages	0 - 1	0	
29		Sharing the package with non-household members	0 - 2	0	
30		Dividing payments	0 - 3	0	

* Not included in the scope of the research



Pilot Survey

This appendix provides an overview of both the design and results of the pilot survey. Firstly, The process of creating prior values for the pilot survey is presented in Section C.1. Ngene was used to create a design for the discrete choice survey (C.2) and the resulting 10 choice tasks are presented in Section C.3. Socio-demographic characteristics of pilot survey respondents are shown in Section C.4. Finally, the respondents' answers were estimated in a choice model with BioGeme for which a .mod (C.5) and a .dat files were created to estimate the choice models.

C.1. Prior Values

In order to use an efficient design, prior estimates were derived the following way:

1. The list of chosen attributes and their parameters were presented to 10 people
2. They were asked to rank them based on how important they were for them when choosing a MaaS package.
3. The most important parameter was set to have a value of |2.5| and the rest of the parameters' prior decreased based on their ranking so that the larger the difference to the next parameter, the larger the decrease in the value.

C.2. Ngene Syntax

For the pilot, an efficient MNL,D-design was used. This Section provides the Ngene syntax that was used in order to device the choice sets for the survey.

```
Design
;alts=Package1, Package2, Opt-out
;rows=14
;eff=(mnl,d)
;cond:
if(package1.PT_T=1, package1.PT_U=0),
if(package1.PT_U=1, package1.PT_T=0),
if(package2.PT_T=1, package2.PT_U=0),
if(package2.PT_U=1, package2.PT_T=0),
if(package1.PU_15=1, package1.PU_30=0),
if(package1.PU_30=1, package1.PU_15=0),
if(package2.PU_15=1, package2.PU_30=0),
if(package2.PU_30=1, package2.PU_15=0),
if(package1.CS_4=1, package1.CS_8=0),
if(package1.CS_8=1, package1.CS_4=0),
if(package2.CS_4=1, package2.CS_8=0),
if(package2.CS_8=1, package2.CS_4=0),
if(package1.BS_4=1, package1.BS_8=0),
if(package1.BS_8=1, package1.BS_4=0),
if(package2.BS_4=1, package2.BS_8=0),
if(package2.BS_8=1, package2.BS_4=0),
if(package1.Taxi_3=1, package1.Taxi_6=0),
```

```

if(package1.Taxi_6=1, package1.Taxi_3=0),
if(package2.Taxi_3=1, package2.Taxi_6=0),
if(package2.Taxi_6=1, package2.Taxi_3=0),
if(package1.Taxi_6=0 and package1.Taxi_3=0 and package1.BS_4=0 and package1.BS_8=0 and
package1.CS_8=0 and package1.CS_4=0,package1.PU_15=0 and package1.PU_30=0),
if(package2.Taxi_6=0 and package2.Taxi_3=0 and package2.BS_4=0 and package2.BS_8=0 and
package2.CS_8=0 and package2.CS_4=0,package2.PU_15=0 and package2.PU_30=0),
if(package1.PU_15=1 or package1.PU_30=1, package1.Taxi_6=1 or package1.Taxi_3=1 or
package1.BS_4=1 or package1.BS_8=1 or package1.CS_8=1 or package1.CS_4=1),
if(package2.PU_15=1 or package2.PU_30=1, package2.Taxi_6=1 or package2.Taxi_3=1 or
package2.BS_4=1 or package2.BS_8=1 or package2.CS_8=1 or package2.CS_4=1),
if(package1.Price=1, package1.Sharing=0),
if(package2.Price=1, package2.Sharing=0),
if(package1.Price=2 or package1.Price=3, package1.PT_U=1),
if(package2.Price=2 or package2.Price=3, package2.PT_U=1)
;model:
U(package1)=b0+b1[3]*Price[1,2,3]+b2.dummy[2]*PT_T[1,0]+b3.dummy[2.8]*PT_U[1,0]+b4.dummy[
0.8]*CS_4[1,0]+b5.dummy[1]*CS_8[1,0]+b6.dummy[0.2]*BS_4[1,0]+b7.dummy[0.3]*BS_8[1,0]+b8.d
ummy[0.5]*Taxi_3[1,0]+b9.dummy[0.6]*Taxi_6[1,0]+b10.dummy[0.2]*Sharing[1,0]+b11.dummy[1]*
PU_15[1,0]+b12.dummy[0.8]*PU_30[1,0]/
U(package2)= b0+b1*Price+ b2*PT_T + b3*PT_U + b4*CS_4 + b5*CS_8 + b6*BS_4 + b7*BS_8 +
b8*Taxi_3 + b9*Taxi_6 + b10*Sharing + b11*PU_15 + b12*PU_30
$

```

C.3. Choice Tasks

The following table shows the choice task design that was yielded from Ngene after 241,158 evaluations. Together with the responses from the 46 pilot participants, they were turned into a data (.dat) file for BioGeme.

Table C.1: The 14 choice tasks generated for the SP pilot survey.

Choice Task	Choice 1											Choice 2											Opt-out	
	Price	PT_Trips	PT_Unlim	CarS_4	CarS_8	BikeS_4	BikeS_8	Taxi_3	Taxi_6	Sharing	PickUp_15	PickUp_30	Price	PT_Trips	PT_Unlim	CarS_4	CarS_8	BikeS_4	BikeS_8	Taxi_3	Taxi_6	Sharing		PickUp_15
1	1	0	1	0	0	0	0	0	1	0	0	1	1	0	0	0	1	0	1	1	0	0	1	0
2	1	0	0	0	1	0	1	0	1	0	0	0	3	0	1	0	0	1	0	1	0	0	1	0
3	2	0	1	1	0	1	0	1	0	0	0	0	2	0	1	0	1	0	0	0	1	0	1	0
4	3	0	1	0	1	1	0	0	1	1	1	0	1	0	0	1	0	0	0	0	0	0	0	1
5	1	1	0	0	0	0	1	1	0	0	1	0	1	0	1	0	1	0	0	0	0	0	0	0
6	2	0	1	0	1	0	0	1	0	1	0	1	1	1	0	0	0	1	0	0	0	0	0	0
7	1	0	0	0	0	1	0	0	1	0	1	0	2	0	1	1	0	0	1	1	0	1	0	0
8	2	0	1	0	1	1	0	1	0	0	1	0	2	0	1	1	0	0	1	0	1	1	0	1
9	2	0	1	1	0	1	0	0	0	1	1	0	3	0	1	0	0	0	0	0	1	1	1	0
10	3	0	1	0	1	0	1	1	0	0	0	1	3	0	1	1	0	1	0	1	0	0	1	0
11	1	0	1	1	0	0	0	1	0	0	1	0	1	1	0	0	1	1	0	0	0	0	0	1
12	3	0	1	1	0	0	1	0	0	0	0	0	3	0	1	0	1	0	1	0	1	0	0	1
13	3	0	1	0	1	0	0	0	0	1	0	1	2	0	1	1	0	1	0	0	1	0	0	1
14	1	1	0	0	1	0	0	0	1	0	0	0	1	0	1	0	0	0	1	0	0	0	1	0

C.4. Results of Pilot Survey

Socio-demographic characteristics of respondents for the pilot survey.

Table C.2: Information on the respondents of the pilot survey.

Number of respondents	46
Age <i>Mean = 36 years</i>	15-17 4% 18-24 11% 25-34 46% 35-44 15% 45-54 9% 55-64 9% 65-74 7%
Municipality	Helsinki 63% Espoo 24% Vantaa 7% Kerava 2% Other 4%
Gender	Female 59% Male 41%
Disposable household income (annual)	<10 000 € 9% 10 000–24 999 € 27% 25 000–34 999 € 18% 35 000–44 999 € 9% 45 000–55 000 € 11% >55 000 € 25%
Household size (persons)	1 26% 2 50% 3 11% 4 13%

C.5. BioGeme Model

Below is the model (.mod) file used to estimate the MNL model from the pilot SP survey results.

```
[ModelDescription]
"Estimation of an MNL model for Mobility-as-a-Service Packages based on 3 alternatives:"
"- Package1"
"- Package2"
"- Opt-out"

[Choice]
//Where the chosen alternative can be found in the file
CHOICE

[Beta]
//Name      Value  LowerBound UpperBound  Status (0=variable, 1=fixed)
B_Package   0      -10000  10000   0
B_Price     -2.5   -10000  10000   0
B_PT_Trips  2      -10000  10000   0
B_PT_Unlim  2.4    -10000  10000   0
B_CarS_4    0.8    -10000  10000   0
B_CarS_8    1      -10000  10000   0
B_BikeS_4   0.2    -10000  10000   0
B_BikeS_8   0.3    -10000  10000   0
B_Taxi_3    0.5    -10000  10000   0
B_Taxi_6    0.6    -10000  10000   0
B_Sharing   0.2    -10000  10000   0
B_PickUp_15 1      -10000  10000   0
B_PickUp_30 0.8    -10000  10000   0

[Utilities]
// Id  Name      Availability cond      Linear-in-parameter expression
1 Package1 Package1 B_Package * one + B_Price * PA_Price + B_PT_Trips * PA_PT_Trips + B_PT_Unlim
* PA_PT_Unlim + B_CarS_4 * PA_CarS_4 + B_CarS_8 * PA_CarS_8 + B_BikeS_4 * PA_BikeS_4 + B_BikeS_8
* PA_BikeS_8 + B_Taxi_3 * PA_Taxi_3 + B_Taxi_6 * PA_Taxi_6 + B_Sharing * PA_Sharing + B_PickUp_15
* PA_PickUp_15 + B_PickUp_30 * PA_PickUp_30
2 Package2 Package2 B_Package * one + B_Price * PB_Price + B_PT_Trips * PB_PT_Trips + B_PT_Unlim
* PB_PT_Unlim + B_CarS_4 * PB_CarS_4 + B_CarS_8 * PB_CarS_8 + B_BikeS_4 * PB_BikeS_4 + B_BikeS_8
* PB_BikeS_8 + B_Taxi_3 * PB_Taxi_3 + B_Taxi_6 * PB_Taxi_6 + B_Sharing * PB_Sharing + B_PickUp_15
* PB_PickUp_15 + B_PickUp_30 * PB_PickUp_30
3 Opt-Out 00 $NONE

[Expressions]
//To define arithmetic expressions for names that are not directly available from the data
one = 1
Package1 = 1
Package2 = 1
00 = 1

[Model]
//$MNL stands for Multinomial Logit Model
$MNL
```


D

Final Survey Design

This appendix provides an overview of the design and results of the final SP survey. Firstly, Ngene syntax used to create a design for the discrete choice survey is presented in Section D.1. The resulting choice task design is shown in Section D.2. The most important correlations between socio-demographic variables and MaaS-related characteristics are shown in Section D.3. Lastly, the Biogeme .mod-file used to estimate the MNL model is presented in Section D.4.

D.1. Ngene Syntax

For the final survey, an efficient MNL,D-design with Bayesian estimations was used. This Section provides the Ngene syntax that was used in order to device the choice sets for the survey.

```
?Main MaaS-survey
Design
;alts=Package1, Package2, Opt-out
;rows=10
;eff=(mnl,d,mean)
;cond:
if(Package1.PT_Trips=1, Package1.PT_Unlim =0),
if(Package1.PT_Unlim=1, Package1.PT_Trips=0),
if(Package2.PT_Trips=1, Package2.PT_Unlim =0),
if(Package2.PT_Unlim =1, Package2.PT_Trips=0),
if(Package1.PickUp_15=1, Package1.PickUp_30=0),
if(Package1.PickUp_30=1, Package1.PickUp_15=0),
if(Package2.PickUp_15=1, Package2.PickUp_30=0),
if(Package2.PickUp_30=1, Package2.PickUp_15=0),
if(Package1.CarS_4=1, Package1.CarS_8=0),
if(Package1.CarS_8=1, Package1.CarS_4=0),
if(Package2.CarS_4=1, Package2.CarS_8=0),
if(Package2.CarS_8=1, Package2.CarS_4=0),
if(Package1.BikeS_Trips=1, Package1.BikeS_Unlim=0),
if(Package1.BikeS_Unlim=1, Package1.BikeS_Trips=0),
if(Package2.BikeS_Trips=1, Package2.BikeS_Unlim=0),
if(Package2.BikeS_Unlim=1, Package2.BikeS_Trips=0),
if(Package1.Taxi_3=1, Package1.Taxi_6=0),
if(Package1.Taxi_6=1, Package1.Taxi_3=0),
if(Package2.Taxi_3=1, Package2.Taxi_6=0),
if(Package2.Taxi_6=1, Package2.Taxi_3=0),
if(Package1.Taxi_6=0 and Package1.Taxi_3=0 and Package1.BikeS_Trips=0 and
Package1.BikeS_Unlim=0 and Package1.CarS_8=0 and Package1.CarS_4=0,Package1.PickUp_15=0
and Package1.PickUp_30=0),
if(Package2.Taxi_6=0 and Package2.Taxi_3=0 and Package2.BikeS_Trips=0 and
Package2.BikeS_Unlim=0 and Package2.CarS_8=0 and Package2.CarS_4=0,Package2.PickUp_15=0
and Package2.PickUp_30=0),
if(Package1.PickUp_15=1 or Package1.PickUp_30=1, Package1.Taxi_6=1 or Package1.Taxi_3=1 or
Package1.BikeS_Trips=1 or Package1.BikeS_Unlim=1 or Package1.CarS_8=1 or
Package1.CarS_4=1),
```

```

if(Package2.PickUp_15=1 or Package2.PickUp_30=1, Package2.Taxi_6=1 or Package2.Taxi_3=1 or
Package2.BikeS_Trips=1 or Package2.BikeS_Unlim=1 or Package2.CarS_8=1 or
Package2.CarS_4=1),
if(Package1.Price=1, Package1.Sharing=0),
if(Package2.Price=1, Package2.Sharing=0),
if(Package1.Price=2 or Package1.Price=3, Package1.PT_Unlim=1),
if(Package2.Price=2 or Package2.Price=3, Package2.PT_Unlim=1)
;model:
U(Package1)=          b0[-1.87]          +          b1[(n, -1.26, 0.183)]*Price[1,2,3]          +
b2.dummy[(n, 0.833, 0.361)]*PT_Trips[1,0] + b3.dummy[(n, 1.99, 0.345)]*PT_Unlim[1,0] +
b4.dummy[(n, 0.318, 0.245)]*CarS_4[1,0] + b5.dummy[(n, 0.589, 0.227)]*CarS_8[1,0] +
b6.dummy[(n, 0.03, 0.234)]*BikeS_Trips[1,0] + b7.dummy[(n, 0.287, 0.213)]*BikeS_Unlim[1,0] +
b8.dummy[(n, 0.35, 0.215)]*Taxi_3[1,0] + b9.dummy[(n, 0.711, 0.22)]*Taxi_6[1,0] +
b10.dummy[(n, 0.527, 0.217)]*Sharing[1,0] + B11.dummy[(n, 0.381, 0.218)]*PickUp_15[1,0] +
b12.dummy[(n, -0.129, 0.235)]*PickUp_30[1,0]/
U(Package2)= b0+b1*Price + b2*PT_Trips + b3*PT_Unlim + b4*CarS_4 + b5*CarS_8 +
b6*BikeS_Trips + b7*BikeS_Unlim + b8*Taxi_3 + b9*Taxi_6 + b10*Sharing + b11*PickUp_15 +
b12*PickUp_30
$

```

D.2. Choice Task Design

This Section provides the Experiment design for the final SP survey as well as the visualisation of the choice tasks that was presented to the respondents.

Table D.1: Final Choice Task Design.

Choice Task	Choice 1											Choice 2											Opt-Out	
	Price	PT_Trips	PT_Unlim	CarS_4	CarS_8	BikeS_Trips	BikeS_Unlim	Taxi_3	Taxi_6	Sharing	PickUp_15	PickUp_30	Price	PT_Trips	PT_Unlim	CarS_4	CarS_8	BikeS_Trips	BikeS_Unlim	Taxi_3	Taxi_6	Sharing		PickUp_15
1	2	0	1	0	1	0	1	1	0	0	0	1	0	0	1	0	1	0	0	0	1	0	0	0
2	0	0	0	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0
3	1	0	1	0	1	1	0	1	0	1	1	0	0	1	1	0	0	0	0	0	0	1	0	0
4	1	0	1	1	0	0	1	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0
5	1	0	1	1	0	1	0	0	1	0	1	0	1	0	1	0	0	0	0	1	0	1	0	1
6	2	0	1	1	0	0	0	1	0	1	0	1	0	1	0	0	1	1	0	0	0	0	0	1
7	2	0	1	1	0	0	1	0	1	1	0	0	1	0	1	1	0	0	1	0	1	0	1	0
8	0	1	0	0	1	0	0	0	1	0	0	1	0	0	1	0	1	0	1	1	1	1	0	0
9	0	1	0	1	0	1	0	1	0	0	0	1	0	1	1	0	0	0	0	0	1	1	1	0
10	0	0	1	0	0	1	0	0	1	0	0	0	0	1	0	0	1	0	1	0	1	0	0	0

D.3. Correlations

This section provides cross tables of the most significant correlations between socio-demographic and mobility related characteristics as well as interest towards Mobility-as-a-Service packages. The tables are explained in more detail in Section 6.1.3.

Table D.2: Cross table of Gender and HSL Season pass ownership. It can be seen that women are more likely to own a Seasonal public transport pass.

		Gender		
		Male	Female	Total
HSL season	No	76	79	155
	Yes	28	67	95
Total		104	146	250

Table D.3: Cross table of household's disposable income and ownership of seasonal travel pass. It can be seen that majority of seasonal pass owners have below average income.

		Disposable Income										Rather not say	Total
		< 10 000 €	10 000 - 14 999 €	15 000 - 19 999 €	20 000 - 24 999 €	25 000 - 29 999 €	30 000 - 39 999 €	40 000 - 59 999 €	60 000 - 79 999 €	80 000 - 99 999 €	> 100 000 €		
HSL season	No	5	6	9	14	12	18	38	16	5	10	19	152
	Yes	11	7	7	9	5	14	18	12	2	6	6	97
Total		16	13	16	23	17	32	56	28	7	16	25	249

Table D.4: Cross table of age and smart phone ownership. The table shows that smart phone ownership decreases as the respondents' age increases.

		Age							Total
		15-17	18 - 24	25 - 34	35 - 44	45 - 54	55 - 64	65-70	
Smart phone	No	0	1	0	1	7	12	17	38
	Yes	5	11	41	33	33	48	42	213
Total		5	12	41	34	40	60	59	251

Table D.5: Cross table of age and interest in MaaS packages. It shows that interest in packages decreases when age increases.

		Age							Total
		< 18	18 - 24	25 - 34	35 - 44	45 - 54	55 - 64	≥ 65	
Interest in MaaS packages	No	3	2	14	15	23	30	42	129
	Yes	2	10	27	19	17	30	17	122
Total		5	12	41	34	40	60	59	251

Table D.6: Cross table of household disposable income and interest in MaaS packages. It can be seen that interest in packages decreases with higher income.

		Disposable Income										Rather not say	Total
		< 10 000 €	10 000 - 14 999 €	15 000 - 19 999 €	20 000 - 24 999 €	25 000 - 29 999 €	30 000 - 39 999 €	40 000 - 59 999 €	60 000 - 79 999 €	80 000 - 99 999 €	> 100 000 €		
Interest in MaaS packages	No	5	6	6	14	7	16	31	11	3	9	20	128
	Yes	11	7	10	9	10	16	25	17	4	7	5	121
Total		16	13	16	23	17	32	56	28	7	16	25	249

D.4. BioGeme Model

The model (.mod) file for BioGeme estimations was constructed as follows:

```
[ModelDescription]
"Estimation of an MNL model for Mobility-as-a-Service Packages based on 3 alternatives:"
"- Package1"
"- Package2"
"- Opt-out"

[Choice]
//Where the chosen alternative can be found in the file
CHOICE

[Beta]
//Name Value LowerBound UpperBound Status (0=variable, 1=fixed)
ASC_OptOut 0 -10000 10000 0
B_Price -1.26 -10000 10000 0
B_PTTrips 0.833 -10000 10000 0
B_PTUnlim 1.99 -10000 10000 0
B_CarS4 0.318 -10000 10000 0
B_CarS8 0.589 -10000 10000 0
B_BikeSTrips 0.03 -10000 10000 0
B_BikeSUnlim 0.287 -10000 10000 0
B_Taxi3 0.35 -10000 10000 0
B_Taxi6 0.711 -10000 10000 0
B_Sharing 0.527 -10000 10000 0
B_PickUp15 0.381 -10000 10000 0
B_PickUp30 -0.129 -10000 10000 0
i_Age 0 -10000 10000 0
i_Income 0 -10000 10000 0
i_Sharing 0 -10000 10000 0

[Utilities]
// Id Name Availability cond Linear-in-parameter expression
1 Package1 Package1 B_Price * PA_Price + B_PTTrips * PA_PT_Trips + B_PTUnlim * PA_PT_Unlim +
B_CarS4 * PA_CarS_4 + B_CarS8 * PA_CarS_8 + B_BikeSTrips * PA_BikeS_Trips + B_BikeSUnlim *
PA_BikeS_Unlim + B_Taxi3 * PA_Taxi_3 + B_Taxi6 * PA_Taxi_6 + B_Sharing * PA_Sharing + i_Sharing
* HH_PA_Sharing + B_PickUp15 * PA_PickUp_15 + B_PickUp30 * PA_PickUp_30
2 Package2 Package2 B_Price * PB_Price + B_PTTrips * PB_PT_Trips + B_PTUnlim * PB_PT_Unlim +
B_CarS4 * PB_CarS_4 + B_CarS8 * PB_CarS_8 + B_BikeSTrips * PB_BikeS_Trips + B_BikeSUnlim *
PB_BikeS_Unlim + B_Taxi3 * PB_Taxi_3 + B_Taxi6 * PB_Taxi_6 + B_Sharing * PB_Sharing + i_Sharing
* HH_PB_Sharing + B_PickUp15 * PB_PickUp_15 + B_PickUp30 * PB_PickUp_30
3 Opt-Out one ASC_OptOut * one + i_Age * Age + i_Income * Income

[Expressions]
//To define arithmetic expressions for names that are not directly available from the data
one = 1
Package1 = 1
Package2 = 2
HH_PA_Sharing = HH * PA_Sharing
HH_PB_Sharing = HH * PB_Sharing

[Model]
//$MNL stands for MultiNomial Logit Model
$MNL
```

E

Full Final Survey

This Section provides the whole final paper survey sent to respondents. Because the survey was distributed in Finnish, a translation to English will be provided on the right side of the paper

Hei!

Haluatko olla mukana kehittämässä tulevaisuuden liikkumispalveluja? Kaikkien kyselyyn vastanneiden kesken arvotaan 3 kpl **50 €** Helsingin Seudun Liikenteen (HSL) matkalahjakorttia.

TUTKIMUKSEN AIHE

Teen diplomityötä hollantilaisessa Delftin Teknisessä Yliopistossa, liikennesuunnittelun tutkimus-ohjelmassa. Tutkimuksen tarkastelee matkustajien suhtautumista uudenlaista liikkumispalvelua ja sen tarjoamia palveluita kohtaan. Osana työtä, teen kyselytutkimuksen Helsingin Seudun Liikenteen (HSL) alueella. Tulosten yhteenveto toimitetaan SITO Oy:n ja yliopiston lisäksi myös Liikennevirastolle ja HSL:lle.

Kyselytutkimusta varten tarvitsen kaikenlaisia matkustajia: niin joukkoliikennettä käyttäviä kuin myös autoilijoita.

OSALLISTUMINEN

Vastaathan kyselyyn **23.3. 2017 mennessä**. Kyselyyn vastaaminen kestää 10-20 minuuttia ja siihen voi vastata kahdella tavalla:

- Sähköinen kysely**
 - Vastaa ja palautaa kysely sähköisesti osoitteessa (saatavissa myös sivun alareunan QR-koodilla):
<https://goo.gl/forms/c0yvNu65WhSCOJXa2>
- Paperinen kysely**
 - Vastaa kyselyyn ja palautaa kyselylomake oheisella kirjekuorella, joka on varustettu postimerkillä.

Toivon kyselylle ensisijaisesti sähköisiä vastauksia. Vastaaminen tulee tapahtumaan anonymisti ja kerättyjä tietoja käsitellään ehdottoman luottamuksellisesti.

YHTEYSTIEDOT

Jos mieltäsi askarruttaa kysymys tutkimukseen liittyen, voit lähettää sähköpostia osoitteeseen:
h.ratilainen@student.tudelft.nl

Kaikki vastaukset ovat arvokkaita ja olen kiitollinen kaikille vastaajille.

Ystävällisin terveisin,
Hanna Ratilainen



Hello!

Would you like to take part in the development of future mobility services? All the participants will take part in the drawing of 3 travel gift cards for Helsinki Regional Transport (HSL). Value of each gift card is **50 €**.

RESEARCH TOPIC

I am a student at Delft University of Technology, graduating from an MSc Transport, Infrastructure and Logistics degree programme. My research explores travellers' attitudes towards new mobility services and as a part of the research, I am conducting a survey in the HSL service area. Summary of the findings will be delivered to the University, SITO Oy, Finnish Transport Agency as well as HSL.

For the survey, I need all kind of travellers: both regular transport as well as private car users.

PARTICIPATION

Please respond to the survey by 23rd of March, 2017. Filling in the survey takes approximately 10-20 minutes and you can participate in the two following ways:

- Electronic survey**
 - Fill in and submit the survey electronically at (also available through the QR-code):
<https://goo.gl/forms/c0yvNu65WhSCOJXa2>
- Paper survey**
 - Fill in the survey and submit it in attached envelope (mailing costs are already paid for).

I wish primarily for electronic responses. All participants will remain anonymous and your information will be confidential.

CONTACT

If you have questions or comments with regards the survey, you can contact me at:
h.ratilainen@student.tudelft.nl

All responses are valuable and I am grateful for all respondents.

Yours faithfully,
Hanna Ratilainen



LIKKUMISPAKETIT

Kuljemme kaikkialle autolla, koska se on "kätevää". Asiaa ei auta se, että monen vaihtoehtoisen kulkumuodon yhteensovittaminen on vaivalloista: reittioppaat eivät sisällä kaikkia kulkumuotoja ja niiden maksamista ei ole koottu yhteen. Onko autoillulle edes vaihtoehtoa?

Liikkumispaketit toimivat samalla tavoin kuin puhelinliittymäsi mutta tekstiviestien, minuuttien sekä netin sijasta saat erilaisia kulkumuotoja, joista maksat kuukausimaksun. Ajatuksena on, että valitset itsellesi sopivan kuukausipaketin, jolla hoidat kuukauden liikkumistarpeesi. Puhelinliittymäsi tavoin, voit muokata liikkumispakettiasi seuraavalle laskutuskaudelle niin, että pakettisi vastaa aina tarpeitasi.

Palvelu toimii puhelinsovelluksen kautta, jossa voit:

1. Suunnitella reittisi
2. Valita kulkumuodon
3. Hakea aikatauluja
4. Varata kulkumuotoja ja
5. Hankkia elektroniset matkaliput

Jokainen liikkumispaketti on erilainen. Alla on kuvattu kaksi erilaista liikkumispalvelun kuukausipakettia. Jokaiseen pakettiin liittyy ominaisuuksia sekä kuukausihinta, jonka maksamalla pakettiin sisältyvät palvelut saa käyttöön.



OMINAISUUDET

Hinta	Palvelun kuukausihinta
Paikallisliikenne (HSL)	= paikallisjuna, linja-auto, metro, raitovaunu sekä Suomenlinnan lautta. o 15 matkaa = 15 matkaa alueella "Sisäinen" (= yhden kunnan sisällä) o Rajaton = 30 päivän rajaton liikkuminen alueella "Sisäinen"
Yhteiskäyttöauto	= Yhteiskäyttöautot ovat saatavilla vuorokauden ympäri ja palvelu sallii hyvinkin lyhyet vuokra-ajat. Yhteiskäyttöauton hintaan kuuluvat polttoaine ja vakuutus. Auton voi palauttaa eri pisteeseen kuin mistä se on vuokrattu. o 4h = voit käyttää yhteiskäyttöautoa 4 tuntia kuukaudessa o 8h = voit käyttää yhteiskäyttöautoa 8 tuntia kuukaudessa
Kaupunkipyörä	= Kaupunkipyörät toimivat samoin kuin yhteiskäyttöautot. o 6 matkaa = voit tehdä kuusi pyörämatkaa, joiden pituus on enintään 30 min. o Rajaton = rajaton määrä pyörämatkoja, joiden pituus on enintään 30 min.
Taksi	o 3 x 10 km = 3 x 10 kilometriä taksilla kuukaudessa o 6 x 10 km = 6 x 10 kilometriä taksilla kuukaudessa
Perhe / Henk. koht.	o Perhe = Samassa kotitaloudessa asuvat ihmiset voivat käyttää yhdessä samaa pakettia ja sen tarjoamia palveluja o Henkilökohtainen = Palvelu on henkilökohtainen
Aikalupa	o 15 min = Kulkuneuvo on saatavissa käyttöön 15 min sisällä tilauksesta o 30 min = Kulkuneuvo on saatavissa käyttöön 30 min sisällä tilauksesta o Ei = Ei lupautu kulkuneuvon saatavuuden nopeudesta

MOBILITY PACKAGES

We travel by car because it is 'convenient'. It does not help that combining various alternative modes is complicated: route planners do not include all the modes and one needs to pay for them separately. Does an alternative for private car use really exist?

Mobility packages work similarly to your phone plan where instead of SMS, minutes and internet, your package consists of various modes over which you pay one monthly subscription fee. The idea is that you choose a package that meets your monthly travel needs. Similarly to your phone plan, you can modify your travel packages for the next month so that the package will always meet your needs.

The service can be accessed through a mobile application with which you can:

1. Plan your route
2. Choose the mode(s) you want to travel with
3. Look for timetables
4. Book the modes, and
5. Access the e-tickets

Each mobility package is different. Below, you can see two different monthly packages. Both of them consist of features and a monthly price. By paying the price, you have an access to the transport modes mentioned under the package.



FEATURES

Price	Monthly cost of using the package
Public Transport (HSL)	= commuter train, buses, metro, tram and Suomenlinna ferry. o 15 trips = 15 trips within one zone o Unlimited = 30 day unlimited travel within one zone
Car sharing	= Shared cars are available around the clock and the service allows for short rental periods. It includes petrol and insurance costs. You can drop the car off at a different location than when you picked it up from. o 4h = You can use car sharing services for 4 hours per month o 8h = You can use car sharing services for 8 hours per month
Bike sharing	= Bike sharing works similarly to car sharing. o 6 trips = 6 trips with maximum length of a trip being 30 minutes. o Unlimited = unlimited trips with maximum length of a trip being 30 minutes.
Taxi	o 3 x 10 km = 3 x 10 kilometres with taxi per month o 6 x 10 km = 6 x 10 kilometres with taxi per month
Family / Personal	o Family = All the members of the household can use the same package o Personal = Only you can use the package
Pick-up speed	o 15 min = You will have access to the vehicle within 15 minutes of booking it o 30 min = you will have access to the vehicle within 30 minutes of booking it o Ei = No promise of how fast the vehicle will be available to you

VALINTAKYSYMYKSET

Tämä kysely tutkii ihmisten mieltymyksiä liikkumispaketteja kohtaan. Alla on kuvattu kymmenen liikkumispakettiparia. Jokaiseen pakettipariin liittyy kysymys:

”Minkä kolmesta vaihtoehdoista ostaisit (Paketin 1, Paketin 2 vai ”Et kumpaakaan”)?

Vastaa kysymyksiin ottaen huomioon tämänhetkinen elämäntilanteesi. Vastaa ympyrimällä sen vaihtoehdon numero, jonka valitsit. Ota huomioon kaikki pakettien ominaisuudet ja valitse vaihtoehto, jonka ostaisit kaikkein todennäköisimmin. Vastatkaa raxittamalla mieleisenne vaihtoehdon viereinen laatikko.

VALINTA 1/10

Paketti 1		Paketti 2	
 Rajaton Paikallislilenne, HSL - Sisäinen	 Henk. koht. Paketti on henkilökohtainen	 4 h Yhteiskäyttöauto	 Henk. koht. Paketti on henkilökohtainen
 8 h Yhteiskäyttöauto	 30 min Aikalupaus palvelun saatavuuden nopeudesta	 6 Kaupunkipyörämatkaa, 30 min	 - Ei lupaus palvelun saatavuuden nopeudesta
 Rajaton Kaupunkipyörä, 30 min		 6 Taksimatkaa, 10 km	
 3 Taksimatkaa, 10 km			
237 € / kk		79 € / kk	

1. Minkä vaihtoehdon ostaisit?

- Paketti 1
 Paketti 2
 Ei kumpikaan

2. Jos et valinnut kumpaakaan pakettia, miksi et?

- Paketit eivät vastaa tarpeitani
 Paketit ovat liian kalliita
 Muu syy

VALINTA 2/10

Paketti 1		Paketti 2	
 8 h Yhteiskäyttöauto	 Henk. koht. Paketti on henkilökohtainen	 Rajaton Paikallislilenne HSL - Sisäinen	 Perhe Pakettia voi käyttää koko kotitalous
 Rajaton Kaupunkipyörä, 30 min	 15 min Aikalupaus palvelun saatavuuden nopeudesta	 4 h Yhteiskäyttöauto	 30 min Aikalupaus palvelun saatavuuden nopeudesta
 6 Taksimatkaa, 10 km		 6 Kaupunkipyörämatkaa, 30 min	
		 3 Taksimatkaa, 10 km	
79 € / kk		237 € / kk	

3. Minkä vaihtoehdon ostaisit?

- Paketti 1
 Paketti 2
 Ei kumpikaan

4. Jos et valinnut kumpaakaan pakettia, miksi et?

- Paketit eivät vastaa tarpeitani
 Paketit ovat liian kalliita
 Muu syy



CHOICE QUESTIONS

This survey explores people's preferences towards mobility package. Below, you can find 10 pairs of mobility package and each pair has a question attached to them:

”Which of the three alternatives would you buy (Package 1, Package 2 or Neither)?

Please answer the questions taking into consideration your current living conditions. Consider all the features of the package and choose the alternative you would most likely buy by ticking the box next to the alternative.

CHOICE 1/10

Package 1		Package 2	
 Unlimited Public Transport HSL - Internal	 Personal The package is for personal use	 4 h Car sharing	 Personal The package is for personal use
 8 h Car sharing	 30 min Promise of the pick-up speed	 6 Bike sharing trips, 30 min	 - No promise of the pick-up speed
 Unlimited Bike sharing, 30 min		 6 Taxi trips, 10 km	
 3 Taxi trips, 10 km			
237 € / month		79 € / month	








1. Which option would you buy?

- Package 1
 Package 2
 Neither of them

2. If you chose neither of the packages, why not?

- The packages do not meet my needs
 The packages are too expensive
 Other

CHOICE 2/10

Package 1		Package 2	
 8 h Car sharing	 Personal The package is for personal use	 Unlimited Public Transport HSL - Internal	 Family The whole household can use the package
 Unlimited Bike sharing, 30 min	 15 min Promise of the pick-up speed	 4 h Car sharing	 30 min Promise of the pick-up speed
 6 trips Taxi, 10 km/trip		 6 trips Bike Sharing, 30 min/trip	
		 3 trips Taxi, 10 km/trip	
79 € / month		237 / month	

3. Which option would you buy?

- Package 1
 Package 2
 Neither of them

4. If you chose neither of the packages, why not?

- The packages do not meet my needs
 The packages are too expensive
 Other

VALINTA 3/10

Paketti 1		Paketti 2	
	Rajaton Paikallisiikenne, HSL - Sisäinen		15 Paikallisiikennematkaa, HSL - Sisäinen
	8 h Yhteiskäyttöauto		8 h Yhteiskäyttöauto
	6 Kaupunkipyörämatkaa, 30 min		Henk. koht. Paketti on henkilökohtainen
	3 Taksimatkaa, 10 km		15 min Aikalupaus palvelun saataavuuden nopeudesta
	Perhe Pakettia voi käyttää koko kotitalous		Henk. koht. Paketti on henkilökohtainen
158 € / kk		79 € / kk	

5. Minkä vaihtoehdon ostaisit?

- Paketti 1
- Paketti 2
- Ei kumpikaan

6. Jos et valinnut kumpaakaan pakettia, miksi et?

- Paketit eivät vastaa tarpeitani
- Paketit ovat liian kalliita
- Muu syy

CHOICE 3/10

Package 1		Package 2	
	Unlimited Public Transport HSL - Internal		15 trips Public Transport HSL - Internal
	8 h Car sharing		8 h Yhteiskäyttöauto
	6 trips Bike Sharing, 30 min/trip		Family The whole household can use the package
	3 trips Taxi, 10 km/trip		15 min Promise of the pick-up speed
	Family The whole household can use the package		Personal The package is for personal use
158 € / month		79 € / month	

5. Which option would you buy?

- Package 1
- Package 2
- Neither of them

6. If you chose neither of the packages, why not?

- The packages do not meet my needs
- The packages are too expensive
- Other

VALINTA 4/10

Paketti 1		Paketti 2	
	Rajaton Paikallisiikenne, HSL - Sisäinen		Rajaton Paikallisiikenne, HSL - Sisäinen
	4 h Yhteiskäyttöauto		4 h Yhteiskäyttöauto
	Rajaton Kaupunkipyörä, 30 min		Henk. koht. Paketti on henkilökohtainen
	3 Taksimatkaa, 10 km		- Ei lupaus palvelun saataavuuden nopeudesta
	Perhe Pakettia voi käyttää koko kotitalous		Henk. koht. Paketti on henkilökohtainen
158 € / kk		158 € / kk	

7. Minkä vaihtoehdon ostaisit?

- Paketti 1
- Paketti 2
- Ei kumpikaan

8. Jos et valinnut kumpaakaan pakettia, miksi et?

- Paketit eivät vastaa tarpeitani
- Paketit ovat liian kalliita
- Muu syy

CHOICE 4/10

Package 1		Package 2	
	Unlimited Public Transport HSL - Internal		Unlimited Public Transport HSL - Internal
	4 h Car sharing		4 h Yhteiskäyttöauto
	Unlimited Bike sharing, 30 min		Family The whole household can use the package
	3 trips Taxi, 10 km/trip		- No promise of the pick-up speed
	Family The whole household can use the package		Personal The package is for personal use
158 € / month		158 € / month	

7. Which option would you buy?

- Package 1
- Package 2
- Neither of them

8. If you chose neither of the packages, why not?

- The packages do not meet my needs
- The packages are too expensive
- Other

VALINTA 5/10

<p>Paketti 1</p> <p>Rajaton Paikallisliikenne, HSL - Sisäinen</p> <p>4 h Yhteiskäyttöauto</p> <p>6 Kaupunkipyörämatkaa, 30 min</p> <p>6 Taksimatkaa, 10 km</p> <p>15 min Aikalupaus palvelun saatavuuden nopeudesta</p> <p>Henk. koht. Paketti on henkilökohtainen</p> <p>158 € / kk</p>	<p>Paketti 2</p> <p>Rajaton Paikallisliikenne, HSL - Sisäinen</p> <p>8 h Yhteiskäyttöauto</p> <p>6 trips Bike Sharing, 30 min/trip</p> <p>6 trips Taxi, 10 km/trip</p> <p>30 min Aikalupaus palvelun saatavuuden nopeudesta</p> <p>Perhe Pakettia voi käyttää koko kotitalous</p> <p>158 € / kk</p>
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9. Minkä vaihtoehdon ostaisit?

- Paketti 1
 Paketti 2
 Ei kumpikaan

10. Jos et valinnut kumpaakaan pakettia, miksi et?

- Paketit eivät vastaa tarpeitani
 Paketit ovat liian kalliita
 Muu syy

CHOICE 5/10

<p>Package 1</p> <p>Unlimited Public Transport HSL - Internal</p> <p>4 h Car sharing</p> <p>6 trips Bike Sharing, 30 min/trip</p> <p>6 trips Taxi, 10 km/trip</p> <p>15 min Promise of the pick-up speed</p> <p>Personal The package is for personal use</p> <p>158 € / month</p>	<p>Package 2</p> <p>Unlimited Public Transport HSL - Internal</p> <p>8 h Car sharing</p> <p>30 min Promise of the pick-up speed</p> <p>Family The whole household can use the package</p> <p>158 / month</p>
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9. Which option would you buy?

- Package 1
 Package 2
 Neither of them

10. If you chose neither of the packages, why not?

- The packages do not meet my needs
 The packages are too expensive
 Other

VALINTA 6/10

<p>Paketti 1</p> <p>Rajaton Paikallisliikenne, HSL - Sisäinen</p> <p>4 h Yhteiskäyttöauto</p> <p>3 Taksimatkaa, 10 km</p> <p>30 min Aikalupaus palvelun saatavuuden nopeudesta</p> <p>Perhe Pakettia voi käyttää koko kotitalous</p> <p>30 min Aikalupaus palvelun saatavuuden nopeudesta</p> <p>237 € / kk</p>	<p>Paketti 2</p> <p>Rajaton Paikallisliikenne, HSL - Sisäinen</p> <p>4 h Yhteiskäyttöauto</p> <p>3 Taksimatkaa, 10 km</p> <p>30 min Aikalupaus palvelun saatavuuden nopeudesta</p> <p>Henk. koht. Paketti on henkilökohtainen</p> <p>79 € / kk</p>
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11. Minkä vaihtoehdon ostaisit?

- Paketti 1
 Paketti 2
 Ei kumpikaan

12. Jos et valinnut kumpaakaan pakettia, miksi et?

- Paketit eivät vastaa tarpeitani
 Paketit ovat liian kalliita
 Muu syy

CHOICE 6/10

<p>Package 1</p> <p>Unlimited Public Transport HSL - Internal</p> <p>4 h Car sharing</p> <p>3 trips Taxi, 10 km/trip</p> <p>30 min Promise of the pick-up speed</p> <p>Family The whole household can use the package</p> <p>237 € / month</p>	<p>Package 2</p> <p>Unlimited Public Transport HSL - Internal</p> <p>4 h Yhteiskäyttöauto</p> <p>3 trips Taxi, 10 km/trip</p> <p>30 min Promise of the pick-up speed</p> <p>Personal The package is for personal use</p> <p>79 € / month</p>
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11. Which option would you buy?

- Package 1
 Package 2
 Neither of them

12. If you chose neither of the packages, why not?

- The packages do not meet my needs
 The packages are too expensive
 Other

VALINTA 7/10

Paketti 1		Paketti 2	
 Rajaton Paikallislitkenne, HSL - Sisäinen	4 h Yhteiskäyttöauto	 Rajaton Paikallislitkenne, HSL - Sisäinen	8 h Yhteiskäyttöauto
 Rajaton Kaupunkipyörä, 30 min	6 Taksimatkaa, 10 km	 6 Kaupunkipyörämatkaa, 30 min	6 Taksimatkaa, 10 km
 Perhe Pakettia voi käyttää koko kotitalous	 30 min Aikalupaus palvelun saatavuuden nopeudesta	 Henk. koht. Paketti on henkilökohtainen	 15 min Aikalupaus palvelun saatavuuden nopeudesta
237 € / kk		237 € / kk	

13. Minkä vaihtoehdon ostaisit?

- Paketti 1
 Paketti 2
 Ei kumpikaan

14. Jos et valinnut kumpaakaan pakettia, miksi et?

- Paketit eivät vastaa tarpeitani
 Paketit ovat liian kalliita
 Muu syy

CHOICE 7/10

Package 1		Package 2	
 Unlimited Public Transport HSL - Internal	4 h Car sharing	 Unlimited Public Transport HSL - Internal	8 h Yhteiskäyttöauto
 Unlimited Bike sharing, 30 min	6 trips Taxi, 10 km/trip	 6 trips Bike Sharing, 30 min/trip	6 trips Taxi, 10 km/trip
 Perhe Pakettia voi käyttää koko kotitalous	 30 min Promise of the pick-up speed	 Personal The package is for personal use	 15 min Promise of the pick-up speed
237 € / month		237 € / month	

13. Which option would you buy?

- Package 1
 Package 2
 Neither of them

14. If you chose neither of the packages, why not?

- The packages do not meet my needs
 The packages are too expensive
 Other

VALINTA 8/10

Paketti 1		Paketti 2	
 15 trips Paikallislitkenne, HSL - Sisäinen	8 h Yhteiskäyttöauto	 Rajaton Paikallislitkenne, HSL - Sisäinen	8 h Yhteiskäyttöauto
 6 Taksimatkaa, 10 km	 Henk. koht. Paketti on henkilökohtainen	 Rajaton Kaupunkipyörä, 30 min	 Perhe Pakettia voi käyttää koko kotitalous
 30 min Aikalupaus palvelun saatavuuden nopeudesta	 15 min Aikalupaus palvelun saatavuuden nopeudesta	 6 Taksimatkaa, 10 km	 15 min Aikalupaus palvelun saatavuuden nopeudesta
79 € / kk		237 € / kk	





15. Minkä vaihtoehdon ostaisit?

- Paketti 1
 Paketti 2
 Ei kumpikaan

16. Jos et valinnut kumpaakaan pakettia, miksi et?

- Paketit eivät vastaa tarpeitani
 Paketit ovat liian kalliita
 Muu syy

CHOICE 8/10

Package 1		Package 2	
 15 trips Public Transport HSL - Internal	8 h Car sharing	 Unlimited Public Transport HSL - Internal	8 h Yhteiskäyttöauto
 6 trips Taxi, 10 km/trip	 Personal The package is for personal use	 Unlimited Bike sharing, 30 min	 Family The whole household can use the package
 30 min Promise of the pick-up speed	 15 min Promise of the pick-up speed	 6 trips Taxi, 10 km/trip	 15 min Promise of the pick-up speed
79 € / month		237 € / month	

15. Which option would you buy?

- Package 1
 Package 2
 Neither of them

16. If you chose neither of the packages, why not?

- The packages do not meet my needs
 The packages are too expensive
 Other

VALINTA 9/10

Paketti 1		Paketti 2	
15 Paikallisiikennematkaa, HSL - Sisäinen	Henk. koht. Paketti on henkilökohtainen	Rajaton Paikallisiikenne HSL - Sisäinen	Perhe Pakettia voi käyttää koko kotitalous
4 h Yhteiskäyttöauto		4 h Yhteiskäyttöauto	
6 Kaupunkipyörämatkaa, 30 min	15 min Aikalupaus palvelun saatavuuden nopeudesta	6 Taksimatkaa, 10 km	15 min Aikalupaus palvelun saatavuuden nopeudesta
3 Taksimatkaa, 10 km			
79 € / kk		158 € / kk	

17. Minkä vaihtoehdon ostaisit?

- Paketti 1
 Paketti 2
 Ei kumpikaan

18. Jos et valinnut kumpaakaan pakettia, miksi et?

- Paketit eivät vastaa tarpeitani
 Paketit ovat liian kalliita
 Muu syy

CHOICE 9/10

Package 1		Package 2	
15 trips Public Transport HSL - Internal	Personal The package is for personal use	Unlimited Public Transport HSL - Internal	Family The whole household can use the package
4 h Car Sharing		4 h Car Sharing	
6 trips Bike Sharing, 30 min/trip	15 min Promise of the pick-up speed	6 trips Taxi, 10 km/trip	15 min Promise of the pick-up speed
3 trips Taxi, 10 km/trip			
79 € / month		158 € / month	

17. Which option would you buy?

- Package 1
 Package 2
 Neither of them

18. If you chose neither of the packages, why not?

- The packages do not meet my needs
 The packages are too expensive
 Other

VALINTA 10/10

Paketti 1		Paketti 2	
Rajaton Paikallisiikenne, HSL - Sisäinen	Henk. koht. Paketti on henkilökohtainen	15 Paikallisiikennematkaa, HSL - Sisäinen	Henk. koht. Paketti on henkilökohtainen
6 Yhteiskäyttöauto		8 h Yhteiskäyttöauto	
6 Kaupunkipyörämatkaa, 30 min	- Ei lupaus palvelun saatavuuden nopeudesta	Rajaton Kaupunkipyörä, 30 min	- Ei lupaus palvelun saatavuuden nopeudesta
6 Taksimatkaa, 10 km		6 Taksimatkaa, 10 km	
79 € / kk		79 € / kk	

19. Minkä vaihtoehdon ostaisit?

- Paketti 1
 Paketti 2
 Ei kumpikaan

20. Jos et valinnut kumpaakaan pakettia, miksi et?

- Paketit eivät vastaa tarpeitani
 Paketit ovat liian kalliita
 Muu syy

CHOICE 10/10

Package 1		Package 2	
Unlimited Public Transport HSL - Internal	Personal The package is for personal use	15 trips Public Transport HSL - Internal	Personal The package is for personal use
6 trips Bike Sharing, 30 min/trip	- No promise of the pick-up speed	8 h YCar Sharing	- No promise of the pick-up speed
6 trips Taxi, 10 km/trip		6 trips Taxi, 10 km/trip	
79 € / month		79 € / month	

19. Which option would you buy?

- Package 1
 Package 2
 Neither of them

20. If you chose neither of the packages, why not?

- The packages do not meet my needs
 The packages are too expensive
 Other

21. Oletko kiinnostunut ostamaan lisäominaisuuden, jolla voi laajentaa paikallisliikenteen palvelualuetta?

(Peruspaketti sisältää vain Sisäisen* liikenteen)

- En
 Kyllä, Seutu-liikenne (+29 €/kk)**
 Kyllä, Lähiseutu 2-liikenne (+29 €/kk)***
 Kyllä, Lähiseutu 3-liikenne (+59 €/kk)****

22. Oletko kiinnostunut ostamaan pakettiin lisäksi kaukoliikenteen palveluita?

(Kaukoliikenne sisältää VR:n kaukojunat sekä kaukoliikenteen linja-autot)

- En
 Kyllä, junamatkoja
 Kyllä, linja-automatkoja
 Kyllä, molempia

23. Oletko kiinnostunut ostamaan pakettiin lisäksi vuokra-autopalveluita?

- En
 Kyllä

* Toimii alueella Helsinki / Espoo ja Kauniainen / Vantaa / Kerava ja Sipoo / Kirkkonummi
 ** Toimii alueella Helsinki, Espoo, Vantaa ja Kauniainen
 *** Toimii alueella Espoo, Vantaa, Kauniainen, Kerava, Kirkkonummi ja Sipoo
 **** Toimii alueella Helsinki, Espoo, Vantaa, Kauniainen, Kerava, Kirkkonummi ja Sipoo

21. Are you interested in purchasing an additional feature with which you can extend the coverage of public transport?

(The basic plan includes only one zone*)

- No
 Yes, Seutu (+29 €/month)**
 Yes, Lähiseutu 2 (+29 €/month)***
 Yes, Lähiseutu 3 (+59 €/month)****

22. Oletko kiinnostunut ostamaan pakettiin lisäksi kaukoliikenteen palveluita?

(Kaukoliikenne sisältää VR:n kaukojunat sekä kaukoliikenteen linja-autot)

- No
 Yes, train trips
 Yes, coach trips
 Yes, both

23. Oletko kiinnostunut ostamaan pakettiin lisäksi vuokra-autopalveluita?

- No
 Yes

* Works in Helsinki / Espoo ja Kauniainen / Vantaa / Kerava ja Sipoo / Kirkkonummi
 ** Works in Helsinki, Espoo, Vantaa and Kauniainen
 *** Works in Espoo, Vantaa, Kauniainen, Kerava, Kirkkonummi and Sipoo
 **** Works in Helsinki, Espoo, Vantaa, Kauniainen, Kerava, Kirkkonummi and Sipoo

TAUSTAKYSYMYKSET

Rakittakaa oikean vaihtoehdon viereinen laatikko.

<p>24. Sukupuoli</p> <p><input type="checkbox"/> Mies <input type="checkbox"/> Nainen</p>	<p>25. Ikä</p> <p><input type="checkbox"/> Alle 18v. <input type="checkbox"/> 18 - 24v. <input type="checkbox"/> 25 - 34v. <input type="checkbox"/> 35 - 44v. <input type="checkbox"/> 45 - 54v. <input type="checkbox"/> 55 - 64v. <input type="checkbox"/> Yli 65v.</p>	<p>26. Asuinkunta</p> <p><input type="checkbox"/> Helsinki <input type="checkbox"/> Espoo <input type="checkbox"/> Vantaa <input type="checkbox"/> Kauniainen <input type="checkbox"/> Kirkkonummi <input type="checkbox"/> Kerava <input type="checkbox"/> Sipoo <input type="checkbox"/> Muu</p>	<p>27. Asuinmuoto</p> <p><input type="checkbox"/> Omakotitalo <input type="checkbox"/> Kerrostalo <input type="checkbox"/> Rivitalo <input type="checkbox"/> Paritalo <input type="checkbox"/> Maatila <input type="checkbox"/> Muu</p>
<p>28. Mikä seuraavista vaihtoehdoista kuvaa parhaiten pääasiallista toimintaanne?</p> <p><input type="checkbox"/> Opiskelija tai koululainen (peruskoulu, lukio, ammattiopisto, korkeakoulu) <input type="checkbox"/> Eläkeläinen <input type="checkbox"/> Työtön <input type="checkbox"/> Työssäkäyvä, kokopäiväinen <input type="checkbox"/> Työssäkäyvä, osa-aikainen <input type="checkbox"/> Varusmies tai siviilipalvelusmies <input type="checkbox"/> Kotiäiti / -isä <input type="checkbox"/> Muu</p>	<p>29. Kotitaloutenne käytettävissä olevat tulot? <i>Huomioikaa koko kotitaloutenne käytettävissä olevat vuositulot (tulot verojen jälkeen).</i></p> <p><input type="checkbox"/> < 10 000 € <input type="checkbox"/> 10 000 – 14 999 € <input type="checkbox"/> 15 000 – 19 999 € <input type="checkbox"/> 20 000 – 24 999 € <input type="checkbox"/> 25 000 – 29 999 € <input type="checkbox"/> 30 000 – 39 999 € <input type="checkbox"/> 40 000 – 59 999 € <input type="checkbox"/> 60 000 – 79 999 € <input type="checkbox"/> 80 000 – 99 999 € <input type="checkbox"/> >100 000 € <input type="checkbox"/> En halua sanoa</p>		

BACKGROUND QUESTIONS

Tick the correct option.

<p>24. Gender</p> <p><input type="checkbox"/> Male <input type="checkbox"/> Female</p>	<p>25. Age</p> <p><input type="checkbox"/> Under 18yo <input type="checkbox"/> 18 - 24yo <input type="checkbox"/> 25 - 34yo <input type="checkbox"/> 35 - 44yo <input type="checkbox"/> 45 - 54yo <input type="checkbox"/> 55 - 64yo <input type="checkbox"/> Over 6yo</p>	<p>26. Municipality</p> <p><input type="checkbox"/> Helsinki <input type="checkbox"/> Espoo <input type="checkbox"/> Vantaa <input type="checkbox"/> Kauniainen <input type="checkbox"/> Kirkkonummi <input type="checkbox"/> Kerava <input type="checkbox"/> Sipoo <input type="checkbox"/> Other</p>	<p>27. Dwelling type</p> <p><input type="checkbox"/> Detached <input type="checkbox"/> Block of flats <input type="checkbox"/> Terraced <input type="checkbox"/> Semi-detached <input type="checkbox"/> Farm <input type="checkbox"/> Other</p>
<p>28. Occupation</p> <p><input type="checkbox"/> Student (comprehensive- or secondary school / higher education) <input type="checkbox"/> Pensioner <input type="checkbox"/> Unemployed <input type="checkbox"/> Working, full time <input type="checkbox"/> Working, part time <input type="checkbox"/> Conscript <input type="checkbox"/> Home maker <input type="checkbox"/> Other</p>	<p>29. Household's annual disposable income <i>Consider the income after taxes.</i></p> <p><input type="checkbox"/> < 10 000 € <input type="checkbox"/> 10 000 – 14 999 € <input type="checkbox"/> 15 000 – 19 999 € <input type="checkbox"/> 20 000 – 24 999 € <input type="checkbox"/> 25 000 – 29 999 € <input type="checkbox"/> 30 000 – 39 999 € <input type="checkbox"/> 40 000 – 59 999 € <input type="checkbox"/> 60 000 – 79 999 € <input type="checkbox"/> 80 000 – 99 999 € <input type="checkbox"/> >100 000 € <input type="checkbox"/> I do not want to say</p>		

30. Montako henkilöä kuuluu talouteenne? <i>Laskekaa itsenne mukaan.</i>	31. Montako alle 18-vuotiasta kuuluu talouteenne? <i>Laskekaa itsenne mukaan.</i>	32. Mikä seuraavista teillä on? <i>Voitte valita useita vaihtoehtoja.</i>
<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 tai enemmän	<input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 2 tai enemmän	<input type="checkbox"/> Älypuhelin <input type="checkbox"/> Mopokortti <input type="checkbox"/> Henkilöautoajokortti <input type="checkbox"/> HSL-matkakortti, kausi <input type="checkbox"/> HSL-matkakortti, arvo <input type="checkbox"/> Kaupunkipyöräjäsenyys (kauden aikana) <input type="checkbox"/> Yhteiskäyttöautojäsenyys <input type="checkbox"/> VR-kausilippu <input type="checkbox"/> Muu <input type="checkbox"/> Ei mitään

33. Kuinka usein käytätte seuraavia kulkumuotoja:		
a. Paikallisliikenne (HSL) <input type="checkbox"/> Päivittäin <input type="checkbox"/> 5-6 päivänä viikossa <input type="checkbox"/> 3-4 päivänä viikossa <input type="checkbox"/> 1-2 päivänä viikossa <input type="checkbox"/> Pari kertaa kuukaudessa <input type="checkbox"/> Harvemmin <input type="checkbox"/> En koskaan	b. Kaukoliikenne (junat ja linja-autot) <input type="checkbox"/> Päivittäin <input type="checkbox"/> Viikottain <input type="checkbox"/> Kuukausittain <input type="checkbox"/> Harvemmin <input type="checkbox"/> En koskaan	c. Taksi <input type="checkbox"/> Päivittäin <input type="checkbox"/> Viikottain <input type="checkbox"/> Kuukausittain <input type="checkbox"/> Harvemmin <input type="checkbox"/> En koskaan
d. Vuokra-auto <input type="checkbox"/> Viikottain <input type="checkbox"/> Kuukausittain <input type="checkbox"/> Harvemmin <input type="checkbox"/> En koskaan	e. Auto (kuljettajana) <input type="checkbox"/> Päivittäin <input type="checkbox"/> 5-6 päivänä viikossa <input type="checkbox"/> 3-4 päivänä viikossa <input type="checkbox"/> 1-2 päivänä viikossa <input type="checkbox"/> Pari kertaa kuukaudessa <input type="checkbox"/> Harvemmin <input type="checkbox"/> En koskaan	f. Auto (matkustajana) <input type="checkbox"/> Päivittäin <input type="checkbox"/> 5-6 päivänä viikossa <input type="checkbox"/> 3-4 päivänä viikossa <input type="checkbox"/> 1-2 päivänä viikossa <input type="checkbox"/> Pari kertaa kuukaudessa <input type="checkbox"/> Harvemmin <input type="checkbox"/> En koskaan
g. Yhteiskäyttöauto <input type="checkbox"/> Päivittäin <input type="checkbox"/> Viikottain <input type="checkbox"/> Kuukausittain <input type="checkbox"/> Harvemmin <input type="checkbox"/> En koskaan	h. Pyörä (kesällä) <input type="checkbox"/> Päivittäin <input type="checkbox"/> 5-6 päivänä viikossa <input type="checkbox"/> 3-4 päivänä viikossa <input type="checkbox"/> 1-2 päivänä viikossa <input type="checkbox"/> Pari kertaa kuukaudessa <input type="checkbox"/> Harvemmin <input type="checkbox"/> En koskaan	i. Pyörä (talvella) <input type="checkbox"/> Päivittäin <input type="checkbox"/> 5-6 päivänä viikossa <input type="checkbox"/> 3-4 päivänä viikossa <input type="checkbox"/> 1-2 päivänä viikossa <input type="checkbox"/> Pari kertaa kuukaudessa <input type="checkbox"/> Harvemmin <input type="checkbox"/> En koskaan
j. Muut kulkuneuvot <i>Esim. mopo, kevytmoottoripyörä tai moottoripyörä</i> <input type="checkbox"/> Päivittäin <input type="checkbox"/> Viikottain <input type="checkbox"/> Kuukausittain <input type="checkbox"/> Harvemmin <input type="checkbox"/> En koskaan		

30. How many people are in your household? <i>Include Yourself.</i>	31. How many of your household are younger than 18? <i>Include Yourself.</i>	32. Which of the following do you possess? <i>You can choose multiple</i>
<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 or more	<input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 2 or more	<input type="checkbox"/> Smart phone <input type="checkbox"/> Moped license <input type="checkbox"/> Driving license <input type="checkbox"/> HSL-travel pass, Season <input type="checkbox"/> HSL-travel pass, Value <input type="checkbox"/> Bike sharing membership (during season) <input type="checkbox"/> Car sharing membership <input type="checkbox"/> VR-season pass <input type="checkbox"/> Other <input type="checkbox"/> None of the above

33. How often do you travel by the following modes:		
a. Public transport (HSL) <input type="checkbox"/> Daily <input type="checkbox"/> 5-6 days per week <input type="checkbox"/> 3-4 days per week <input type="checkbox"/> 1-2 days per week <input type="checkbox"/> Couple times per month <input type="checkbox"/> Rarely <input type="checkbox"/> Never	b. Long distance train and coach <input type="checkbox"/> Daily <input type="checkbox"/> Weekly <input type="checkbox"/> Monthly <input type="checkbox"/> Rarely <input type="checkbox"/> Never	c. Taxi <input type="checkbox"/> Daily <input type="checkbox"/> Weekly <input type="checkbox"/> Monthly <input type="checkbox"/> Rarely <input type="checkbox"/> Never
d. Rental car <input type="checkbox"/> Weekly <input type="checkbox"/> Monthly <input type="checkbox"/> Rarely <input type="checkbox"/> Never	e. Car (as a driver) <input type="checkbox"/> Daily <input type="checkbox"/> 5-6 days per week <input type="checkbox"/> 3-4 days per week <input type="checkbox"/> 1-2 days per week <input type="checkbox"/> Couple times per month <input type="checkbox"/> Rarely <input type="checkbox"/> Never	f. Auto (as a passenger) <input type="checkbox"/> Daily <input type="checkbox"/> 5-6 days per week <input type="checkbox"/> 3-4 days per week <input type="checkbox"/> 1-2 days per week <input type="checkbox"/> Couple times per month <input type="checkbox"/> Rarely <input type="checkbox"/> Never
g. Car sharing <input type="checkbox"/> Daily <input type="checkbox"/> Weekly <input type="checkbox"/> Monthly <input type="checkbox"/> Rarely <input type="checkbox"/> Never	h. Bike (in summer) <input type="checkbox"/> Daily <input type="checkbox"/> 5-6 days per week <input type="checkbox"/> 3-4 days per week <input type="checkbox"/> 1-2 days per week <input type="checkbox"/> Couple times per month <input type="checkbox"/> Rarely <input type="checkbox"/> Never	i. Bike (in winter) <input type="checkbox"/> Daily <input type="checkbox"/> 5-6 days per week <input type="checkbox"/> 3-4 days per week <input type="checkbox"/> 1-2 days per week <input type="checkbox"/> Couple times per month <input type="checkbox"/> Rarely <input type="checkbox"/> Never
j. Other vehicles <i>For example moped, lightweight motor cycle or motor cycle</i> <input type="checkbox"/> Daily <input type="checkbox"/> Weekly <input type="checkbox"/> Monthly <input type="checkbox"/> Rarely <input type="checkbox"/> Never		

ARVONTA

Kaikkien täyden kyselyn palauttaneiden kesken arvotaan kolme (3) viidenkymmenen euron (50€) HSL-matkalahjakorttia.

Arvonta tapahtuu 3.4.2017 ja voittajin otetaan yhteyttä 7.4.2017 mennessä.

Jos haluat osallistua arvontaan, kirjoita alle nimesi ja yhteystietosi. Yhteystietojasi ei jaeta kolmansille osapuolille.

Nimi: _____

Puhelinnumero: _____

Sähköpostiosoite: _____ @ _____

PRIZE DRAW

Three (3) travel gift cards of fifty euros (50€) for HSL services will be drawn between all those who have handed in a fully filled in survey. Prize drawing will take place on the 3rd of April, 2017 and the winners will be contacted by the 7th of April, 2017.

If you want to participate in the drawing, fill in your name and contact details. Your information will not be shared to third parties.

Name: _____

Phone number: _____

Email address: _____ @ _____

F

Personal Reflection

This appendix will end the report with a personal reflection upon the graduation process.

F.1. Reflection

This master thesis was hosted by two Finnish organisations, Sito Oy and the Finnish Transport Agency, while majority of the work was carried out in the Netherlands. I am grateful I was given this opportunity and that so many people in both countries wanted to provide me with support whenever needed. I was not familiar with the concept of MaaS until it was proposed to me as a topic 18 months ago. Over the duration of this project, however, I have come to see it emerge in the transport sector discussions, especially in Finland, and I am glad I could be part of the start in research.

During the first phase, I held discussions with the organising bodies as well as interviews with potential customers of MaaS. I was happy to notice that so many people were interested, and even enthusiastic, about the topic. Conducting the interviews helped me not only with listing the factors that could be of influence on travellers' choice of mobility packages but also getting ideas of how to present this unfamiliar concept to consumers without prior knowledge on the matter.

Second part of the research consisted of a Stated Preference experiment. Originally, I approached the topic of MaaS in order to apply my knowledge on Stated Preference research. Nevertheless, I have come to recognise how limited my expertise on the methodology actually is and how much there is to be improved upon. Especially constructing the experimental design proved a challenge. For instance, constructing an experimental design with realistic enough plans is not easy. It required plenty of restrictions to the syntax which, regardless of the amount of trying, yielded some interesting choice sets. I am certain it could have been done in a much simpler way.

I was pleasantly surprised by the amount of feedback I received during both the pilot and final SP surveys. I got plenty of positive feedback on the topic stating that they deemed the research valuable and how they wanted to try out the service. However, it is the critical comments by participants that provoke most discussion and provide a starting point to improving the service.

During this thesis, I was able to combine my interest in choice modelling, transport and smart mobility. Despite the challenges I faced, I am proud of the process and the results. I may not have been familiar with MaaS at first but I have come to appreciate its innovativeness and I am eager to follow its development in the future. I hope these insights will inspire others and are found to be useful for further research and possible applications of Mobility-as-a-Service.