Bachelor Thesis Report

Success Factors in Increasing a Higher Modal Share of Environmentally Friendly Transport Modes

A Comparison between the Metropolises of Amsterdam and Vienna

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Preface

Transportation and the impacts of some transport modes are important for the quality of life. The following quotes I found very inspiring, distinct, and worth remembering.

„Die Mobilität in einer Großstadt ist wichtig für die Lebensqualität der BewohnerInnen: die alltäglichen Wege zu Ausbildungs- oder Arbeitsplatz, zum Einkauf oder in Erholungsgebiete sollen möglichst bequem und mit vertretbarem Zeit- und Kostenaufwand zu bewältigen sein. Gleichzeitig gilt es, die mit dem Verkehr verbundenen Beeinträchtigungen der Lebensqualität – z. B. durch Lärm, Luftschadstoffe oder Unfallgefahren – möglichst gering zu halten."

– Stadtforschung Stadt Wien (Gielge & Czarsny, 2009)

Translation:

'The mobility in a metropole is of a big importance for the quality of life of the inhabitants: the everyday paths to education or work, for shopping or recreational purposes should be as comfortable as possible and within reasonable time and costs. At the same time, it is important to minimize the impacts, associated with transport on the quality of life, such as noise, air pollution or accidents.'

– City research Vienna (Gielge & Czarsny, 2009)

[Die Motorisierung hat] Einen unglaublichen Einfluss [auf unsere Gesellschaft]. Das Auto ist wie ein Virus, das sich im Gehirn festsetzt und Verhaltenskodex, Wertesystem und Wahrnehmung total umkehrt. Ein normaler Mensch würde unseren derzeitigen Lebensraum als total verrückt bezeichnen! Wir ziehen uns mehr oder weniger freiwillig in abgedichtete Häuser mit Lärmschutzfenstern zurück, um den Außenraum dem Krach, dem Staub und den Abgasen der Autos zu überlassen. Das ist doch eine völlige Werteumkehr, die uns nicht einmal mehr auffällt.

– Prof. Hermann Knoflacher (Hablesreiter & Stummerer, 2007)

Translation:

[The motorization has had] An incredible influence [on our society]. The car is like a virus that is stuck in our brains and it has changed our behavior, value system and perception. A normal person would describe our current habitat as absolutely crazy! We retreat more or less voluntarily into sealed houses with noise protection windows, to leave the outside space to the noise, the dust and exhaust fumes of the cars. This is a complete change of values, which is not even more noticeable to us.

– Professor Hermann Knoflacher (Hablesreiter & Stummerer, 2007)

Amsterdam is the capital city of the Netherlands, my home country, and a bright example as a city with a high number of cyclists. I have a personal connection with Vienna, since I studied over there in the first semester of my third academic year. When I came back, I found out that Vienna was named the city with the highest quality of life in the world for the eighth consecutive year by consulting firm Mercer in March 2017. Transport was one of the criteria, next to political stability, health care, education, crime, etc. (Nasralla, 2017). Since transport is of such importance for the quality of life and an important track in the civil engineering world, I decided to dive into this topic.

This thesis will have a look on measures in favor of environmentally transport modes. This could provide insight for municipalities for determining which set of measures to implement.

This bachelor thesis is the last unit in fulfilling the requirements for my bachelor study at Civil Engineering at Delft University of Technology. I was engaged in researching and writing this thesis report from April to June 2017.

Without help and support, this report would not have achieved its current level. I would first like to thank my thesis supervisors Dr. Oded Cats, Dr. ir. Yufei Yuan and ir. Rolf Koster for the tight schedule of submissions and their weekly feedback. Special thanks to my personal supervisor ir. Ilse Galama. The door of your office was always open to me. I would also like to thank Jeroen Grooten and Tadej Brezina for their friendly participation in the interviews. Finally, I would like to thank my family and friends for their support and reviewing my work.

Yida Tao

Delft, 20 June 2017

Summary

The European capitals of Amsterdam and Vienna are successful in shifting the modal split to more environmentally friendly transportation mode. They can serve as role model and inspiration sources for other cities. Environmentally friendly transport modes, namely walking, cycling, and public transport, fulfil a city's demand for mobility in a sustainable way. Unlike car trips, trips by these sustainable modes contribute to a better health, clean air, more safety, and thus a higher quality of life. In the European capitals Amsterdam and Vienna, the percentage of car trips has been decreasing over the past decades. Furthermore, their modal split distribution shows other notable details: In Vienna, public transport was the main form of transport with 39% of the total trips in 2015. However, in the same year, cycling was the most used type of transport by the inhabitants for Amsterdam with 36% of the total trips. Besides, these cities have many traffic related policies and a big traffic research sub organization. This thesis researches innovative, effective, and recommendable measures, taken by the city municipalities of Vienna and Amsterdam. The aim of these measures is an increase of the modal split for sustainable transport, and could be served as an example for other cities. This research focuses on measures regarding trips, taking place inside the municipality boundary and which are taken by inhabitants of the city.

In this study, we used various methods, to examine measures regarding the modal split, namely literature study, interviews, and a survey. The focus lies on infrastructural measures, financial measures, and legal/administrative measures. Vienna defines more precise goals regarding modal shift in their policy documents than Amsterdam. For example, the municipality of Vienna aims to decrease the modal split for cars to 25% by 2020, whereas Amsterdam only wants to reduce the role of the car and make them less visible in the city center. Through interviews key points for the development of the modal split are stated. In Amsterdam, strict parking policy largely caused the mode shift towards cycling. In Vienna, mainly (re)building infrastructure has caused an increase in supply of public transport. To collect stated preference data about mode choices of both cities, a survey was conducted with inhabitants from Amsterdam and Vienna as main target. In total, 108 people responded to this survey. These persons had an average age of 22,63 years and 75% of them is a student at higher education institute. The difference in answering, between Amsterdam and Vienna regarding two fictive measures, was proved significant. These measures were an increase of the tram frequency and broadening of bicycle paths. Viennese citizens reported a bigger increase than inhabitants from Amsterdam, on the mode the measure was applied on. Another analysis showed that the inhabitants from Amsterdam found a decrease of ticket price for public transport the most important measure to change their modal split, while Viennese chose an increase of frequency of public transport and broadening of bicycle paths.

From the interviews, it can be concluded that the most effective measures regarding a high modal share of public transport in Vienna are a dense network of stops, prioritization of surface rights of way and public transport presence in the city. In Amsterdam, the first effective measure was the strict parking policy, which caused a shift from car to bicycle trips. Other effective measures were the building of supporting facilities, such as bicycle parking places, and separated cycle lanes. To increase effectiveness, one could take certain city preferences into account, since the response to measures, based on residence, is not universal. For city planners, it is recommendable to conduct a survey about stated preferences, before making the decision which measure to apply. The survey could be reconducted with other target groups, such as elderly and tourists.

Contents

1 Introduction

Mobility is an important factor on our quality of life. However, transportation means running on fossil energy has become one of the major sources of air pollution and global warming. In fighting against climate change, it is important to develop and promote environmentally friendly transportation modes in major cities. How to shift from the usage of car to the more environmental friendly transportation modes, for instance by use of public transportation, or by bike? Different European cities are experimenting their own solutions with good results achieved in Amsterdam and Vienna. In this chapter, a first look at the modal split is provided for the metropolises of Amsterdam and Vienna. After that, the objectives of this research, are defined in paragraph 1.3. Subsequently, the research questions are refined. Further, in paragraph 1.4, the scope of the research is discussed. The last paragraph gives an overview of the next chapters.

1.1 Research content and motivation

As Gielge & Czarsny (2009) stated, the mobility is an important factor on the quality of life. The demand for mobility should be fulfilled in a comfortable way, with little resistance in terms of time or money. At the same time, it is important to minimize the negative impacts from transport, such as noise and pollution, on the quality of life.

For decennia, city design was car-centered. The car had to be able to reach all locations of human activities. There was little interest in ecological aspects, such as noise and emissions. Furthermore, according to Professor Knoflacher from TU Vienna, the increasing motorization was like a virus which took over the human habitat; leading to short-sighted city planning (Hablesreiter & Stummerer, 2007). Nowadays, some cities plan 'increase the attractiveness and economic vitality of the city centers by reducing the presence of parked and moving vehicles, and by "urban compatible" means of travel' (Scheepers et al., 2014). There is a shift from giving priority to cars to trying to increase the percentage of mode choice for environmentally friendly traffic forms, such as by foot, by bicycle or by public transport.

These transport modes are not only positively associated with fewer nuisance in noise, emissions, and less energy consumptions, but they also contribute to a higher level of safety and a higher quality of the urban area. Moreover, cycling 'contributes to: livable cities, efficient urban transport, less congestion, less traffic noise, healthy physical activity, road safety, clean air, fighting against climate change, saving fossil fuels, and sustainable tourism', according to the Charter of Brussels (2009). The Charter of Brussels (2009) is a policy document which European cities can sign as commitment 'to invest in bicycle policy as an integrated part of urban mobility', which over sixty cities did already. They committed themselves among other things to increase their bicycle modal share to 15% by 2020 (ECF, n.d.).

So, nowadays cities want to improve the means of transport by increasing the modal share of environmental friendly transport modes and to decrease the modal share of cars. This thesis will look at the metropolises of Amsterdam and Vienna. These cities are both capitals of a European country, with extensive city planning and traffic research sub organizations. Besides, they have characteristic modal split percentages. In Vienna, nearly 40% of the trips was travelled by public transport in 2015. For inhabitants in Amsterdam, 36% of the modal split were bike trips in 2015. Besides these large mode shares of certain environmentally friendly modes, the percentage for car traffic in both cities is

dropping too. In Table 1 of Appendix A, the modal split and shift is listed for all transport modes per city and it is further investigated in Chapter 2.

The cities of Amsterdam and Vienna have these characteristic modal split percentages. However, more improvements should be made to make city centers more livable and economically attractive. Some changes have already put in motion. In Vienna, a great emphasis is placed on the 'Umweltverbund', which is a name for environmentally friendly traffic modes, namely public transport, and the active modes, walking, and cycling. Satisfaction is not yet reached by their high mode share for public transport. They are now expanding their bicycle network, and they take examples from the Netherlands as best-practices. For Amsterdam, it could be interesting to research how a higher mode share of public transport could be obtained by looking to Vienna. This thesis' aim is to find success factors and to regenerate tips to decrease the modal split of cars and increase the number of ways traveled by pedestrians, cyclists, and public transport users.

1.2 Research objective

Both Vienna and Amsterdam share the view that car traffic decreases the quality of life, since it is polluting and space consuming. (Gemeente Amsterdam, 2016; Stadtentwicklung Wien, 2003) The city councils of Amsterdam and Vienna have taken several measures to decrease the mode choice percentage for cars. In this thesis, the development of the modal split is compared to each other. Furthermore, the successful measures of each city are investigated. Lastly, recommendations are made about what they could learn from each other, which is also interesting for other cities with sustainable transport mode share goals, for example the cities which signed the Charter of Brussels.

1.3 Research question

The research question of this thesis is stated as follows:

Which measures taken by the city municipalities of Vienna and Amsterdam, to increase the modal split for sustainable transport modes (and to decrease the modal split of cars) are innovative, effective, and recommendable to other cities with sustainable transport goals?

Here, innovative measures can be explained in two ways: they have new technology implemented or are unique for one city and not seen in other cities. With effective measures, it is meant measures which had an impact on the modal split in a successful way. The following sub questions were derived from the problem statement and the research question.

- Which similarities and differences are there in the actual mode choice and its development in Amsterdam and Vienna? How has the modal split for city inhabitants developed over time?
- What is the objective in the policy plans of the city municipals of Amsterdam and Vienna regarding to transport and mobility?
- Which measures are there in the policy plans of the city municipals of Amsterdam and Vienna? Which 'hard measures' are implemented over the past years?
- Which measures were considered most successful/effective for each city, according to an interviewee working at the municipality? To what extend is it suitable for other cities to adopt those measures, which were considered most successful?
- What differences and preferences are there, by conducting a survey, for inhabitants of Amsterdam (Netherlands) and Vienna (Austria) regarding mode choice?

The modal split development gives main characteristics for Amsterdam and Vienna over time. The objective is obtained from policy documents, to see whether the modal split is developing in a positively way. Then, the measures are obtained from policy documents and together with

information from interviews, the main question regarding innovative and effective measures is tried to be answered. In the end, the survey's aim is to research whether there is any significant difference of the response to measures based on residence. If such a difference is found, measures from best-practices will not necessarily lead to the same outcomes and is therefore not recommendable. In the chapter 'Methodology and Design Approach' will be an extensive discussion about the methodology.

1.4 Scope

To narrow down the problem statement, the scope of the research is broken down in the following aspects: transport movements, public transport network, stakeholders, and measures.

Transport Movements

Firstly, a subdivision is made between transport movements and groups of people making trips. There are several route types, as shown in Figure 1.

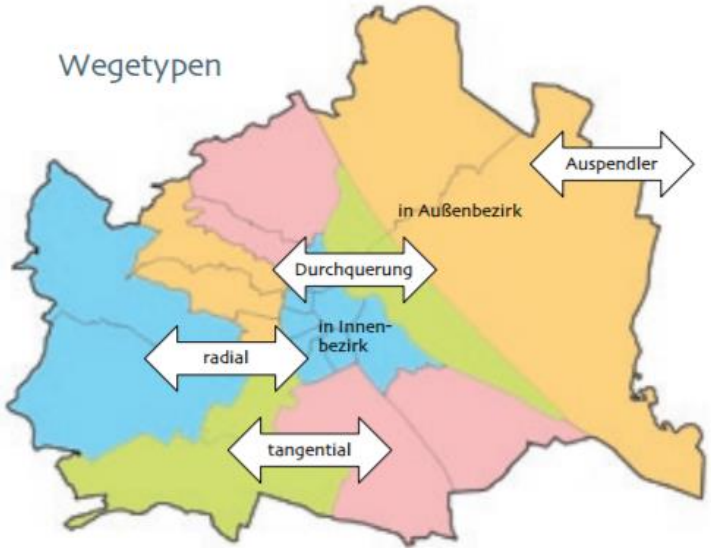

Figure 1: Type of ways (Gielge & Czarsny, 2009)

I. Transport movements (direction)
   a. Radial (city center ←→ outer city areas)
   b. Tangential (outer city areas ←→ outer city areas)
   c. Crossing (crossing the city center, 'Durchquerung')
   d. Leaving or entering the city ('Auspendler')

II. Transport movements (geographically)
   a. Movement within the city center
   b. Leave or enter the city center
   c. Movement within the city (municipal city boundary)
   d. Leaving or entering the municipal city boundary

III. Traveler types
   a. Locals (inhabitants)
   b. Tourists
   c. Commuters, living outside the metropole

In this thesis, one will analyze interurban trips only, thereby leaving intercity trips out of the scope. This is because the active modes, walking and cycling, are more suitable for relatively short distances, where a substitution effect between the transport modes can take place. These investigated trips are taken within the municipality boundary and their direction could be radial, tangential, and crossing.

Public transport network

In the network of public transport, there is a division in busses, trams, ferries, metros, and trains. Amsterdam has 15 tram lines, 41 bus lines, 4 metro lines and 7 ferry lines (GVB, n.d.), next to the intercity and sprinter trains. Vienna has 29 tram lines, 127 bus lines (of which 24 are night lines) and 5 metro lines. In addition, there are several stations for regional and local trains (Vienna City Administration, n.d.). In both cities, there are connections to international trains and busses too. In this thesis, the focus is on the modal shift in urban areas, therefore the analysis concentrates on

improvements of tram, (local) bus and metro lines. Both cities have these means of transportation. Furthermore, the distance traveled with these vehicles can also be cycled; a substitution is possible.

Stakeholders
In this thesis, the following four groups of stakeholders are considered most important in a mobility investigation:

1. Government, most important on municipal level, but also on regional or national level;
2. Inhabitants of the city;
3. Public transport companies (GVB & Wiener Linien, NS & ÖBB);
4. Commercial parties.

For all stakeholders, a high standard of quality of life is important. For the government, the quality of life as a criterion to make decisions is of major importance. The municipal governments of the metropolises are considered to be the clients in this thesis.

The inhabitants of the city are directly affected by the quality of life and the emissions. Making the route and mode choices, they are generating the traffic demand. Public transport companies are supplying, trying to reach quality and comfort for the passenger and other criteria demanded by the government as regulator and client.

Commercial parties have a twofold interest towards parking policies. On one side, they like parking spaces, so that they are easily reachable by their employees and customers. On the other side, less parking spaces leads most of the time to a more attractive area and a positive perception of the public space, which generates more potential customers.

Measures
In this thesis, measures are defined as interventions by external parties. Those measures can be categorized by the four groups of 'stakeholders'. The measures researched in this thesis will be ones the city municipality can influence or implement.

Measures can also be sorted by their kind, they are mostly divided in two categories: the first kind being hard measures, such as (re)building infrastructure, laws for maximum speeds, parking fees and restriction of number of parking spots. Opposite of the hard, are the soft measures. These are for example awareness raising and mobility management. These measures are set, with the purpose of influencing the psychological factors. It is generally considered to be compulsory to implement a set of both 'hard measures' and 'soft measures', to change long-term travel patterns. In this thesis, only 'hard measures' will be investigated. A more detailed categorization of these 'hard' measures can be found in Chapter 2.1 Mode shift determinants and measures.

1.5 Structure of the research

To answer the sub questions and main research question, this report is structured in five chapters. Chapter 2 contains literature review, from which measures are classified in categories. Furthermore, it contains the analysis of the modal split development of Vienna and Amsterdam. The third chapter will give the methodology of the remaining sub questions and explains how the survey was carried out. In Chapter 4, the results and analysis contained four parts. Firstly, the objectives of Vienna and Amsterdam are discussed. Then measures from policy documents and success factors from interviews of both cities are argued. The last sub chapter contains the results and analysis of the survey, whether residence influences the stated mode choice significantly. The final chapter, Chapter 5, holds the conclusion, discussion, and recommendations of this research.

2 Literature review

In this chapter, types of measures are discussed, by doing literature study on a modal shift from car trips towards environmentally friendly transport modes. First, a table of categories of determinants or measures is given from four papers with this topic. Then, there is an overview of three categories of measures on which this research focus. In the second part, the development of the modal split is graphically displayed from the 1990's until 2015 for Vienna and Amsterdam. This development is compared.

2.1 Mode shift determinants and measures

Four scientific papers regarding a mode shift towards (some) sustainable modes were found useful on this subject. The authors are listed in Table 1, as well as their own categorization of measures. A small elaboration on the topics of the papers can be found on Appendix A.

Paper	*Categories*
Heinen et al. (2009)	• Built environment • Natural environment • Socio-economic factors • Psychological factors • Cost, travel time, effort, and safety
Ogilvile et al. (2004)	• Targeted behavior change programs • Publicity campaigns and agents of change • Engineering measures • Financial incentives • Providing alternative services
Redman et al. (2014)	• Physical: reliability, frequency, speed, accessibility, price, information provision, ease of transfers/interchanges, vehicle condition • Perceived: comfort, safety, convenience, aesthetics
Scheepens et al. (2014), 'Tools'	• Legal • Economic • Communicative • Physical
Scheepens et al. (2014), 'Interventions'	• Work-place-based interventions • Architectural and urbanistic adjustments • Population-wide interventions • Bicycle-renting system interventions

Table 1: Categories of factors, aspects, tools, and interventions found in literature

Following from the table, there are three categories of measures on which this research will focus, namely infrastructural, financial measures and legal/administrative measures.

Infrastructural measures

Infrastructural measures are referring to the network layout, for example the network density, the coherence and continuity. For public transport, measures in the infrastructural reach are the number of metro/bus/trams lines, stops and stations. Also, the street layout is important: the width of car lanes, bicycle paths, and pavements and whether the different modes have their own dedicated lane. The street layout has a specific importance regarding safety. At intersections and at bicycle tracks next to parallel car-parking, street design should minimize potential conflicts.

It is important to have sufficient and secure parking places for the bicycles, especially at potential transfer points to the public transport. The quality of the pedestrian network can be improved by widening of the sidewalks. Overall, the surface quality is important.

Financial measures
Many measures regarding the car have a financial nature: petrol prices, toll, parking fees and cashing out of employer-paid parking, the opposite of parking fees, since every free parking space has an opportunity cost. In Trondheim, a toll ring was introduced: inbound traffic had to pay toll from 6 am till 5 pm on workdays. In the research, a shift was found only in the timing in the car trips and it did not affect the modal split over a whole week (Scheepens et al., 2014).

Financial measures, found having a big positive impact in increasing the mode share of environmentally friendly transport modes, were discounted season tickets on buses (or other public transport) or a free bike and buss pas for a year (Ogilvile et al., 2004). However, providing free public transport reduces the cycling trips. Moreover, a questionnaire showed that paying people to cycle to work would have a great positive impact (Heinen et al., 2009).

Legal/administrative measures
This category of measures contains car-restrictions, parking limitations, speed limitations, the adjustments of traffic lights, or frequencies of public transport. Car-restrictions can come in the form of car-free city centers and automobile restricted zones, with or without exceptions for residents and delivery traffic. Also, the number of parking spaces can be limited severely, as was done in Bristol (Scheepens et al., 2014). Furthermore, parking is only allowed at certain times, outside peak hours, or working hours. Speed limitations are often applied by rebuilding a street into a 30 km/h zone. Traffic lights can be adjusted in favor of a certain mode, mostly public transport, or pedestrians to decrease their waiting time. Moreover, frequencies of public transport are often found 'to have a key influence on public transport demand and satisfaction' (Redman et al., 2012).

2.2 Development of modal split of Amsterdam and Vienna

The development of the modal split of both Amsterdam and Vienna show a very fascinating decrease in the percentage of car trips made. With this decrease, the percentage for other transport modes has increased. Where did this increase appeared? This section discusses the development of the modal split of both metropoles.

In Figure 2, the modal split is plotted from the 1990s to 2015. Here, the red line represents Amsterdam and the blue one Vienna. Also, the goal of Vienna for 2020 is plotted in light blue (Stadtentwicklung Wien, 2013). Following from these graphs, a few similarities and differences can be found. The comparison is made between the years 1993 and 2015 for Vienna and the time periods 1986-1991 to 2013-2014 for Amsterdam (Gemeente Amsterdam, 2016; Stadtentwicklung Wien, 2013 & Wiener Linien, 2016). Data of 2015 in Amsterdam has not been taken in account in the analysis, because the research methodology for the modal split has changed.

By foot
The percentage of pedestrian trips over time has been fluctuating between 19 and 28% for both cities. The biggest difference was 8 percent points (p.p.), around the year 2005. Over the total time span, the walking trips has decreased by 3% in Amsterdam and 1% in Vienna. Therefore, it can be argued that the modal share of pedestrians has remained quite constant and the percentages are almost the same (less than 10p.p. maximum difference).

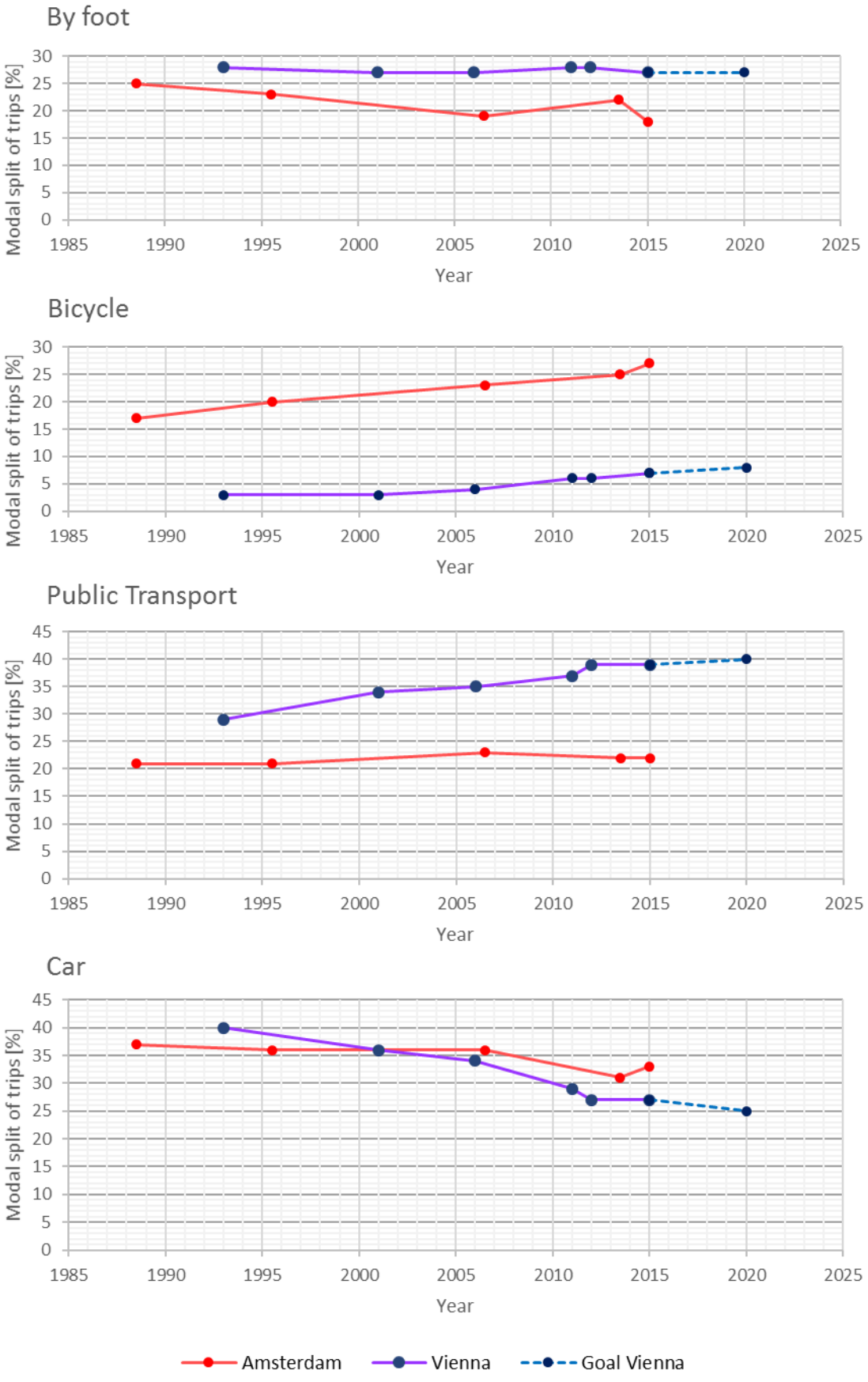

*Figure 2: Modal split of trips in Amsterdam and Vienna *2015 data from Amsterdam: different source (Gemeente Amsterdam, 2016; Stadtentwicklung Wien, 2013 & Wiener Linien, 2016)*

Bicycle
One of the most remarkable characteristics of Amsterdam's modal split is their high percentage of cycling trips. The increase was from 17% to 25%, 8 percent points. For Vienna, their cycling share has also increased from 3% to 7%, which was more than a doubling. However, it is still small compared to Amsterdam, the difference in mode share is around 18 percent points.

Public Transport
In Vienna, the public transport mode share has increased with 10 percent points over the year, to 39% in 2015. The development of Amsterdam differs much from that of Vienna. There, the percentage has remained almost constant, only 1 percent point has increased and with 22% in 2013-2014, it is relatively low compared to Vienna.

Car
In both cities, the car percentage has decreased. In Vienna, this decrease was from 40% to 27% (13 p.p.) and for Amsterdam, it was from 37% to 31% (6 p.p.). The decrease of percentage of car trips was relatively more in Vienna than in Amsterdam. The biggest difference over was 4p.p., therefore it can also be argued that the percentages for the car share was almost the same for both cities.

2.3 Conclusion
In conclusion, three categories of measures were determined which were inside the research scope: infrastructural measures, financial measures, and legal/administrative measures. This categorization will be further used in chapter 4.3 'Measures in Amsterdam and Vienna', as a sub-division.

A comparison was made between the different modal split developments. Both cities report a decrease in the percentage of car trips. The high share and growth of the cycling mode is fascinating for Amsterdam, whereas the development of public transport is impressive for Vienna. When looking for recommendable measures, the focus will be on these combinations of travel mode and city.

3 Methodology and Design Approach

In this chapter, the methodology is explained. The main question, sub questions, and their relations are stated in the introduction, section 1.3 Research questions. In the figure below, an overview is given of the research approach. Primary research contains interviews and a survey, secondary research is done on policy documents from municipalities and scientific articles on a mode shift from car trips to environmental friendly transport modes.

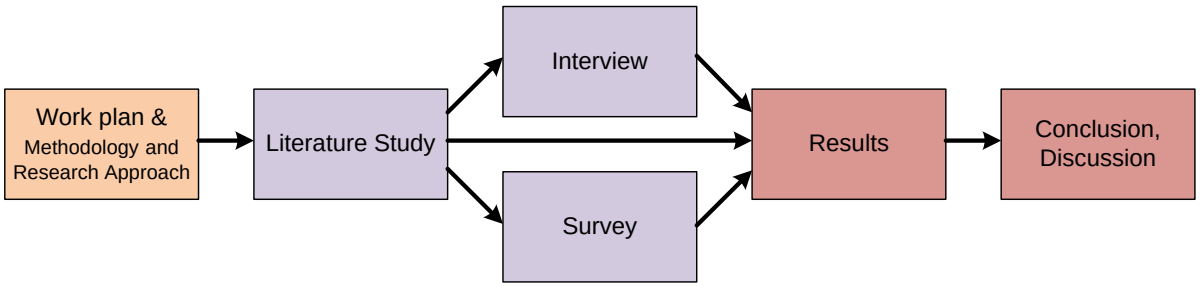

Figure 3: Overview of research approach

3.1 Remaining research questions

In Chapter 2, literature study was done about different types of measures. Three categories were determined, along with various examples, which were infrastructural measures, financial measures, and legal/administrative measures. Also, the modal split for the two cities has been compared.

Remaining research questions contain the objective, intended measures, and implemented (hard) measures, next to successes and recommendations to other cities. These questions will be answered by literature and interviews. The elaboration on these methods is written in section 3.2. In section 3.3, the survey set-up is discussed, used for answering the sub questions regarding differences and preferences in mode choice based on residence.

3.2 Literature study and interviews regarding policy plans and measures

For answering these sub questions, official policy plans will be processed, focusing on statements about the goals in modal split and modal shift. It is important to find the objectives of the municipalities, to determine later whether the measures have achieved the desired effect. In addition, reports of the progress of implementation of policy measures will be sorted out. This provides an enumeration of policy measures, which will be helpful for comparison between the two cities and to come up with possible interview questions.

Interviews are conducted to determine the most successful measures, which could be recommended to other cities too. The interviewees are civil servants, working a long time at the municipality (in the ideal case). The aim for this bachelor thesis is to find one interviewee per city. In Appendix B, the interview questions and answers with people from Amsterdam and Vienna are included.

Interviewing leads to gaining highly detailed information and data. Also, with asking counter questions to a response, specific themes can be discussed more deeply. The interview of this thesis will be semi-structured, starting with a set of predefined questions. The structure can be found in Appendix B, where it is discussed with the interviewee. Using this method, there should be awareness to possible bias and credibility, since the interviewees work for the government, which is both the client for the objectives regarding modal split goals as commissioner for the investigation to effects of measures.

3.2 Survey regarding preferences in mode choice

To determine the preference in mode choice of a group, a survey is necessary. The preference is important, because it determines the elasticity of the modal shift of the several transport modes. In addition, a different population, based on residence, could respond in varying degrees to implemented measures. If such a relation is found means that the most effective measures could differ per city.

The survey was designed in Google Forms; spread through social media, mainly Facebook; and processed using SPSS and Microsoft Excel. The survey was divided into of three parts. In the following paragraphs, a short overview of the survey is given. In Appendix C, the whole set-up of the survey is discussed, as well as the answer options.

The first section of the survey asked the participants about their general preferences. They were requested to indicate which mode has their preference and which they use the most. Also, they had to estimate how many days per week they would use a certain mode.

The second section contained questions regarding a fictive situation. Some characteristics were given for several modes and participants were asked which mode had their preference. Then some measures were described, which were amongst others parking fee increase and broadening of cycle lanes. The respondents could mark to what extent their travel behavior would change on a Likert-scale. In addition, they could indicate to what measure they would most likely change their behavior.

The last section contained general questions. The respondents were asked about their age, gender, residence, monthly household income before taxes, education level and whether they have a bike, driver's license, car, and a subscription on public transport services.

By analyzing the answers of the general questions, one could determine whether the demographics of the survey are representative for the population. The hypothesis around the general preferences is, that they will show that the Viennese people have a strong preference for public transport and the Amsterdam inhabitants like cycling the most. In the last part, there will be a test done whether there is a significant difference in responses towards measures between groups based on residence.

4 Results and analysis

In section 4.1 we address the objective of the city municipalities of Amsterdam and Vienna. This is important, because it determines the interpretation of the development of the modal split. In 4.2, the measures of each city municipality are researched, subdivided into the modes and the categories infrastructural, financial, and legal/administrative from Chapter 2. For the first two paragraphs, research was mainly done by reading policy documents from municipalities. Then, the most important measures are determined in 4.3, by interviews with experts from Amsterdam and Vienna. Lastly, the outcomes of the survey are analyzed, to determine stated mode choice preferences.

4.1 Objective of the city municipalities of Amsterdam and Vienna

In this section, the objectives of the municipality regarding the modal split are discussed. The objectives are discussed in the paragraphs overall goal, active modes, public transport, and car. In general, the objectives of Vienna (Stadtentwicklung Wien, 2008; Stadtentwicklung Wien, 2013) related to the proportion of the different modes are more concrete than the objectives of Amsterdam (Appendix B; Gemeente Amsterdam, 2011).

Overall goal

In Amsterdam, the goal is to make role of the car smaller and less visible in the city center ('autoluwer') (Gemeente Amsterdam, 2011). They want to improve the quality of the public space by changing the destination from one mode to another, for example to reduce parking places on the street to create more space for cyclists and pedestrians. In addition, they want to facilitate the expected growth of kilometers by bike (Jeroen Grooten, Appendix B).

In Vienna, they want to reach a certain modal split for the journeys of Viennese citizens. The proportion of motorized individual transport should be reduced to 25% by 2020. Also, 75% should consist of environmentally friendly modes by both men and women. There is quite a big difference in transport-related life-style between genders. In 2003, it was reported that '71% of women use environmentally friendly modes of transport, but only 56% of men (Stadtentwicklung Wien, 2003).'

Active modes: walking and cycling

Amsterdam does not have specific goals regarding to the development of the modal split, but they want to facilitate expected growth of the cyclists. However, according to Jeroen Grooten, city researcher at the municipality of Amsterdam, there are a few exceptions were the municipality actively seek to increase the mode share of the bicycle. In the district Amsterdam Zuidoost, there are relatively few high school students biking to school. For this group, there are targeted programs to increase the mode share for the bicycle. Regarding pedestrians and the quality of life in a city, the importance of sufficient space for sidewalks is growing (Appendix B).

The target for Vienna is to increase the proportion of cycling to 8% in 2020 and to keep the proportion of walking trips the same, which is 27%. For cyclist, the city researches saw in 2003 that there was a shift in the purpose of cycling, namely from mainly leisure trips to cycling as an everyday transport mode (Stadtentwicklung Wien, 2003). Vienna must act with the challenge that the cycling demand strongly dependent on the temperature (See Appendix D, Figure 1). For pedestrian trips, road safety and personal safety have top priority. The pedestrian network should be comprehensive and interconnecting, which is also good for the pedestrian-based economy.

Public transport

Policy regarding public transport in Amsterdam is not carried out by the municipality, but by the transport region Amsterdam ('Vervoerregio Amsterdam'). The municipality does not have goals

regarding the mode share of public transport. However, they provide subsidies. The aim is to reduce the subsidies and to make the public transport company, GVB, cover its own costs. Furthermore, the municipality asks for a better reliability and optimization of the network.

The municipality of Vienna aims for an increase of the modal split of public transport to 40% in 2020. Also, every Viennese should live within 15 minutes of a public transport stop and cost of an annual pass for public transport in Vienna should remain at least constant in relation to the average income.

Car

The objective of the city municipality of Amsterdam is to aim for a good traffic flow and an acceptable overall speed. They want to avoid congestion, specifically for the city center, they aim for no further growth in the amount of car trips (Grooten, Appendix B).

Regarding the car, the municipality of Vienna has set an objective of 25% of the modal split, including the moped. In addition, the number of journeys made by car (car km) should decrease further, as well as traffic crossing the Gürtel (similar to Ring A10 in Amsterdam). Lastly, the occupancy rate should be at least 1,5 in Vienna.

4.2 Measures in Amsterdam and Vienna

Here, the measures are listed for Amsterdam and Vienna. The division is the same as in the section 4.1: in the order of the active modes, public transport, and car. There is also a subdivision in infrastructural, financial, and legal/administrative measures.

Active modes: walking and cycling

Amsterdam had no genuine bicycle traffic strategy until 1978. 'Cycling facilities did not result from any municipal pro-cycling policy, but as a by-product of national measure to eliminate traffic by elevating railroads in urban settings' (Oldenziel et al., 2016). In 1978, a cycling network ('Hoofdnet Fiets') was created. On parts of the main cycling network, wider paths are need. Also, more parking spaces are needed in the public space and within buildings to meet the growing demand of cyclists. From 2013 to 2020, 40000 extra bicycle parking spaces are realized, especially in the city center and near public transport transfer points. In the municipality, more bicycle paths are built, signage is added, and the cycle routes are improved (Grooten & Kuik, 2010). These are all infrastructural measures.

Financial measures regarding the bike are to make bicycles for children available in the districts Noord, Nieuw-West and Zuidoost. (Gemeente Amsterdam, 2017). In addition, the municipality provides at some points free guarded parking and free use of bicycle pumps.

In the policy document Meerjarenplan Fiets 2017-2020 (Gemeente Amsterdam, 2017) some administrative measures can be found, to make cycling more comfortable. One of them is implementing innovative traffic lights. These have a rain and snow sensor, which will give cyclist more often right-of-way when there is bad weather. Also, the traffic lights will display the waiting time, so that the 'experience' of waiting will be more positive. For the high school students in Amsterdam Zuidoost, measures are currently being researched. Options are a mobile app or a bike sharing system.

In Vienna, the construction of the main cycling network is almost completed. From 2003 to 2008, they invested 30 million euros (Stadtentwicklung Wien, 2003). In addition, there were 12000 bicycle parking places created from 2006 to 2011. Besides, rebuilding streets to one-ways streets with a cycle lane contrary to the flow of traffic is also a measure to improve the cycling facilities (Stadtentwicklung Wien, 2013). For pedestrians, the network should be improved, e.g. attractive

pedestrian connections should be created in densely built-up areas. Sufficient lighting and light and audible signals is necessary to improve the subjective feeling of safety. Also, at every passage between different levels there should be an unrestricted way, which is important for people with special needs. Regarding the width of the sidewalks, a minimum of 2,0 meters is required. This width is the lower psychological threshold for two people next to each other. (Brezina, Appendix B).

Furthermore, the aim is to 'reduce the average waiting time for pedestrians to a maximum of 40 seconds, and the green phase in seconds should be equal to the crossing length in meters' (Stadtentwicklung Wien, 2003).

Public transport

The city municipality of Amsterdam is expanding the public transport network by planning of the metro Noord-Zuidlijn, the rail connection IJmeerlijn, and extending of some tram lines. It is also tried to spread the passengers. The public transport network should not only focus on the central station but shift towards other train stations too (Kuik et al., 2013) Financial measures, like decreasing the ticket price, can be indirectly done by subsidies. However, the subsidy towards the GVB is decreasing over the past years. Regarding administrative measures, the frequency of most lines is now a vehicle for every 10 minutes and the timetables are going to be optimized after the opening of the Noord-Zuidlijn.

In Vienna, they are expanding their metro network by extending the U1 and U2 and by planning U5, having a total of six lines after realization. Besides, metro lines U4 and U6 are modernized. Also, they have built tramlines 25 and 26 in favor of tangential traffic and they are planning to extend tramline 18. For a figure, please see Figure 2 in Appendix D. Public transport is heavily subsidized in Vienna. Besides, in 2012, the price for an annual public transport pass reduced from €449,- to €365,- (Stadtentwicklung Wien, 2013). In 2003, they intended to make it possible that 'Job tickets' could be issued tax-free. Furthermore, traffic lights will be improved with a tool to detect public transport vehicles to reduce waiting times at intersections. An important term for improve public transport is to make it 'barrier-free', public transport must be accessible to everyone. Public transport stops with lifts are a standard in Vienna (Stadtentwicklung Wien, 2003).

Car

There were a lot of measures implemented in Amsterdam. First, there are the infrastructural measures regarding parking places. 5000 parking places for residents are created from 2013 to 2020 (Grooten & Kuiken, 2010). For 2020, the municipality wants to decrease the number of parked cars on the street by 15% and to remove 10% of the parking spaces on the street surface (Kuiken et al., 2013). Besides, the government planned to build new tunnels, the 2nd Coentunnel and the Wijkertunnel, and widening of highways, to improve the traffic flow.

There were financial triggers to decrease car use too. In 1993, the intention for the parking fees for people without permits, was an increase from 1,8€/h to 4,5€/h in the city center. In 2015, the top tariff was increased to 5€/h and there were six tariff zones in total. In the period from 2011 to 2015, the parking proceeds for the municipality have increased steadily. Furthermore in 1993, the intention was to introduce a vignette for peak hours. For every trip longer than 5 km, the additional price would be €1,60. Due lack of support, this measure was not implemented (Grooten & Kuiken, 2010; OIS Amsterdam, 2016).

Regarding legal/administrative measures, residents in Amsterdam faced limited parking spaces and long waiting times for permits. Furthermore, there are parking norms, determined for so called 'A-locations' on 1 parking space/10 employees and 1 parking space/5 employees for B-locations (Grooten & Kuiken, 2010). For a smooth traffic flow, Amsterdam started experiments in practice,

called under ‘Praktijkproeven Amsterdam’. The aim is to integrate innovative in-car and on-road systems. Examples are apps with personal and real-time travel information (outside scope) and a network of connected traffic lights. These can dose the inserting traffic on the A10, preventing congestion on the ring itself (Praktijkproef Amsterdam, n.d.).

In Vienna, they see car-related measures as a package of parking space management. Infrastructural measures include additional commercial parking spaces and Park & Ride spaces. In 2003, they planned on 5000-6000 parking spaces and 8000 Park & Ride spaces in Vienna for 2010. To guarantee a smooth flow of traffic next to the efforts reducing the motorized individual transport, the main road network is expensed (Stadtentwicklung Wien, 2003; Figure 3, Appendix D).

From the financial side, there are also parking fees. The parking rates for short term parking were constant from 1986 to 2003, but the Transport Master Plan 2003 recommended a reviewal of those tariffs. The parking rates were raised on 1-1-2017 to €1,05 per 30 minutes, with a maximum of 2 or 3 hours, depending on the districts. Parking for only 15 minutes is free. In future, the plan is to have fee-generated parking without time limitation. At Park & Ride garages, this fee is about €3,40 per day (Stadtentwicklung Wien, 2003; Parking in Vienna, n.d.). Compared to Amsterdam, these fees are much lower and there are no tariff zones.

Lastly, the city would like to see a reduction of the minimum obligated parking spaces at companies (Stadtentwicklung Wien, 2013). The city of Vienna would like to see that the Land Vienna introduces laws regarding ‘the upper limits for parking space numbers for non-residential use’, which are for example ‘associated with commercial premises, office blocks and shopping centers’ (Stadtentwicklung Wien, 2003). Besides, more car-free and temporary car-free spaces are planned.

4.3 Success factors for obtaining a high share of environmentally friendly traffic modes

In this section, first the most important measures for obtaining a high mode share of cyclist in Amsterdam is discussed. The shift from car to bicycle trips was caused mainly by strict parking policy and supporting facilities. Then, measures regarding public transport in Vienna are discussed. Most of the information used was obtained from the interviews with Jeroen Grooten, municipality of Amsterdam and Tadej Brezina, Technical University of Vienna. They are both researchers in the field of transport (Appendix B).

Amsterdam – cycling

In Amsterdam, the high modal share of cycling could be explained by the unattractiveness of other transport mode, which was mainly a strict parking policy. The parking fees have been raised regularly since 1995 (Appendix D, Figure 4). According to CROW Fietsberaad (2009), the high mode share of cycling in some cities, among which Amsterdam, goes together with a public transport network which was unable to replace most cycling trips.

However, it is important to facilitate an expected growth of cycling trips, by building sufficient bicycle parking places and separated cycle lanes. Especially parking facilities at train stations have high attention: on many locations, the occupation rate exceeded 100%. By keeping up the infrastructure, expected growth will turn in to actual growth. A side note to separated cycle lanes is, although they provide good safety and comfort, they could be easily overcrowded. Street-designs with the shared-space principle are more flexible towards facilitating an increased number of cyclists.

One factor in Amsterdam which could not be directly affected by measures, is the demographic composition: younger and higher educated people tend to cycle more. Moreover, traffic-related education at primary school and cycling role-models, like the Dutch King, are typical aspects of the Dutch cycling culture.

Vienna – public transport

In Vienna, the most effective measures regarding a high modal share of public transport in Vienna were according to the interviewee a dense network of stops, prioritization of surface rights of way and public transport presence in the city. Additionally, reduced barriers are important. There are three categories: which could be related to the physical environment, to reliable information provision or to a 'third party'. Problems related to the physical environment are amongst others high pavement edges, street crossings, bad surface conditions and high floor vehicles. Information of poor quality or even missing information can cause problems too. Announcements could be not understandable or not provided in enough languages. 'Third party'-problems are for example construction sites and ruthless behavior by other traffic participants and staff of public transport providers (Emberger et al., 2013).

High frequencies in Vienna make the public transport attractive. In rush hours, most trams, metros, and busses run every 3 to 5 minutes. The results of high intervals are shorter waiting and transfer times. In addition, it is not necessary for the traveler to pre-plan a trip to determine the time of departure.

In Vienna, there was a two percent point increase in the modal split of public transport mode in 2011-2012. In that year, there was a decrease of price of the annual pass for public transport, lowering the price from €449,- to €365,- by 18,7% (Stadtentwicklung Wien, 2013). The sales of annual transport cards raised immensely from 373 000 to 500 000, where it was more constant before (Appendix D, Figure 5). One could state that the price factor is also highly important for the modal share of public transport.

4.4 Survey analysis: Differences in mode choice between Amsterdam and Vienna

In this section, the results of the survey are analyzed. The method is explained in Chapter 3 and the whole survey, including answers and rough outcomes, can be found in Appendix C. With this information, the last sub question is answered, which is 'What differences and preferences are there, by conducting a survey, for inhabitants of Amsterdam (Netherlands) and Vienna (Austria) regarding mode choice?'. This is very important to know, because different populations will react differently and to varying degrees. The same implementation of measures from best-practices will not necessarily lead to the same outcomes.

In the survey, there were first general questions asked, such as about age, gender, and residence. Then, some questions are about a priory preference, ownership of car/driver license, public transport usage and mostly used transport mode. A descriptive analysis was done on these results in section 4.4.1. Then analysis of the part regarding reaction to measures is done in section 4.4.2. In the end, limitations, conclusions, and hypothesis of the survey are discussed.

4.4.1 Descriptive analysis of sample group

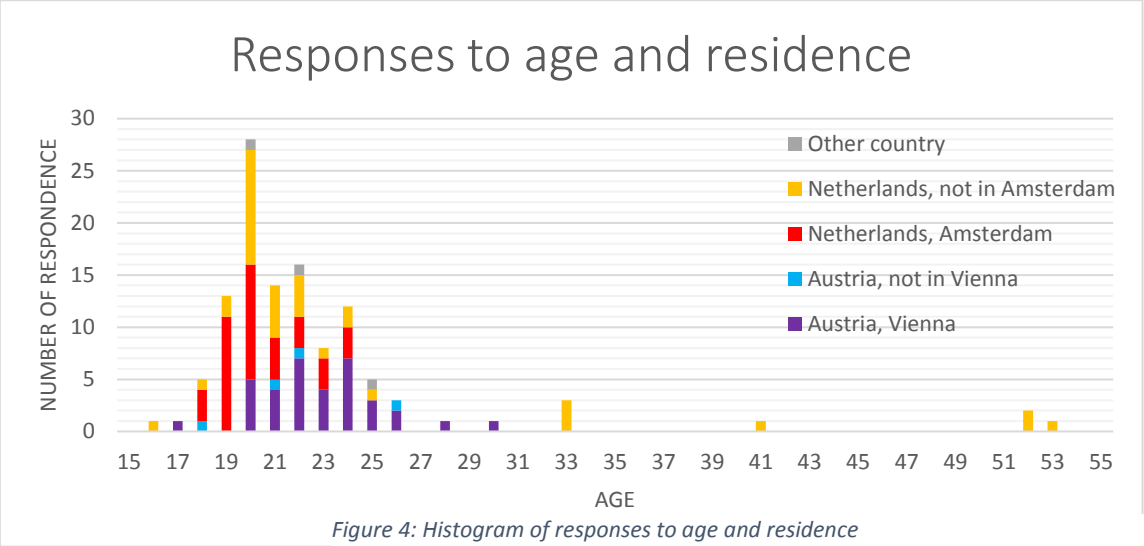

Figure 4: Histogram of responses to age and residence

There were 115 participants in total. 62 were female, 53 were male. There were 35 participants from Vienna, 38 from Amsterdam, and 35 of the Netherlands (not Amsterdam). There were also 4 participants from Austria (not Vienna) and 3 participants from other countries. In the Figure 4, the responses to age and residence are displayed.

As seen from the figure, the most responses are from people in the age range from 18 to 26. There are some outliers. To determine these people, boxplots were drawn, see Figure 5. The outliers are the respondents older than 29 years old and most of them were from Netherlands, not Amsterdam. In Table 2, the number of respondents, the average age, and the median age is summarized

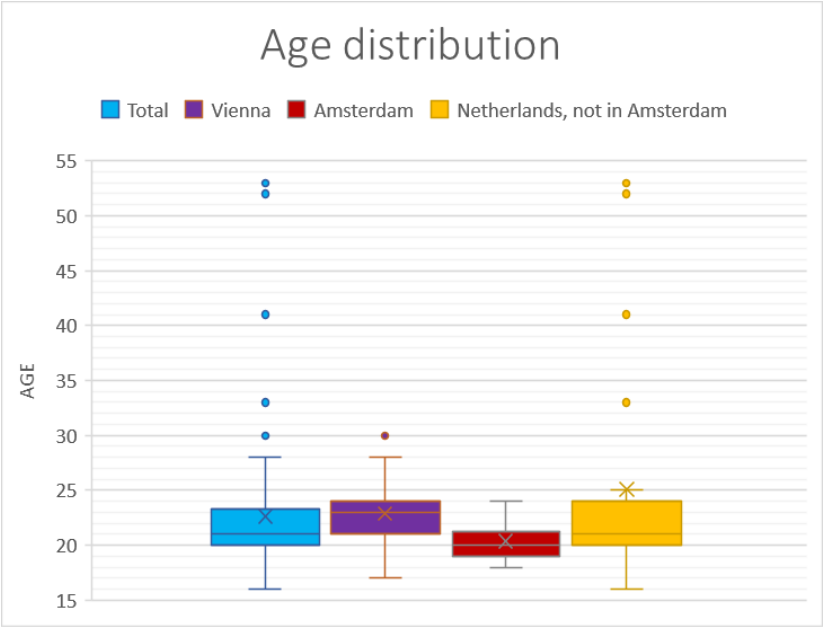

Figure 5: Boxplots of age distribution

	Total	*Vienna*	*Austria, not in Vienna*	*Amsterdam*	*Netherlands, not in Amsterdam*	*Other country*
No. of respondents	115	35	4	38	35	3
Average age [years]	22,63	22,86	-	20,37	25,09	-
Median age [years]	21	22	-	20	21	-

Table 2: Overview of respondents: residence and age

The household income per month, before taxes was asked additionally. 73% reported to have an income less than 2500 euro per month. The modal income in the Netherlands was 2846 euro before taxes (Modaal Inkomen 2017, n.d.). Furthermore, 75% is currently studying at a higher education institute.

	Total	*Austria, Vienna*	*Netherlands, Amsterdam*	*Netherlands, not in Amsterdam*
Ownership of bike	83,5	54,3	100,0	94,3
Having a driver's license	70,4	77,1	68,4	65,7
Ownership of car	11,3	11,4	5,3	14,3
Having subscription for public transport	79,1	97,1	68,4	80,0

Table 3: Overview of bike, driver's license, car, public transport subscription possession [%]

In conclusion, the group of 115 participants is young by an average age of 22,63 years, has largely a low income of 0-2500 euros per month before taxes, and is mostly a student. The total group consisted of three significant subgroups: from Vienna, Austria; Amsterdam, Netherlands; and Netherlands, not in Amsterdam. From the overview of Table 3, the percentage of bike, driver's license, car, public transport subscription possession can be seen. The percentages differ much in the categories of ownership of bike and having subscription for public transport. In the Netherlands, nearly everyone has a bike, whereas in Vienna 97,1% has a public transport subscription.

4.4.2 Analysis of effects of fictive implemented measures in relation with residence

The following measures were described for the preferences. The outcome of the measures is listed in Figure 6. The outcomes vary between strong decrease and strong increase.

1. Parking fee increase – from 3€/h to 4€/h
2. Frequency public transport increases – from every 10 minutes to every 5 minutes
3. Bicycle lanes broadening (See Appendix C for pictures)
4. Longer travel time due to full parking lot (for cars)
5. Price public transport decreases – from €2,80 to €1,90
6. Sidewalks broadening

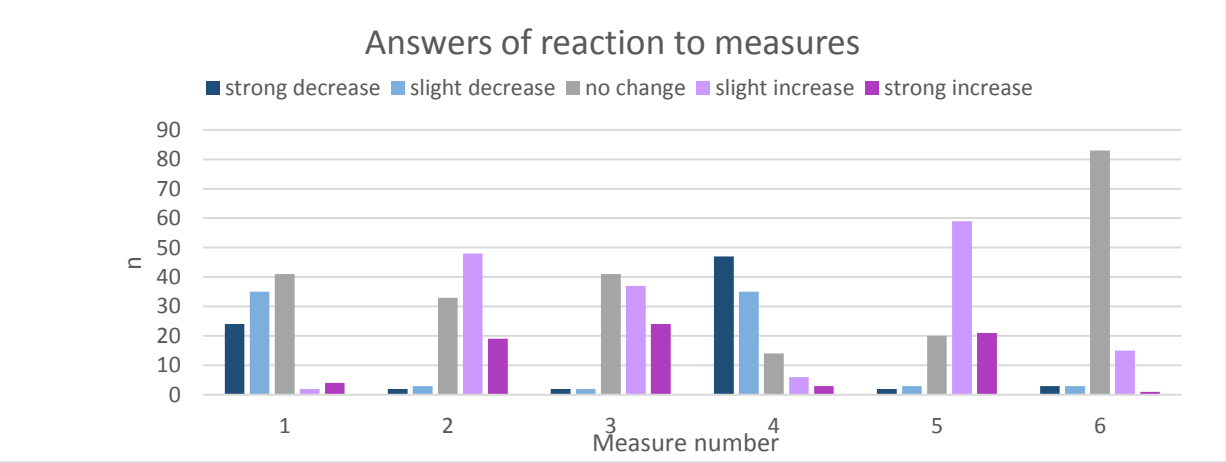

Figure 6: Answers of reaction to measure

From the above graph, one can see that the responses are very different for every measure. For measure 6, broadening of the sidewalks, most respondents reported no change of walking trips (79%). For the other measures, there is a clear increase or decrease seen in the figure. Further analyses will be done whether the residence plays a significant role in the answer pattern. Here fore,

the Fisher's exact test was performed. The Fisher's exact test was chosen, because the data were independent ordinal and nominal variables (see Appendix C for more elaboration).

Reaction to measures in relation with residence

	Measure no.	*Exact significance 2-sided (Fisher's exact test)*	
1.	*Parking fee increase - from 3€/h to 4€/h*	0,635	(63,5%)
2.	*Frequency PT increases - from every 10 min. to every 5 min.*	0,031	(3,1%)
3.	*Bicycle lanes broadening*	0,003	(0,3%)
4.	*Longer travel time due to full parking lot (for cars)*	0,090	(9,0%)
5.	*Price public transport decreases - from €2,80 to €1,90 return ticket*	0,072	(7,2%)
6.	*Sidewalks broadening*	0,252	(25,2%)

Table 4: outcomes Fisher's exact test

Here, the outcomes of the reaction of measures was proven with the residence. The groups based on residence were Amsterdam (38 respondents), Netherlands, not Amsterdam (35) and Vienna, Austria (35), giving a total of 108. Two relations were proven significant, with a confidence level of 95%. There were the relations containing measure 2 and 3, see Table 4. These two relations will be further discussed in the next paragraphs.

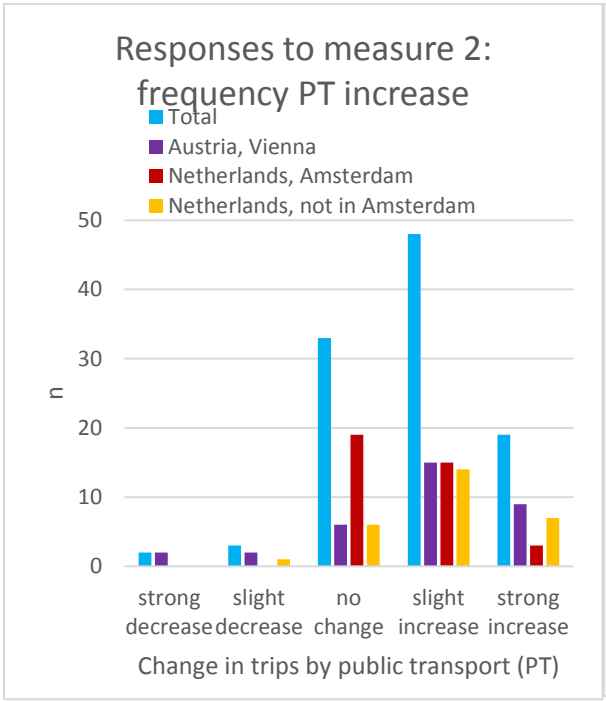

Figure 7: Measure 2

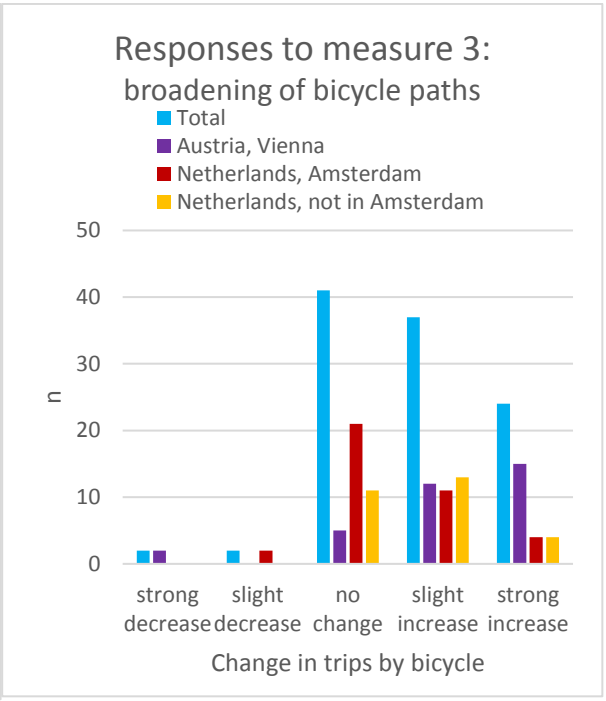

Figure 8: Measure 3

For measure 2, it can be seen from Figure 7 that inhabitants from Amsterdam are less likely to increase their use for public transport than the other groups. They do not respond as much as the Viennese and other Dutch people.

Regarding measure 3, the same can be said about Amsterdam; the biggest group answers the question with 'no change', see Figure 8. However, here, the mode of the Viennese people is with the answer 'strong increase'. From this data, the conclusion can be drawn, that for increasing the mode

share for bicycles, the effect of broadening of bicycle paths will be bigger in Vienna than in Amsterdam.

The outcome of two other measures related to residence was not significant within the 95% confidence level, but still significant within the 90% confidence level. This were measure 4, longer travel time due to full parking lot, and measure 5, decrease of price of public transport. The outcomes will be briefly discussed.

With a longer travel time, due to a full parking lot (measure 4), people from Amsterdam reacted heavily, and more than the other groups. For measure 5, it was notable, that a big group of Amsterdam reported to increase the use of public transport slightly (71%), whereas the response of other groups was more evenly distributed over the answer options. For graphs and please see Appendix C.

Most important measure in relation with residence

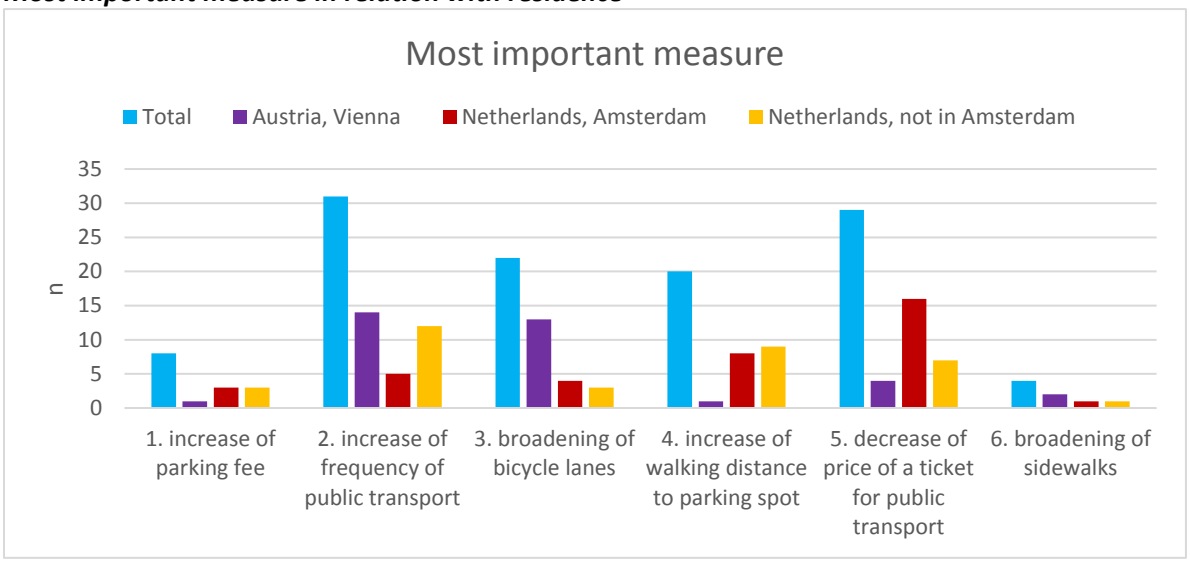

Figure 9: Answers to most important measure to change behavior

The outcomes of the question 'Which of the measures (changes) was the most important for you to change the way you would travel?' was very interesting to analyze. Firstly, the answer pattern (see Figure 9) of the total group showed that an increase of the frequency of public transport was the most favorite measure, followed by a price lowering for public transport, broadening of bicycle lanes, and an increase of walking distance to parking spot.

Then, the significance of the answer pattern related with residence was tested by doing the Fisher's exact test, and was proven significant (exact significance: 0,0%). In Figure 9, the answers are plotted. The most important measure considered in Amsterdam was a decrease of price for public transport, where in Vienna it was an increase of frequency of public transport and broadening of bicycle lanes.

4.4.3 Limitations of the survey

This survey has a few limitations. First, the sample size was small, the total was 115. The margin of error was calculated with a tool from Surveymonkey (n.d.). For Vienna, the estimated population is 1,8 million people and the sample size 35. Tested with a confidence level of 95%, the margin of error is 17% (90% confidence level gives 14% margin of error). For Amsterdam, the estimated population is 0,85 million and the sample size is 38. The margin of error is 16% for a confidence level of 95% and 13% for a confidence level of 90%. These margins are relatively big and they affect the reliability of the results in a negative way. A bigger sample size will decrease the margin of error.

For analysis, the outliers in age have not been removed. In the group of Netherlands, not Amsterdam were most of the 29+ years. Age could be a more decisive aspect than residence, since the age does have an impact on the mode choice for people in Amsterdam (Appendix D, Figure 6). Furthermore, the sample group is inhomogeneous in other aspects, such as education level. Most respondents reported to be students. Students have different patterns than kids, working people and elderly. Also, the respondents had to fill in the survey over internet and most of them received the survey-link through Facebook. A more representative survey sample could be generated by asking people on the street to participate. In conclusion, the group of respondents is not representative for the total population.

Moreover, there was no distinction made between different public transport modes. They are often put together. Similarities are that they are paid services and they operate by time tables. However, some characteristics differ, for example average speed. In addition, general preferences for a certain mode could play a role. According to Bunschoten (2012), the tram bonus exists. This is a general preference for the tram instead of the bus.

4.4.4 Conclusion and hypothesizes for further research

Based on this survey, we can conclude, that the residence is a significant aspect on how one city's dwellers react to a certain measure. However, it depended on the specific measure. Of the six measures asked, two measures were proven significant in relation with residence on a 95% confidence level. These measures were the increase of frequency in public transport and bicycle lanes broadening. Two others were proven significant on a 90% confidence level (but not on 95% level): the longer travel time due to full parking lots and a decrease in price for public transport. Following of these findings, the zero-hypothesis, namely that residence would not be a significant factor in the reaction towards a measure, is rejected.

As the answer patterns were studied further, the following hypothesis were stated. Further research, with bigger and more diverse groups, can be done to confirm these relations.

- The preference for bike lays within the culture of Amsterdam; the bicycle will be their favorite mode and therefore they are less willing or able to change the travel mode.
- Spacious infrastructural measures, such as building broad, separate cycle paths are important for Viennese to choose for cycling. This could to do with perceived safety aspects and third-party aspects, for example the behavior of car drivers and their unawareness of possible conflicts with cyclists.
- Financial aspects, such as the ticket price for public transport, are more important for inhabitants of Amsterdam than infrastructural or legal/administrative measures

5 Discussion and conclusion

This chapter contains the key findings of the research, which are the answers to the main and sub questions. Also, the limitations are discussed in sub chapter 5.2. In 5.3, implications and further research recommendations are given.

5.1 Key findings

To increase the modal split of environmentally transport modes, many measures were found from the metropolises of Amsterdam and Vienna. Measures of particularly interest were innovative and effective ones: with new technology implemented, unique for one city or with a large positive impact. In both cities, the modal split for car trips has decreased over the past decennia. Besides, the metropolises have other notable characteristics in the modal split: in Amsterdam, the cycling share is 27%, and in Vienna the public transport share is 39%, based on the latest data. The objective of the two city municipalities is to make the role of the car smaller, which was stated abstractly for Amsterdam and more concrete for Vienna.

Based on interviews, the most effective measures in Amsterdam were a strict parking policy for cars and building cycling infrastructure, such as bicycle parking places and separated cycle lanes, to facilitate the growth of cyclists. In Vienna, these were cheap annual tickets for public transport, a high frequency, a dense network of stops, prioritization of surface rights of way, public transport presence in the city, and the high importance of 'barrier free' planning. This principle has three aspects: physical, information related and 'third party' related. An innovating measure were traffic lights with sensors which could give certain modes quicker right-of-way. In Amsterdam, these traffic lights would give cyclist quicker right-of-way in bad weather, and in Vienna public transport is privileged at intersections.

From the survey, it was proven that there was a significant connection between the reaction towards some measures and the residence of the respondent. Two measures were proven significant in relation with residence on a 95% confidence level. These measures were the increase of frequency in public transport and bicycle lanes broadening. Viennese people tend to change their travel mode more than people from Amsterdam reported. Two other measures were proven significant on a 90% confidence level (but not on 95% level): the longer travel time due to full parking lots and a decrease in price for public transport. Here, a big percentage of the respondents of Amsterdam choose for one specific answer. They reported 'a strong decrease' in trips by car when the parking lot was full, and 'a slight increase' in trips by public transport, when the price decreases. Such a strong answer pattern was not found for Viennese people. There was also a significant difference in the stated most important measure. In Amsterdam, this was a decrease of price for public transport, whereas in Vienna, this was an increase of frequency of public transport and broadening of bicycle lanes. This means that different population, based on residence, react differently and that the same implementation of measures from best-practices will not necessarily lead to the same outcomes. It depends on one city dwellers' characteristics and preferences whether a measure from Amsterdam or Vienna is recommendable.

5.2 Limitations and reflection on content

Regarding literature review about the municipalities, six different documents from several sub organizations of the municipality of Amsterdam were read. For Vienna, there were five. There remains the possibility that we missed some more detailed information. Using interviews, it was tried to obtain specific aspects of each city. This was also extra information on the subjects from the policy

documents. Bias of the interviewees and publication bias of the municipality could be an issue. Besides, the interview held in Amsterdam was oral and with Vienna the correspondence was via Email. The different format could have caused bias as well.

In the survey, the margin of error is of a big magnitude (between 13% and 17%, depending on city and confidence level). Furthermore, the sample size was inhomogeneous. There was a big group of people between 19 and 24 years old, students and people with a low income. Bias could be generated by the fact that the survey was spread and filled in on the internet. Moreover, interpretation of the question between certain groups could differ.

Last, limitations in this survey are set by the scope. This thesis has only focused on 'hard measures'. Other factors, like education and perceived safety aspects were not investigated, but also have an important role in the mode choice. Additionally, there was no distinction made in the purpose of trips. People could have different mode preferences for leisure trips than for work trips. In the future, more work-related trips could be substituted by tele-communication.

5.3 Implications and further research

These findings could be used as examples from best-practice-cities for city municipalities, which would like to increase their modal shift of environmentally friendly transport modes. Many measures from Amsterdam and Vienna are named. However, different cities could need different strategies, because the response to measures between city dwellers differ.

This rapport has compared the modal split and measures of the metropolises of Amsterdam and Vienna. In most rapports regarding a modal shift, the focus is on either an increase in cycling or in public transport. Here, all environmentally friendly transport modes were taken together. Public transport and bicycles are often seen as competitors in the modal split. It would be interesting to design and/or investigate a combination of measures which will have the effect, that by promoting environmentally friendly transport modes, the car trips will decrease.

Future studies could consist of a survey with a bigger sample size, which has a better distribution in age, income, and education level. In addition, hypothesis could be proved. For example, the following hypothesizes were drafted by the outcome of the stated most important measure: 'Perceived safety factors (broad, separate cycle paths) are important for Viennese to choose for cycling' and 'Financial aspects, such as the ticket price for public transport, are more important for inhabitants from Amsterdam than infrastructural or legal/administrative measures.' To minimize bias, different methods could be used. Additional qualitative interviews could be held next to the survey. Furthermore, the objective of the survey could change from stated preferences to revealed preferences. In addition, a division in public transport modes can be made. Besides, the target cities could be expanded.

References

The source of the edited figure on the front page is Urban Hub. (n.d.) Reinventing the wheel or the future of urban biking. [Image] Retrieved June 17, 2017 from: http://www.urban-hub.com/ideas/reinventing-the-wheel-or-the-future-of-urban-biking/

Bunschoten, T. (2012). *To tram or not to tram. Exploring the existence of the tram bonus.* Retrieved from: https://repository.tudelft.nl/islandora/object/uuid:4378a883-d3e5-4534-99f9-04c2147ca514/datastream/OBJ/download

Charter of Brussels. (2009). Retrieved from: http://www.velo-city2009.com/assets/files/VC09-charter-of-brussels.pdf

CROW Fietsberaad. (2009). Het fietsbeleid van de Europese toppers: langdurig en integraal. Retrieved from: http://www.fietsberaad.nl/library/repository/bestanden/Fietsberaad_Publicatie%20nummer%207.pdf

ECF (European Cycling Federation). (n.d.). *Charter of Brussels.* Retrieved May 2, 2017 from: https://ecf.com/who-we-are/our-mission/charter-brussels

Emberger, G., König, I., Krpata, R., Rollinger, W. & Grundner, M. (2013). *Public transport for (disabled) people – the Vienna experience.* In 13th World Conference on Transport Research (WCTR), Rio de Janeiro (p. 20). Retrieved from: http://www.wctrs-society.com/wp/wp-content/uploads/abstracts/rio/selected/2913.pdf

Gemeente Amsterdam (2011). *Structuurvisie Amsterdam 2040. Economisch sterk en duurzaam.* Amsterdam, Nederland: Gemeente Amsterdam/Dienst Ruimtelijke ordening. Retrieved from: https://www.amsterdam.nl/publish/pages/546779/structuurvisie_def_maart2011_web.pdf

Gemeente Amsterdam (2016). *Amsterdamse Thermometer van de Bereikbaarheid 2016.* Amsterdam, Nederland: Gemeente Amsterdam/Verkeer en Openbare Ruimte. Retrieved from: https://www.amsterdam.nl/parkeren-verkeer/bereikbaar/thermometer/

Gemeente Amsterdam (2017). Voor fietsers en een gezonde bereikbare stad. *Meerjarenplan fiets 2017-2022.* Amsterdam, Nederland: Gemeente Amsterdam/Verkeer en Openbare Ruimte. Retrieved from: https://www.amsterdam.nl/parkeren-verkeer/fiets/nieuws/inspraak-voorbij/

Gielge, J. & Czarsny, K. (2009). Sozialwissenschaftliche Grundlagenforschung II. Verkehrsmittelwahl der WienerInnen. *Beiträge zur Stadtentwicklung – Newsletter, Nummer 16*. Vienna, Austria: MA 18, Stadtentwicklung und Stadtplanung Stadt Wien.

Grooten, J., Kuik, F. (2010). Mobiliteit in en rond Amsterdam: Een blik op de toekomst vanuit een historisch perspectief. Amsterdam, Nederland: Gemeente Amsterdam, Dienst Infrastructuur Verkeer en Vervoer. Retrieved from: http://www.fietsberaad.nl/index.cfm?lang=nl&repository=Mobiliteit+in+en+rond+Amsterdam:+Een+blik+op+de+toekomst+vanuit+een+historisch+perspectief

GVB (n.d.). *Tourist Guide*. Retrieved May 2, 2017 from: https://www.gvb.nl/ontdek-amsterdam/tourist-guide

Hablesreiter, M. & Summerer, S. (2007, September 13). Die Zeit – Wirtschaft: „Das Auto macht uns total verrückt". *Die Zeit, Hamburg, Germany*. Retrieved from: http://www.zukunft-ennstal.at/pdfs/Interv-Knoflacher.pdf

Heinen, E., van Wee, B. & Maat, K. (2009). Commuting by Bicycle: An Overview of the Literature, Transport Reviews, 30:1, pp. 59-96, DOI: 10.1080/01441640903187001

Kuik, F., Breuckens, J., Van Hees, S. & Van der Veur, W. (2013). Amsterdam Aantrekkelijk Bereikbaar. MobiliteitsAanpak Amsterdam 2030. Amsterdam, Nederland: Gemeente Amsterdam: DIVV & DRO. Retrieved from: https://www.amsterdam.nl/parkeren-verkeer/openbaar_vervoer/mobiliteitsaanpak/

Modaal inkomen 2017 (n.d.). Retrieved May 3, 2017 from: http://www.gemiddeld-inkomen.nl/modaal-inkomen-2017/

Nasralla, S. (2017, March 14). Vienna named city with highest quality of life in the world for eighth consecutive year. *The Independent.* Retrieved from: http://www.independent.co.uk/news/world/europe/vienna-friendliest-city-eighth-year-row-london-paris-tokyo-new-york-city-baghdad-scandinavia-a7628786.html

Ogilvile, D., Egan, D., Hamilton, V., Petticrew, M. (2004). Promoting walking and cycling as an alternative to using cars: systematic review. BMJ 2004;329:763, doi:10.1136/bmj.38216.714560.55. Retrieved from: http://www.bmj.com/content/329/7469/763

OIS Amsterdam. (2016). Amsterdam in Cijfers, Jaarboek 2016. Retrieved from: http://www.ois.amsterdam.nl/assets/pdfs/2016%20jaarboek%20amsterdam%20in%20cijfers.pdf

Oldenziel, R., Emanuel, R., de la Bruhèze, A.A., Veraart, F. (2016). Cycling cities: The European Experience. Hundred Years of Policy & Practice. Eindhoven, the Netherlands: Foundation for the History of Technology. ISBN 987-90-73192-46-1

Praktijkproef Amsterdam. (n.d.) Over PPA. Retrieved on June 20, 2017 from: https://www.praktijkproefamsterdam.nl/over-ppa

Redman, R., Friman, M., Gärling, T. & Hartig, T. (2013). Quality attributes of public transport that attract car users: A research review. Transport Policy 25, pp. 119-127. DOI: https://doi.org/10.1016/j.tranpol.2012.11.005

Scheepens, C.E., Wendel-Vos, G.C.W., den Broeder, J.M., van Kempen, E.E.M.M, van Wesemael, P.J.V. & Schuit, A.J. (2014). Shifting from car to active transport: A systematic review of the effectiveness of interventions. Transportation Research Part A 70 (2014) 264-280. DOI: https://doi.org/10.1016/j.tra.2014.10.015

Stadtentwicklung Wien. (2013). Masterplan Verkehr Wien 2003 – Evaluierung 2013. ISBN 978-3-902576-74-3. Retrieved from: https://www.wien.gv.at/stadtentwicklung/studien/pdf/b008353.pdf

Stadtentwicklung Wien. (2008). Masterplan Verkehr Wien 2003 – Evaluierung 2008. ISBN 978-3-902576-15-6. Retrieved from: https://www.wien.gv.at/stadtentwicklung/studien/pdf/b008012.pdf

Stadtentwicklung Wien. (2003). *Transport Master Plan Vienna 2003. Abridged version* Vienna, Austria: Vienna City Administration, Municipal Department 18 – Urban Development and Urban Planning, Transport Planning and Regional Development Section. Retrieved from https://www.wien.gv.at/stadtentwicklung/studien/b007500.html

Surveymonkey. (n.d.). *Sample Size Calculator.* Retrieved June 16, 2017 from: https://www.surveymonkey.com/mp/sample-size-calculator/

Vienna City Administration. (n.d.). *Vienna Public Transport*. Retrieved May 2, 2017 from: https://www.wien.gv.at/english/transportation-urbanplanning/public-transport/

Wiener Linien. (2016). Modal Split – *So sind die Wiener unterwegs*. [Image] Retrieved from: https://www.wienerlinien.at/media/files/2016/modalsplit_173728.pdf

Appendix A: elaboration on modal split and papers

This appendix contains rough information about the modal split in support of the introduction. Also, some background of the papers used in Chapter 2 is provided.

Modal split

The modal split is according to the transportation dictionary (n.d.):

'1. The proportion of total person trips that uses each of various specified modes of transportation.
2. The process of separating total person trips into the modes of travel used.
3. A term that describes how many people use alternative forms of transportation. It is frequently used to describe the percentage of people who use private automobiles, as opposed to the percentage who user public transportation.'

In Table 1, the modal split and the change in percent points is listed, to get an estimate on how the modal split has developed over the past decennia in the cities Amsterdam and Vienna.

Transport mode	*City*					
	Vienna			**Amsterdam**		
	1993 [%]	2015 [%]	**Change [p.p.]**	1986-1991 [%]	2013-2014 [%]	**Change [p.p.]**
Car	40	27	**-13**	36	29	**-7**
Public Transport	29	39	**+10**	21	22	**+1**
Bicycle	3	7	**+4**	17	25	**+8**
By Foot	28	27	**-1**	25	22	**-3**
Moped	-	-	-	1	2	+1

Table 1: Modal split and shift of trips of all transport modes for Vienna and Amsterdam, in percentages. (Wiener Linien, 2016 & Gemeente Amsterdam, 2016)

In figures 1 and 2, the modal split development per city is displayed.

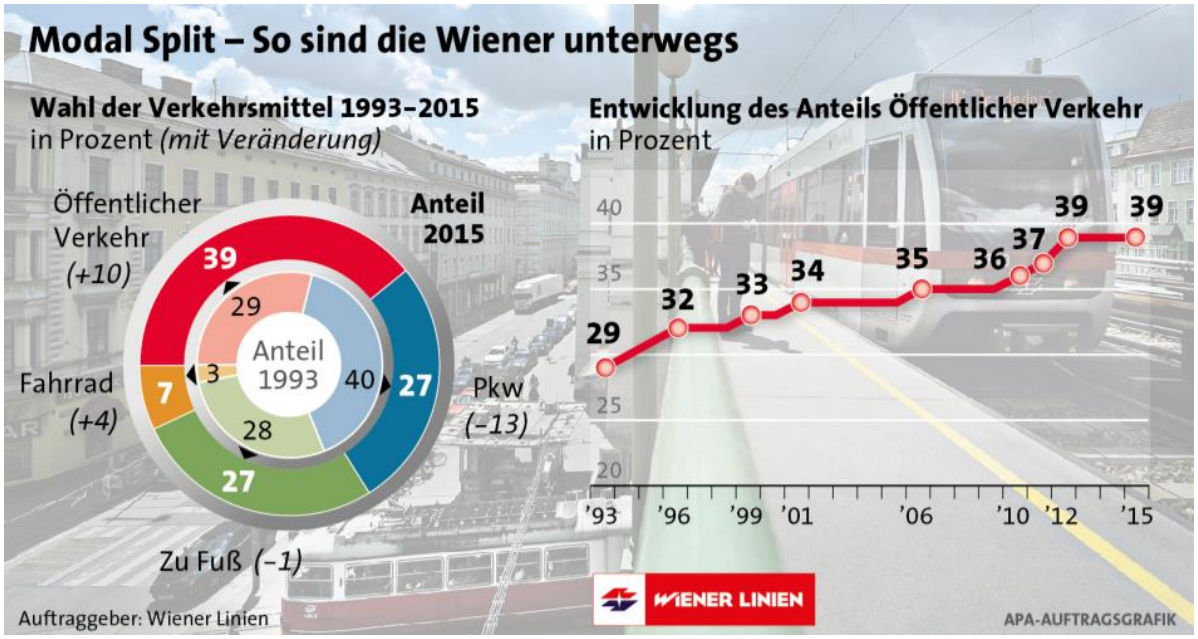

Figure 1: Modal split of Vienna in 1993 & 2015 and the development of percentage of public transport (Wiener Linien, 2016)

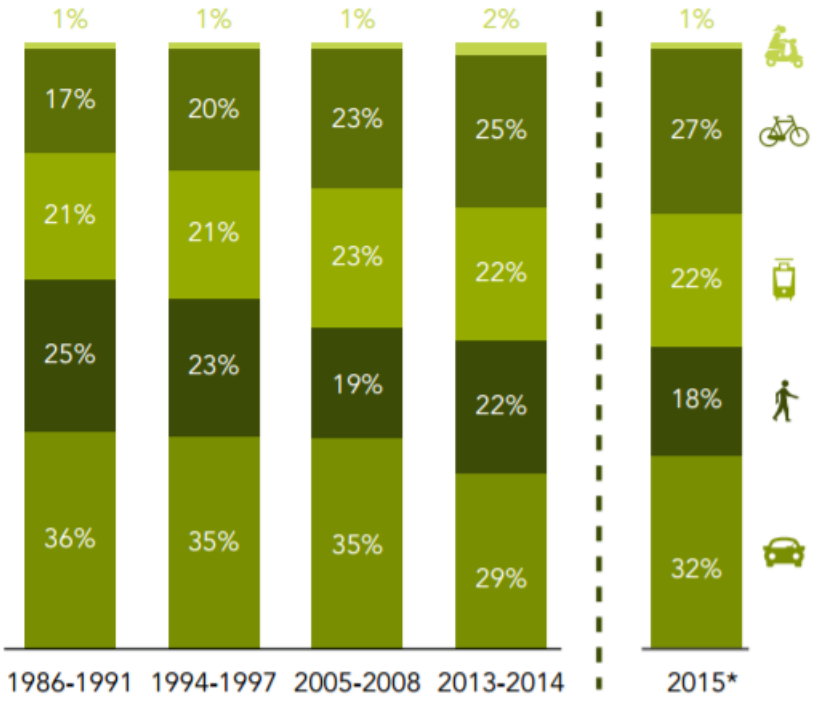

*Figure 2: Modal split of Amsterdam 1986-2015. (*Different source used) (Gemeente Amsterdam, 2016)*

Papers on mode shift towards (one of the modes of) environmentally friendly transport

The following papers were found useful on this subject:

- Heinen et al., 2009. Commuting by Bicycle: An overview of the Literature.
- Ogilvile et al., 2004. Promoting walking and cycling as an alternative to using cars: systematic review.
- Redman et al., 2013. Quality attributes of public transport that attract car users: A research review.
- Scheepers et al., 2014. Shifting from car to active transport: A systematic review of the effectiveness of interventions.

The paper of Heinen et al. (2009) contains an extensive list and elaboration on determinants for the mode choice for cycling. The (in)attractiveness of these determinants for cycling are also of great importance of the mode choice for other traffic modes. Most of the determinants are easily transferrable to other traffic modes, of which trip distance, (perceived) safety and costs are the most important ones. For biking specifically, the natural environment is most important. For other traffic modes, the weather conditions generally have less influence on the experience of the trip. Some of the main advantages of cycling, such as costs and health benefits, are also the main disadvantages of car usage, so measures influencing these determinants can cause a positive effect in modal shift towards the objective of a municipality. The categories of determinants are given in the table below.

The papers of Ogilvile et al. (2014) and Scheepers et al. (2014) both give an overview of implemented measures in favor of cycling and walking. The paper of Ogilvile et al. (2014) includes twenty-two studies and in the paper of Scheepers et al. (2014), a total of nineteen original studies were described and analyzed. The characteristics of each original study were listed. Furthermore, there was a general categorization in tools and in intervention types, which are also listed in Table XX.

Redman et al. (2012) describe the quality aspects of public transport, which are most likely to attract car users. The aspects were divided in physical aspects and perceived aspects, whether the aspects can be measures with or without involving public transport users.

References

Heinen, E., van Wee, B. & Maat, K. (2009). Commuting by Bicycle: An Overview of the Literature, Transport Reviews, 30:1, pp. 59-96, DOI: 10.1080/01441640903187001

Gemeente Amsterdam (2016). *Amsterdamse Thermometer van de Bereikbaarheid 2016.* Amsterdam, Nederland: Gemeente Amsterdam/Verkeer en Openbare Ruimte. Retrieved from: https://www.amsterdam.nl/parkeren-verkeer/bereikbaar/thermometer/

Ogilvile, D., Egan, D., Hamilton, V., Petticrew, M. (2004). Promoting walking and cycling as an alternative to using cars: systematic review. BMJ 2004;329:763, doi:10.1136/bmj.38216.714560.55. Retrieved from: http://www.bmj.com/content/329/7469/763

Redman, R., Friman, M., Gärling, T. & Hartig, T. (2013). Quality attributes of public transport that sattract car users: A research review. Transport Policy 25, pp. 119-127. DOI: https://doi.org/10.1016/j.tranpol.2012.11.005

Scheepens, C.E., Wendel-Vos, G.C.W., den Broeder, J.M., van Kempen, E.E.M.M, van Wesemael, P.J.V. & Schuit, A.J. (2014). Shifting from car to active transport: A systematic review of the effectiveness of interventions. Transportation Research Part A 70 (2014) 264-280. DOI: https://doi.org/10.1016/j.tra.2014.10.015

Transportation dictionary (n.d.). *Definition of: modal split.* Retrieved on June 19, 2017 from http://www.transportation-dictionary.org/Modal_Split

Wiener Linien. (2016). Modal Split – *So sind die Wiener unterwegs*. [Image] Retrieved from: https://www.wienerlinien.at/media/files/2016/modalsplit_173728.pdf

Appendix B: Interviews with Jeroen Grooten (Amsterdam) and Tadej Brezina (Vienna)

In this appendix, the content is about the oral interview in Amsterdam and written interviews with experts from Vienna.

The oral interview with Jeroen Grooten on May 19th, 2017 was held at the municipality of Amsterdam, Weesperplein 8, Amsterdam. The interview was in Dutch and it consisted of three parts: introduction and the work of Jeroen Grooten, Objective of the city and Measures. The written text is held close to the original spoken text. There is an audio tape of the interview. If you are interested in the tape, please send an email to P.Y.Tao@student.tudelft.nl .

This part with Vienna starts on page 11. In the ideal case, the interviewee was someone having a similar position as Jeroen Grooten at the municipality. However, the municipality of Vienna responded to my emails with only links to policy documents, but also indicated not having time for interviews. The included questions from this Appendix were sent to experts from other institutions: DI Tadej Brezina, researcher of TU Wien at the Institute for traffic sciences ('Institut für Verkehrswissenschaften'), Ass.Prof. Dipl.-Ing. Dr.techn. Bardo Hörl, of the section for traffic planning ('Verkehrsplanung'), at TU Wien, and to the institute for traffic ('Institute für Verkehrswesen') of BOKU, University of Natural Resources and Life Sciences, Vienna. Tadej Brezina replied and his answers are included. However, he was critical to the questions and partly answered the interview. A follow-up set of questions was sent to him with more elaboration. Unfortunately, the retrieval of answers was unsuccessful.

Interview with Jeroen Grooten, municipality of Amsterdam

Deel 1: Inleiding en het werk van Jeroen Grooten (0:00)

Het gesprek begon met een algemene introductie, maar dat is niet opgenomen. Het ging over wat we zoal in het dagelijks leven doen.

Yida Tao (YT): Yes, de opname loopt als het goed is.

Jeroen Grooten (JG): Ik werk dus acht jaar in een team wat Onderzoek en Kennis heet, hier bij Verkeer en Openbare ruimte. Wat wij vooral doen is dat wij heel veel data verzameld hebben en daar analyses op doen, zodat onze beleidscollega's verstandig beleid kunnen maken, bijvoorbeeld over parkeren.

YT: Ik had vernomen dat de collega's van Kennis en Kaders die de opdrachten geven aan jullie.

JG: Ja, ja zo gaat het in overwegend in zijn werk.

YT: Ik heb gelezen dat u het document Mobiliteit in en rond Amsterdam heeft geschreven, daar staat uw naam onder. Verder bent u aan mij geïntroduceerd als 'the founding father' van de Amsterdamse Thermometer van de Bereikbaarheid. Hoe is dat document tot stand gekomen?

JG: Ik heb samen met een collega aan het document 'Mobiliteit in en rond Amsterdam' gewerkt. De collega heeft het geschreven, ik heb vooral daar de cijfers aangeleverd. De Amsterdamse Thermometer van de Bereikbaarheid is een bepaald product wat ik met een paar mensen gemaakt heb. We merkten dat we veel gegevens hadden, maar we merkten dat het nooit op een plek bij elkaar gebracht was. Het leek ons een goed idee om het bij elkaar te brengen in dit product, waarbij

je kan zien hoe de mobiliteit in Amsterdam zich ontwikkeld heeft en ook hoe zaken die dat beïnvloeden zich ontwikkelen, bijvoorbeeld inwoneraantal en verplaatsingen van toeristen. Het is mooi gevisualiseerd door weer andere mensen.

De opzet van het interview wordt doorgenomen. Het interview bestaat uit vijf delen:

A) His work/role in the development/researching within the municipality
B) Summarize objective of the city
C) Go through several already implemented measures in Amsterdam
D) Discuss whether these measures are recommendable to other cities
E) Are measures from other cities (Vienna) possible for Amsterdam?

(2:30 begint het weer)

YT: We hebben het eerste puntje, over uw werk, al een soort van besproken. U bent vooral een onderzoeker: uw collega's maken het beleid en u levert dan de getallen aan.

JG: Ja, het is zo dat het college van B&W, die hebben vaak plannen die ze willen realiseren, aan de ambtenaren, onze beleidscollega's, vragen om dat plan te schrijven. Dat doen we zoveel als mogelijk, zoals we dat noemen, 'fact-based' of 'evidence-based', op basis van cijfers. Die leveren we dan aan of die maken we samen, van wat hebben we dan nodig. Welke gegevens willen we op inzetten of doen. Dat sturen ze dan weer naar de gemeenteraad om het plan goed te keuren of niet goed te keuren. En wat we ook doen is, als er eenmaal beleid is, het monitoren en achteraf evalueren. Zowel van tevoren als tijdens als achteraf eigenlijk.

YT: Heeft u eigenlijk ook een adviserende rol in beleid maken, of is het eigenlijk het aanleveren, het ondersteunen?

JG: Nou, het is ook wel meedenken, over welke verstandige maatregelen ergens anders ook zijn, wat je op basis van de cijfers ziet. We denken dan mee, maar we zijn daar niet leidend in, dat zijn de collega's van beleid.

Deel 2: Doel van de stad (3:50)

YT: In Amsterdam staat er in de structuurvisie dat het doel is om het centrumgebied 'autoluwer' te maken. Dat is in mijn ogen een goed doel op zich, alleen het komt een beetje abstract over. Bij het autoluwer maken zitten vooral parkeermaatregelen, maar ik vroeg me eigenlijk af of daar ook in het doel zit om andere vervoersmiddelen aantrekkelijker te maken? Of wordt daar niet actief beleid op gevoerd?

JG: Ja, wel degelijk. Kijk, de structuurvisie is een heel uitgebreid document voor de wat langere termijn, de toekomst waar Amsterdam naartoe wilt gaan, met een hoog abstractieniveau. Maar er zijn daar onder heel veel uitwerkingen gemaakt. Als je naar Verkeer & Vervoer kijkt is er bijvoorbeeld, ik weet niet of je dat tegen bent gekomen, onder andere de Uitvoeringsagenda Mobiliteit (UAM).

YT: Ik ken de mobiliteitsaanpak. Zit die daaronder?

JG: Die is er ook inderdaad. Die zegt ook het een en ander over waar welke vervoerswijzen in welke straat voorrang krijgen. Maar een ander plan, dat hangt er weer onder kan je zeggen, is de Uitvoeringsagenda Mobiliteit (UAM), dat kun je op internet ook wel vinden. Dat heeft onze huidige wethouder, Pieter Litjens, twee jaar geleden gelanceerd en daar wordt nu hard aan gewerkt. Daar staan hele concrete maatregelen in, zoals wij willen zoveel vierkante meter parkeerplekken vrijspelen, zodat er meer openbare ruimte komt voor voetgangers en fietsers. Er zijn ook

maatregelen, die al gedaan zijn, bijvoorbeeld bij de Munt in Amsterdam. Daar mag geen autoverkeer meer rijden en daar is dus meer ruimte voor voetgangers en fietsers. Dat plan zit vooral iets in over hoeveel oppervlakte er verschuift van de ene mobiliteit naar de andere, maar er staat niet, we willen per se dat er meer gefietst wordt of zo.

YT: Dus dat is niet een doel op zich.

JG: Ja, dus dat is niet een doel op zich, nee, precies. Kijk, er is een ander beleidsplan dat heet het MJP (Meerjarenplan) Fiets. Op dit moment is er bijna een nieuw plan voor 2017-2021. Daarvoor hadden we een oude, daar heb ik nooit aan meegewerkt. Daar wordt ook niet gezegd, dat we willen dat Amsterdam meer gaat fietsen. De verwachting is wel dat er meer mensen gaan fietsen, dat er meer fietskilometers gemaakt worden, er komen immers meer inwoners bij. Dan wil je dat dat in ieder geval wordt gefaciliteerd, dus dat je ruimte biedt aan die groei.

YT: Maar je gaat niet zelf op zoek naar die groei, zeg maar.

JG: In principe niet. Er zijn een paar uitzonderings-categorieën. In Zuidoost zie je bijvoorbeeld dat daar een relatief laag aantal middelbare scholieren naar school toe fietsen, vergeleken met andere stukken in Amsterdam en buiten Amsterdam. Je ziet gelijk ook dat daar hoge obesitascijfers zijn bijvoorbeeld. Ik weet niet of daar meteen een relatie tussen is. Maar dan wordt daar gezegd dat het misschien wel verstandig is om het daar wel te stimuleren.

YT: Het viel mij vooral op dat het belangrijke in Wenen is dat ze daar vooral 25% auto's willen halen in 2020. Dan hebben ze het verder verdeeld over de voetgangers, gelijk, fietsers omhoog en het openbaarvervoer omhoog. Daar streven ze ook echt naar, dat het zich zo gaat ontwikkelen.

JG: Nee, Amsterdam heeft niet zo'n target. Die heeft meer afgeleide doelstellingen, zoals ik net zei. Het is op zich positief als er een lager percentage wegen met de auto wordt afgelegd, maar het beleidsstuk voor het autonetwerk is vooral zo geschreven dat het niet het niet helemaal vastloopt hier, dat de snelheid te laag is. Ja, stel dat het percentage heel hoog wordt en er komen auto's bij, dan krijg je files in de stad. Kijk, dat is natuurlijk wat de gemeente niet wilt. Dat wil je wel proberen een beetje te remmen. En specifiek het centrum, dat hebben we met de UAM gezegd, daar willen we dat het niet groeit.

YT: U heeft het nu vooral gehad over de auto, minder straatparkeerplekken zodat er meer ruimte komt voor de voetgangers en de fietsers. Over openbaar vervoer, zijn daar specifieke doelstellingen van?

JG: Kijk het, lastige is bij het openbaar vervoer, dat het in Amsterdam een beetje complex georganiseerd is. Naast de gemeente heb je nog de vervoerregio en de GVB. De gemeente, die gaat bijvoorbeeld bij dit kruispunt [voor het gebouw] erover, wie krijgt er voorrang? De GVB, de GVB die moet ervoor zorgen dat de dienstregeling van de metro, die hieronder rijdt, wordt waargemaakt en dat er chauffeurs worden ingeroosterd, enzovoort. Maar degene die eigenlijk het beleid maakt, is de vervoersregio. Daar heeft de gemeente eigenlijk een best wel beperkte rol. In Wenen heb je daar volgens mij de verkeersbond of iets dergelijks.

YT: In Wenen heb je volgens mij de Wiener Linien, die zorgen voor de metro's, trams en bussen binnen de stad. Deze zijn weer aangesloten bij de Verkehrsbund Ost Region (VOR), die opereert in drie 'provincies' in Oostenrijk. Maar op zich is de gemeente de directe opdrachtgever voor de Wiener Linien.

JG: Hier is dat soms bijna een beetje concurrentie. Ik weet ook niet uit mijn hoofd precies wat vanuit de vervoersregio de doelstelling is wat betreft het openbaar vervoer. Volgens mij hebben ze daar doorstellingen betreffende snelheid, dat de trams en bussen niet te traag door het centrum van Amsterdam heen rijden.

YT: En wat bedoelde u eigenlijk met 'een soort van concurrentie'?

JG: Met concurrentie bedoelde ik, de gemeente moet een afweging maken tussen de verschillende soorten mobiliteiten. Kijk als we hier weer naar het kruispunt kijken, hier rijdt een tram over. De vervoersregio wilt dat die trams sneller gaan, dat de hele tijd de tram voorrang mag bij het kruispunt. Maar de gemeente moet de afweging maken tussen de trams, de auto's en de fietsers. Je wilt het optimaliseren, daar kan je soms een beetje strijd tussen ontstaan.

YT: Wat ik eigenlijk zo in Amsterdam zie, is dat er veel vrij liggende trampaden zijn. Daardoor denk ik, dat de tram daardoor best wel snel kan en ook best veel prioriteit aan de tram gegeven wordt.

JG: Ja dat is wel waar inderdaad. Dat is iets waar de gemeente afwegingen ook over maakt, is dat nou ruimte technisch ideaal of niet. Volgens mij monitort de vervoersregio ook wel hoeveel procent van de ritten met het openbaar vervoer zijn, maar ik weet niet of ze zoals in Wenen ook een doelstelling hebben, van zoveel procent meer ritten. Wij [als gemeente] kunnen het ook wel roepen, maar we gaan er heel weinig over. Dus dan heb je er geen invloed op en kan je beter ook niet zo een doelstelling hebben. Maar het is wel opvallend dat Amsterdam vergeleken met andere steden een veel kleiner aandeel heeft. Dat komt natuurlijk ook door het hoge fietsgebruik. Maar het heeft misschien ook iets te maken met het aanbod van het openbaar vervoer, de kwaliteit. In Wenen zal het vast veel beter zijn, volgens mij is daar de reizigerstevredenheid ook veel hoger dan hier.

Deel 3: Beleidsmaatregelen (12:40)

Het derde puntje zijn die beleidsmaatregelen. Ik wilde eigenlijk in mijn thesis onderzoek kijken naar het grote aantal maatregelen. Sommige daarvan zijn meer succesvol dan de andere. Succesvol is best wel lastig uit te drukken, maar daarmee bedoel ik eigenlijk in hoeverre het gelukt is om het effect te bereiken dat als doel werd gesteld. Ik heb een literatuuronderzoek gedaan. Er zijn een paar voorbeelden dat er een nieuwe fietsroute werd aangelegd, maar dat er geen verandering was in het aantal fietsers.

JG: We hebben ooit met het MJP Fiets 2012-2016 de stijging van fietsritten onderzocht. We zagen dat tussen de jaren '90 en toen, 2011/2012, het fietsgebruik heel erg was toegenomen in Amsterdam, met wel iets van 40%. Toen zijn we gaan kijken of we redenen konden vinden waardoor dit nou is gebeurd? Er zit een analyse in, in de bijlage, waarin we hebben geprobeerd te decomposeren welke effecten daar nu een rol gespeeld hebben. Wat we daar zagen, wat het meest gewerkt heeft is het heel erg streng invoeren van autoparkeerbeleid. In Wenen is dat ook al, maar in Amsterdam is dat volgens mij wat strenger.

Kijk, ooit, toen ik zelf klein was ging ik met mijn ouders weleens naar Amsterdam. Dat was in de jaren '80 en er was hier voor auto's een grote parkeerproblematiek. Er was een hele hoge parkeerdruk en er werd soms ook dubbel geparkeerd. En dat liep zo erg de spuigaten uit, dat toen de gemeente parkeerbeleid in is gaan voeren. Niet zozeer vanwege het fietsgebruik, maar vanwege, überhaupt nog je auto kunnen parkeren.

Parkeerbeleid was toen met tarieven. Het is klein begonnen maar langzaam uitgebreid. Waar het vooral voor gezorgd heeft, hebben we gezien in de data die we geanalyseerd hebben, is dat in

Amsterdam, voor kleine ritjes binnen de stad, wordt er nog heel weinig de auto gebruikt. Terwijl dat we zagen dat voor vroeger dat nog heel vaak gebeurde.

Het was uiteindelijk een cultuuromslag maar het werd wel echt gedreven door prijsprikkels. Het was vroeger zo in de jaren ’70, begin jaren ’80. Ik weet niet hoever jij hebt moeten fietsen vanochtend vanuit je zusje?

YT: Een kwartier geloof ik, ik kwam vanuit Science Park.

JG: Nou, kijk, vroeger was het prima mogelijk om dat soort ritten met de auto te maken. Dat was toen sneller en als je niet hoefde te betalen voor parkeren was het goedkoop, je hoeft maar een beetje benzine te betalen.

YT: Ja, het is relatief goedkoop als je al een auto hebt.

JG: Precies, maar als je nu vijf euro per uur moet betalen, dan ga je wel nog een keer nadenken of dat echt nodig is of je toch beter kan gaan fietsen. We zagen in ieder geval een aantal effecten, maar een was heel sterk. We zagen dat door het strenger maken van het autoparkeerbeleid, dat de interne autoritjes voor een groot deel zijn vervangen door fietsritten.

YT: Dat is dan zo voor het centrum, het gebied waar het parkeertarief vijf euro per uur is?

JG: Ja klopt, maar ook de ring daaronder met vier, ook met drie. Het gebied binnen de ring, de A10, ten zuiden van het IJ, waar je best wel hoge parkeertarieven hebt, daar zag je dat heel sterk afnemen.

Ik woon zelf in noord, zie je anno 2017, voor interne ritjes binnen het stadsdeel wordt er veel de auto gebruikt. Je hebt daar ook bijna overal gratis parkeren. De financiële prikkel is niet de volledige verklaring, maar wel de belangrijkste verklaring.

Er waren nog meer dingen die we zagen. Als we kijken naar de samenstelling van de bevolking van Amsterdam, verandert door de jaren heen. In de jaren ’80 woonden er heel veel ouderen in Amsterdam, nu minder maar dat gaat weer groeien door de vergrijzing.

YT: En jonge gezinnen trekken ook weg.

JG: Precies, maar wat daarnaast bleek was dat inkomen en opleidingsniveau tot onze verassing een sterke verklarende variabele te zijn. Als je namelijk in de jaren ’90 naar Amsterdam kijkt, toen woonden er 700-750 duizend inwoners en uit mijn hoofd was toen 30% hoogopgeleid. Een heel groot deel was laagopgeleid of gemiddeld opgeleid. Toen we die analyse in 2012 deden was niet 30% hoogopgeleid maar 40% of 50% hoogopgeleid.

YT: En die hoogopgeleiden pakken juist de fiets.

JG: Ja, dus wat we zagen was, als je inzoomde op de data uit de jaren ’90 op de hoger opgeleiden die er toen woonden, dat die ook al heel veel fietsten. En de hoger opgeleiden van nu fietsen nog geeneens heel veel meer dan toen, wel een beetje, maar het is vooral dat er van de ‘fiets-minded-people’ meer mensen zijn gekomen. Dan zie je natuurlijk vanzelf op de fietspaden meer fietsverplaatsingen, maar daar heeft de gemeente eigenlijk niks voor gedaan. Je hebt een andere bevolking in de stad en als die mensen meer fietsen, dan gebeurt het ook. Dan moet je natuurlijk ervoor zorgen dat de groei die dat teweegbrengt, aan fietsverplaatsingen, gefaciliteerd moet worden.

Toen we in 2010-2011 keken, zagen we bij alle OV-knooppunten dat de bezettingsgraad van de fietsparkeerplekken ver boven de 100% lag. Dat was niet voldoende gefaciliteerd. De laatste jaren is daar een inhaalslag gemaakt. Er werd ook gezegd, als we dat fietsgebruik niet blijven stimuleren, dan kan het weer omlaag gaan. Dat wil je niet.

YT: Wat betreft de fiets, meer ruimte voor stallingsplaatsen en het ontwikkelen van brom- en snorfietsbeleid en handhaving bij drukke centra waren maatregelen die ik had gevonden. Maar als ik het zo hoor, is het eigenlijk door een demografische ontwikkeling gekomen dat er meer wordt gefietst, en niet zozeer door echte actieve maatregelen.

JG: Ja, dus demografische ontwikkelingen is een belangrijke. Autoparkeerbeleid was een maatregel, niet primair bedoeld voor de fiets maar wel een bijeffect. Ik denk wel zeker dat investeringen die zijn gedaan tussen de jaren '90 en 2012 een bepaalde bijdrage hebben gehad aan de toename van het fietsverkeer. Het is niet zo dat als je een fietspad aanlegt, dat mensen opeens meer gaan fietsen. Volgens mij is het hier eerder andersom, dat de mensen willen gaan fietsen. In Amsterdam hebben we ook gezien dat dat de snelste en de goedkoopste manier is, om je door de stad te verplaatsen. Dat is wat veel mensen willen en dat is dan wat je wilt faciliteren.

Ik denk, een derde reden of vermoeden, die we toen bij het onderzoek bij het MJP niet echt hard hebben kunnen maken, ligt bij het openbaar vervoer. Tussen de jaren '90 en 2010 is dat niet enorm verbeterd in kwaliteit. Er zijn wat dingen bijgekomen, maar ik denk dat andere steden daarin meer verbeterd hebben. Ook de snelheid is niet enorm verbeterd. Ik denk dat op den duur mensen gedacht hebben, het openbaar vervoer vind ik niet goed genoeg meer, dus ik ga maar fietsen. Maar dat was niet echt een bewuste maatregel. Stel nou dat er meer verbeterd was in het OV destijds, dan hadden we misschien minder fietsgroei gezien.

YT: Maar het was toen geen doel op zich, vanuit de gemeente, we willen meer mensen het OV in krijgen, dus we gaan het aanpassen? Er zijn dus niet echt actieve maatregelen genomen om het OV aan te passen zodat het een aantrekkelijk alternatief was voor de fiets?

JG: Dat was niet primair het doel. Wat wel in Amsterdam al heel lang speelt is de Noord-Zuidlijn, die gaat hier volgend jaar rijden. In de jaren '90 waren er al plannen voor. Toentertijd waren er prognoses, dat het aantal OV gebruikers enorm zou gaan stijgen. Daarom zeiden ze ook, we hebben ook een metro nodig, anders past dat niet meer in de trams en bussen en dergelijke. De aanleg van die lijn heeft heel lang geduurd en in de tussentijd zie je dat het OV heel lang constant gebleven is in het aantal gebruikers. De laatste jaren zie je dat het weer toeneemt, ik denk onder andere door toeristen. Het was dus een tijd lang vrij stabiel en dat het fietsgebruik steeg. (22:00)

Er zijn vast en zeker goede maatregelen geweest om het fietsgebruik te verbeteren, maar het is niet dat dat er gelijk voor zorgt dat het enorm spectaculair gaat groeien.

YT: Maar het was ook het minder aantrekkelijk maken van de autoritjes in het centrum en dat de fiets ook een aantrekkelijker alternatief wordt.

JG: Ja, en als we alvast een doorkijkje maken naar Wenen, ze hebben ook wel parkeerbeleid. Ze zouden dat ook wel strenger kunnen doen. Een voorbeeld is vergunningsgebieden. Vergunninghouders kunnen overal in het gebied gratis parkeren. Als je kleine gebieden hebt en je maakt een ritje, dan moet je al vrij snel betalen. Ik weet niet hoe groot of hoe klein hun vergunningsgebieden zijn, maar dat zou ook een knop kunnen zijn waaraan ze nog kunnen draaien. Als je het parkeren minder aantrekkelijk maakt, dan gaat vermoedelijk een deel fietsen. Verder is het

misschien zo dat hun succesvolle OV-systeem negatief is voor de toename van het fietsgebruik. Dat is ook ergens een keuze.

YT: Ja, dat zijn ook precies dezelfde afstanden die men meestal aflegt.

JG: Precies, en ik weet niet hoeveel het OV daar kost, of het duurder is dan hier?

YT: Dat kan ik wel vertellen. Het OV kost daar 365 euro per jaar, dus één euro per dag.

JG: Dat is weinig.

YT: Dat was in 2012 ingevoerd. Ik denk dat van daaruit ook de stijging van OV in dat jaar te verklaren is. Dat was eigenlijk ook een van mijn laatste vragen: Ik had opgezocht dat in Amsterdam het abonnement voor GVB Only 920 euro per jaar kost, en dan krijg je al twee maanden gratis. Dat is 2,5 keer zo duur als in Wenen. Zou zo een maatregel voor mensen in Amsterdam, effect hebben, ik denk het wel, en ook echt mogelijk zijn?

JG: Ik denk dat het wel degelijk effect heeft. Er is in Amsterdam voor 65+ minima is het OV gratis en ik geloof dat dat wel aardig gebruikt wordt. Dus ik denk zeker, als je dat veel goedkoper gaat maken, dat er toch meer mensen de afweging gaan maken, bij slecht weer of als je fiets kapot is, om met het OV te gaan. Dus ik denk, als je dat zou willen, dat het wel kan. Maar uiteindelijk is fietsen per slot van rekening altijd goedkoper, want het kost natuurlijk niks, buiten je fiets te moeten repareren. Maar ik denk dat het zeker wat extra OV gebruik in positieve zin zou veroorzaken.

Kijk, de vraag of je dat wilt, het kan allemaal, maar het is een politieke afweging. Nu wordt gestreefd om het OV steeds meer kostendekkend te maken. GVB krijgt nu nog subsidie van de vervoersregio maar dat wordt steeds wat minder en moet steeds meer op eigen benen staan. De gemeente en de overheid heeft dat geld voor andere doeleinden nodig. Maar stel dat je de subsidie weer laat toenemen en de mensen met meer korting kunnen reizen, dat kan allemaal, maar dat is een keuze.

YT: In Wenen wordt uit mijn hoofd 30% of 40% van de kosten door de kaartverkoop terugverdiend. De rest is gesubsidieerd, buiten wat reclameopbrengsten. Ik denk dan, maar dan heb je ook wel wat.

JG: Ja klopt, hier in Amsterdam was het heel lang ook zoiets, 70% was subsidie maar dat is nu nog maar 30%. De reden dat het lukt in Amsterdam, is te danken aan de grote groep toeristen. Een deel daarvan koopt dagkaartjes voor 13-14 euro. Soms kopen ze ook enkele rit kaarten voor 2 euro zoveel om van CS naar de Dam te gaan. Daar hebben ze veel inkomsten aan. Dit is voor de vervoersregio interessant, want dan kan de subsidie omlaag. Je zou kunnen zeggen, om het dan voor de bewoners goedkoper te maken. Maar Amsterdam heeft niet het beleid op dit moment, dat ze het willen stimuleren. Het is op zich positief dat er zoveel wordt gefietst. Pas als het meer zou toenemen, zou je kunnen kijken of men er een rem op wilt gooien.

YT: Maar bijvoorbeeld voor de mensen die niet willen of kunnen fietsen, zou je het OV wel aantrekkelijker kunnen maken. Ik denk dan aan oudere mensen. Voor mij is Amsterdam al een beetje chaotisch op de fiets en ik denk voor die mensen al helemaal. Daarnaast misschien ook immigranten en gehandicapte mensen.

JG: Dat zijn wel goede punten, maar als je zo naar Wenen kijkt, wat denk je dat Amsterdam dan ervan zou kunnen leren? Wat gaat daar beter dan hier?

YT: Ze hebben daar een heel aantal maatregelen en visies. Een van die visies is dat het allemaal barrièrevrij moet zijn. Als er twee trams voorbijkomen dan is daarvan er één waar mensen direct kunnen instappen met de rolstoel. Alle metro's hebben ook liften en zijn zonder trapjes, het kost wel

wat maar dat moet je net willen. Voor de rest is het dat tijdens de spits om de drie tot vijf minuten een tram of een metro langskomt. Je hebt eigenlijk geen wachttijd, je hoeft niet echt te kijken wanneer je tram gaat en dat is eigenlijk een service wat ze aan die mensen bieden.

JG: Ik denk vooral dat het laatste het verschil is. Wat betreft de eerdere dingen, alle metro's hebben hier ook liften, bijna alle toekomstige en huidige trams zijn ook toegankelijk voor mensen met rolstoelen en kinderbuggy's, dus dat gaat de goede kant uit. Maar wat betreft de frequenties, die zijn interessant. Misschien zou je nog de dienstregelingen naast elkaar kunnen leggen. Is de frequentie hier daadwerkelijk heel veel lager dan daar? Dat zou je ook kunnen onderzoeken?

In Amsterdam moet je vaak wachten en dat is zonde van de tijd. In Wenen heb je een veel uitgebreider metronetwerk dan in Amsterdam en die willen ze ook uitbreiden geloof ik.

YT: Ja, ze hebben U1 t/m U6, maar de vijfde bestaat nog niet. Ze hebben dus vijf metrolijnen, U5 wordt gebouwd en U1 en U2 worden verlengd. Dat is voor hun het laatste stapje om hun doel te bereiken.

JG: Dat is wel een punt waar Amsterdam serieus over nadenkt om het verder uit te bereiden. Verder is het wel dat Amsterdam meer dan twee keer zo klein is als Wenen. Metro's zijn heel duur en het verdient zich pas terug als je voldoende reizigers hebt. In Amsterdam is dat soms nog net te weinig om het rendabel te krijgen. Ook dat iedereen fietst, is een nadeel voor een rendabele metro zou je kunnen zeggen. Er wordt wel over nagedacht en er wordt veel onderzoek naar gedaan.

Het idee is wel dat Amsterdam nog gaat groeien met veel meer inwoners. Het vermoeden is ook dat de groei in arbeidsplaatsen door gaat zetten. Dan heb je vanzelf meer OV-reizigers als het goed is. Dan moet je misschien ook de frequenties van de OV-reizigers op gaan voeren, daar zijn wel plannen voor dat het meer dan nu gaat. Het zou wel interessant zijn om de frequenties van Amsterdam en Wenen naast elkaar te leggen. Tegelijkertijd, als je naar trams kijkt, zou je de frequenties in Amsterdam kunnen verhogen, maar het heeft consequenties voor auto en fietsers. Want een tram, ook deze, die gaat hier een kruispunt over. Als je meer trams hebt, moeten de andere modaliteiten langer wachten en dat wil je ook weer niet. Dat is wel een uitdaging en een overweging.

YT: Maar als er niet meer trams zichtbaar zijn, denken mensen dan niet van, de tram haalt me in, misschien ga ik volgende keer toch met de tram?

JG: Misschien wel. Maar ik denk dat je het positief en negatief kan zien. Dat er in Wenen veel trams rijden, dat is voor de OV-gebruiker heel positief. Maar als Wenen tegelijkertijd het fietsgebruik omhoog wilt krijgen kan het daardoor ook negatief werken, want de trams zitten in de weg bij kruisingen bijvoorbeeld.

YT: Ik zit even te denken. In Wenen heb je wijk 1, het historische centrum. De trams komen niet echt in het centrum zelf maar ze blijven op de ring. Dan spreidt het zich radiaal uit. De trams hebben hun eigen wegen en tussendoor heb je straatjes voor fietsers.

JG: Nou kijk, dat zijn denk ik hele leuke dingen voor jouw scriptie om naar te kijken. Ik denk dat daar Amsterdam heel erg van kan leren nog. Wat je in Amsterdam ziet is dat, vanuit een lange traditie, het OV heel erg op CS gefocust is. Daarbij zitten ook veel voedende tramlijnen, voor- en natransport gaat helemaal naar CS door. Die gaan door het hele drukke centrum.

YT: Ja, dat is niet heel efficiënt als je daar niet hoeft te zijn.

JG: Precies, dus wat Wenen eigenlijk doet, is dat ze het centrum een beetje tramluw hebben en daar omheen veel meer.

YT: Maar in Wenen zitten het centraal station en andere stations ook niet in het centrum zelf.

JG: Amsterdam heeft ook weleens het plan gemaakt om wat minder te focussen op CS en meer op andere treinstations en daar ook meer OV naartoe te laten gaan. Daar kan Amsterdam best nog wat van kan leren hoe ze het daar doen. Daar zie ik zeker nog wel hele grote leerpunten vanuit Wenen waar dat beter gaat.

YT: Ik had nog een vraagje over het OV. In Amsterdam zeggen ze, dat ze de betrouwbaarheid willen vergroten. Maar, gaat het dan vooral over vertragingen en vervroegingen?

JG: Betrouwbaarheid betekent volgens mij vooral van, als je een dienstregeling hebt, dat de trams voorspelbaar rijden. Dat betekent inderdaad dat er weinig verstoringen zijn waar zo een tram dan last van heeft. De aankomsttijd komt overeen met wat je in je hoofd had zitten. De maatregelen die daarvoor gedaan worden, dat weet de vervoerregio beter dan ik.

YT: Ik dacht, misschien zou je dat dan zo kunnen oplossen, om de frequentie zo hoog te laten worden dat het niet meer uitmaakt qua wachttijd.

JG: Dat is een oplossing. Maar tegelijkertijd is er ook een mogelijkheid in Amsterdam dat al die trams moeten wachten op autoverkeer en in een soort van file rijden waardoor de betrouwbaarheid heel laag wordt. Het zit hem eerder bijvoorbeeld in de optimale afstelling van de verkeerslichten of dat als er een keer een ongeluk gebeurt, dat je dan heel snel een team hebt om daar ter plekke te zijn. Meer dat soort maatregelen denk ik om het reiscomfort te vergroten.

YT: Ik had nog een vraag over voetgangers. (37:00) Het is een beetje een onderbelicht thema. Wat ik had gevonden was dat er 'een betere verdeling van ruimte in het centrum', maar er is niet echt een eis of harde maatregel van, we willen dat alle stoepen ongeveer twee meter breed zijn of dat voetgangersstromen zich goed kunnen verplaatsen.

JG: Ja, dat klopt. Het is wel zo dat in de UAM, waar we het net over hadden, staat dat in het centrum meer ruimte moet worden gecreëerd, juist voor voetgangers. Er wordt op dit moment ook gewerkt aan een beleidsplan voor de voetganger waar ook bepaalde criteria worden toegekend aan stoepen. Daar wordt bekeken, wat de werkelijke breedte is die beschikbaar is als stoep en wat de intensiteit is. De combinatie van die twee kan leiden tot 'te vol' of juist niet. In Londen doen ze daar hele mooie dingen mee, ze hebben daar allerlei maatstaven. Ze hebben met heel veel camera's voetgangersstromen kunnen meten. Soms heb je een krappe stoep die vol is, dat is onwenselijk, dan wil je daar maatregelen hebben. Soms is het heel breed maar ook heel vol, de Damrak bijvoorbeeld, dan wil je daar ook maatregelen hebben. Maar soms is het net zoals hier, de stoep is breed en er loopt niemand, dan hoef je er niks aan te doen. Soms heb je een krap stoepje maar er is ook niemand, dan maakt het niet zo uit. Het gaat om die twee zaken, maar dat is in ontwikkeling en dat gaat wel komen. Het is wel waar dat er voorheen eigenlijk niks over voetgangers werd gezegd en nu steeds meer. Het is duidelijk dat het steeds meer van belang is voor een leefbare stad dat je daar genoeg ruimte voor hebt. Een terecht punt, inderdaad.

YT: Dat was het denk ik wel, ik heb verder geen vragen meer.

JG: Mooi, mag ik dan nog een vraag stellen? Over Wenen, waar ik dan wel benieuwd naar ben: we hebben het over het OV gehad maar dat is voor mijn gevoel heel erg binnen de stad. Maar OV gaat ook over de wat langere afstanden. In Nederland heb je daar de trein voor. Je hebt daar een S-bahn systeem?

YT: In Wenen wonen 1,8 miljoen mensen, een kwart van de Oostenrijkse bevolking. Op de grotere stations komt de metro samen met de treinen en de S-bahn, waarmee je verder uit de stad kan.

JG: Dat is volgens mij ook iets wat Amsterdam niet echt heeft, behalve naar Amstelveel misschien. In Rotterdam en Den Haag heb je nog wel de Randstadrail, dat lijkt er meer op. Dat zou als je een vergelijking wilt maken ook nog interessant zijn.

YT: Ik dacht, ik doe het over de stad zelf, anders valt de vergelijking met fietsen en lopen helemaal weg.

JG: In Amsterdam willen ze iets meer dat het woon-werkverkeer via snelfietsroutes gaat, maar dat is nog wel heel beperkt. Maar als je het in Wenen vooral over interne fietsverplaatsingen heeft ben ik het met je eens dat het handig is om daarop te focussen.

YT: Ze willen wel andere slimme maatregelen, zoals P+R, maar die heb je in Amsterdam ook. Ik denk dat het grote verschil tussen Amsterdam en Wenen is, dat heel het gebied daar gefocust is op Wenen, terwijl het hier meer de Randstad is. Dat is een andere geografische conditie die je hebt

JG: Als we het nog even over het fietsen kunnen hebben, want dat was ook een van je vragen dat Wenen wilt dat de modal split toeneemt, meer fietsgebruik en wat ze eraan zouden kunnen doen. We hebben het gehad over, we kunnen het parkeertarief verhogen, over auto's, maar we hebben volgens mij voor de rest niet zoveel dingen bedacht. Maar kijk, Nederland heeft al lang een fietscultuur. Dat is niet zomaar even veranderd. Is Wenen helemaal plat of is het heuvelachtig?

YT: De heuvels zijn zeg maar van categorie brug, zo'n overvaarbare brug, dus het is best geschikt voor de fiets. Maar ja, het weer is hier wel beter op zich, vooral in de winter.

JG: Ja het is voor fietsers belangrijk dat het plat is. De temperatuur speelt ook mee. Maar in Nederland wordt op basisscholen het fietsen verplicht geleerd. Hier wordt het ongeveer met de paplepel ingegoten. Mijn dochtertje is vier, ze kan nog niet fietsen, maar ze wil nu zelf al naar school fietsen. Ze ziet het iedereen doen. Je hebt het voorbeeld, van ouders. Je kan kijken naar wat ze doen met kinderen, wordt het jong slim aangeleerd, vanuit scholen.

YT: Je hebt in Wenen nog iets wat anders is dan hier. Je hebt van die City Bikes, en dan kan je je gratis daarvoor aanmelden. Als je binnen het uur van het ene punt naar het andere punt een verplaatsing aflegt dan is het gratis. Dat is op zich heel interessant, het is gratis en binnen een uur kan je overal komen in de stad. En je hoeft ook niet zoals, zoals bij de OV fiets, de fiets op hetzelfde punt weer in te leveren. Dat is voor hun wel een logistiek dingetje, maar voor de reiziger is het op zich wel fijn.

JG: Wat ik zit te denken met voorbeelden, de koning en de koningin fietsen zelfs. In Oostenrijk, als de hooggeplaatste mensen zoiets laten zien kan het misschien helpen.

En wat ik vooral zit te denken, over dat fietsnetwerk. In Amsterdam heb je heel veel vrijliggende fietspaden. Dat zorgt ervoor dat je best wel veilig kunt fietsen, want ook een vraagstuk bij fietsen is echt verkeersveiligheid. Je hebt in Amsterdam ook het MJP Verkeersveiligheid. Wat doet Amsterdam om het hier allemaal veilig te krijgen? Dat is volgens mij in heel veel andere steden, ook in Londen, een probleem. Kijk, als je in je stad nog steeds heel veel dominante ruimte voor autoverkeer hebt, dan is het ook gewoon eng om daar tussen te fietsen. Ik heb zelf ook eens in Parijs gefietst bijvoorbeeld, dat is best wel gaaf maar ook spannend. Hier is het in principe altijd veilig. Je hebt hier vrijliggende fietspaden, of het is gemengd maar dan mogen auto's niet zo hard rijden. Daar zouden ze wat aan kunnen doen om de inrichting te veranderen.

Tegelijkertijd, wat in Amsterdam een beetje het nadeel van dat succes is, het voordeel van vrijliggende fietspaden is dat je het mooi faciliteert en mensen vinden het veilig, maar het nadeel is wel, als het fietsverkeer zo erg toeneemt als in Amsterdam, dan heb je met zo'n apart fietspad kan het te vol worden. Maar als je gemengde shared-space achtige situaties hebt kun je veel meer groei erin passen.

YT: Het is zo minder flexibel

JG: Dus misschien is het aardig voor Wenen mee te geven, je kan het doen, maar er wel van bewust dat het op termijn weer tegen je kan werken.

YT: Dan heeft u het er vooral over dat de fietsers en de auto's samen van de rijbaan gebruik maken. Wat ik Wenen vaak zie is dat je dan wel een fietspad hebt, maar dat ernaast file-geparkeerd wordt. Dan zou ik bang zijn dat er opeens een deur openklapt.

JG: Al dat soort dingen kunnen wel heel beperkend werken. Ook is de vraag hoe hard de auto's in het centrum van Wenen mogen rijden. Als ze 50 km/h rijden, dan is het best wel eng om ernaast te fietsen. Als dat 30 is, dan is het al veel prettiger

YT: Bij de ring is het 50 km/h, maar dan ligt het fietspad los. Het is wel fietsers en voetgangers gemengd, in mijn ogen ook niet helemaal ideaal.

JG: Dat is ook nog wel een punt. Dat is volgens mij ook in veel Duitse steden het geval, maar dat is in Nederland ook wel heel bewust gescheiden, een apart stuk voor fietsers en een apart stuk voor voetgangers

YT: De verschillende snelheden scheiden

JG: Precies. Fietsers en voetgangers mengen is volgens mij niet goed voor het verbeteren van het fietsverkeer.

Amsterdam had altijd al een hoog fietsaandeel, maar in Kopenhagen was het lager en daar is het gegroeid. Daar kunnen ze ook wel van leren volgens mij.

Interview with Tadej Brezina, TU Wien/Vienna

Questions (I)

This interview is part of the research of my bachelor thesis. I am researching the modal shift from car trips towards trips by foot, by bicycle and by public transport, for trips which are made within the city. I make a comparison between Vienna and Amsterdam, European capitals with very interesting distribution of the modal split percentages.

The interview consists of five parts. First, I would like to ask about your professional position. Then, I would like to discuss several measures, physical, financial, or legal, for public transport, car, bicycle, and pedestrians.

1. How would you describe your work regarding researching and developing traffic (management) policies? Do you have an advising role towards the municipality?
2. Public transport
    a. What are the most important key ingredients for obtaining a high mode share of public transport?

   b. Which conditions should be fulfilled to make a high frequency possible? And what disadvantages should cities take into account when other cities want to implement it?
   c. Are there also objectives regarding the operating speed of trams and the busses? Which measures are taken to ensure an acceptable speed for passengers?
3. Car
   a. Would it be possible to reduce the licensing areas for permits to a half or a third of a district? Do you expect this measure to be useful to reduce the inner-city car-trips?
   b. Could the parking fees be increased for certain 'popular' areas, such as the city centre, which are also easily reachable by public transport?
   c. Are there more measures regarding the car, other than parking management, which were also considered having a role in decreasing the modal split?
4. Bicycle
   a. Which are now the most important criteria to decide which type of cycle street/track/path is built?
   b. With so many trams in the city, waiting times for cyclist at intersections can be very long. Also, it is written that some traffic light circuits will be more 'friendly' towards pedestrians. How could waiting times for cyclist at intersections be shortened or avoided in Vienna?
5. Pedestrians
   a. Why is the standard size of min. 2,0 meters for pavements chosen for obtaining a certain quality?

Answers of DI Tadej Brezina

1. Theoretical focus, sometimes monitoring of measures; no implementation. Vienna seldom; other municipalities sometimes
2. Public transport
   a. Reduced barriers (all 3 types); PT presence in city; dense network of stops; prioritization of surface rights of ways
   b. –
   c. Fluency of ride is considered more import than (local) speed. When is speed acceptable? Prioritization of traffic lights e.g.
3. Car
   a. –
   b. Yes, they would
   c. -
4. Bicycle
   a. StVO & Guidelines offer high variety of options, that is excessively used; mostly its conflicts over space for private cars.
   b. I'm pretty sure that trams and pedestrians are the least problem for cyclist waiting times at traffic lights
5. Pedestrians
   a. Because it is the lower physiological threshold for 2 people next to each other.

Questions (II)

Public transport

The public transport of Vienna is of a high quality and its mode share has been increasing over the past decades, to almost 40% nowadays. I would like to research which measures other cities could apply to increase trips with public transport. One of the characteristics in Vienna, is a high frequency

of vehicles; during rush hours, every 3 to 5 minutes a vehicle passes by. In Amsterdam, this is every 10 minutes. I see the advantages of a high frequency, namely less waiting time for passengers. However, there are also some boundary conditions (enough potential passengers) and disadvantages (high operating costs) that come along with it.

- Q1: When Amsterdam wants to introduce a higher frequency, which other boundary conditions, advantages, and disadvantages will they face?

Car

- Q2: Which measures are there in Vienna to decrease the modal share of the cars?

In Amsterdam, there is a very strict parking policy. The parking fee in the city centre is 5 euros per hour and licensing areas for inhabitants are kept small. According to Jeroen Grooten, researcher at the municipality of Amsterdam, the small licensing areas has led to a strong decrease of the number of short inner-city trips by car, because people had to pay parking fee quite fast. In Vienna, the parking areas for inhabitants with a parking licence are almost the same as the areas of the districts.

- Q3: To what extent would it be possible to introduce a strict parking policy in Vienna? Which positive and negative aspects for Vienna do you see?

Bicycle

In Amsterdam, there are many separated bicycle paths. That is a nice and safe way to facilitate cycling. On the other hand, they face the challenge that the separated paths are becoming overcrowded. Infrastructure with the 'shared-space' principle, where cyclists and low-speeding cars share the same street, is more flexible for the long haul.

- Q4: When redesigning a street in Vienna with cycling facilities, would you prefer perceived safety (separate cycle path) over long-term flexibility ('shared-space')? Why?

Appendix C: Survey elaboration and rough outcomes

This appendix is about the content and the analysis of the survey, conducted for the bachelor thesis. First, the set-up of the survey is discussed, also some elaboration is given as background information for the statements of questions and answers. Then, the rough outcomes of the survey are given. These contain mainly tables and graphs. If you are interested in the rough output as an Excel file, please send an email to P.Y.Tao@student.tudelft.nl.

Contents

Questionnaire design

The questionnaire was carried out using Google forms. It consisted of four sections:

- Part 0. Introduction, see Figure 1
- Part 1. General Preferences
- Part 2. Fictive situation: trip to city hall
- Part 3. General questions

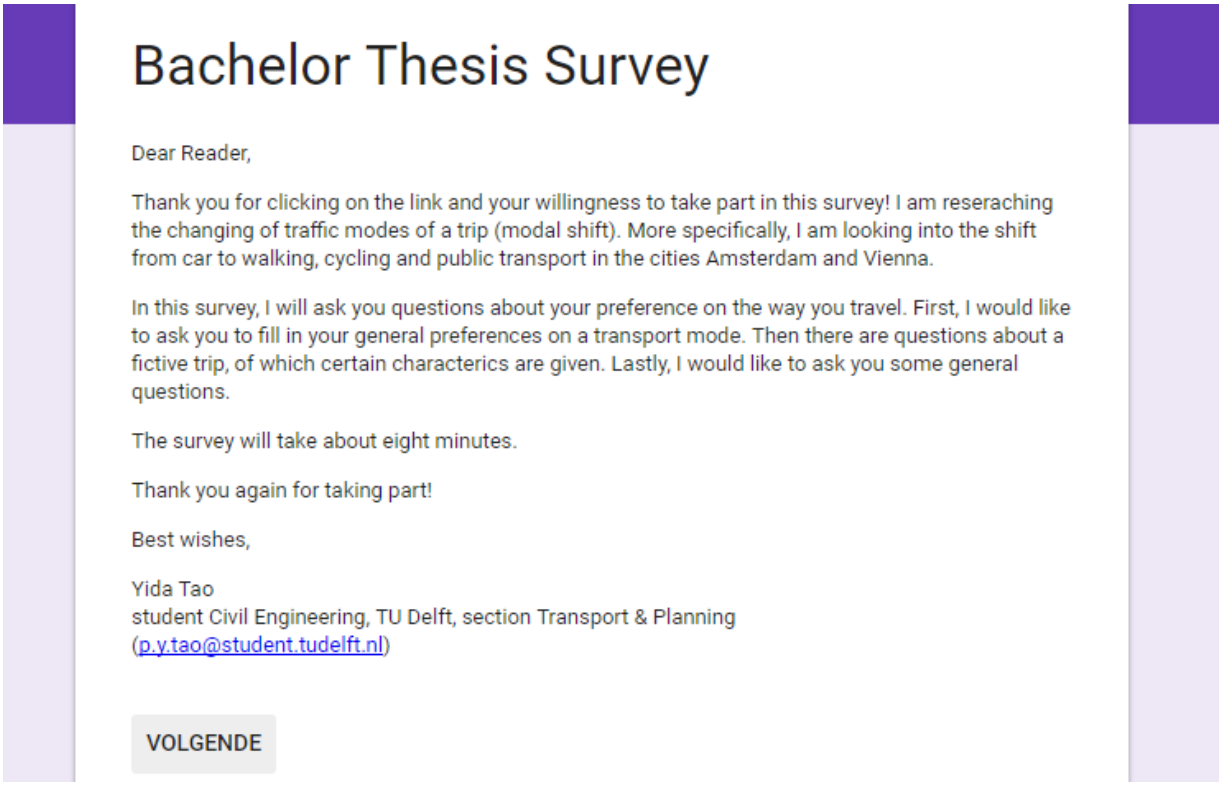

Figure 1: Introduction of survey

The section about general preferences consisted of the following parts:

- Introduction: Firstly, I would like to ask you some questions about general preferences. Please bear in mind that this preference is for trips which start and end in the same city.
- Questions: (the numbering of questions is consistent with the column name in the excel sheet; column A is no question, but a time stamp)
    - B: Which transport mode do you most prefer?
    - C: This is the transport mode I am currently using the most: (amount of trips)
    - D: At this moment, for a trip within your city, how often do you use the following transport mode on average in a week? [by foot]
    - E: At this moment, for a trip within your city, how often do you use the following transport mode on average in a week? [by bicycle]
    - F: At this moment, for a trip within your city, how often do you use the following transport mode on average in a week? [by public transport (tram, metro, bus)]
    - G: At this moment, for a trip within your city, how often do you use the following transport mode on average in a week? [by car]
- Answer options:
    - For questions B&C: by foot – bicycle - tram/bus/metro – car – train
    - For questions D, E&F: never - 1 day a week or less - 2 to 3 days a week - 4 to 5 days a week - 6 to 7 days a week

The following section was about a fictive situation: trip to city hall. The introduction contained a table, an image, and some text.

- Introduction (I): The following situation is given: Imagine you would like to go from home to the city hall. The trip is about 4 kilometres long. You can choose from the following options: going by foot, by bike, by public transport and by car. More detailed information is given in the table below.
  In this situation, it is assumed that you have all the means, such as accessibility to a car, driver's license (or a driver), a bike and a tram stop near your house. Also, the weather is good and there are plenty bicycle parking facilities. The appointment at the municipality takes about an hour.

Mode	Distance	Time	Variable costs	Other
By foot	3,5 km	44 minutes	None	Weather is good Width/comfort is normal Parking places for bicycles
Bicycle	4 km	20 minutes	None	
Public Transport	3,9 km	18 minutes (2 min walking, 4 waiting, 10 tram, 2 walking)	2,80 euros for return journey	Frequency of trams is six an hour (every 10 minutes)
Car	3,9 km	11 minutes (9 min driving, 2 walking)	1 euro fuel costs for return journey	Parking costs = 3 euros for an hour

Table 1: mode characteristics for fictive trip

Figure 2: width of cycle track

- Question H: Which transport mode has your first preference? Second? Third? [1st preference]
- Question I: Which transport mode has your first preference? Second? Third? [2nd preference]
- Question J: Which transport mode has your first preference? Second? Third? [3rd preference]
  - Answers options for questions H, I & J: by foot - by bicycle - by public transport (tram, metro, bus) - by car

- Introduction (II): Now, there are some changes in the situation, due to policies of the municipality. Each question will describe the measure and the mode it should affect. Since the city hall is in the city center, this imaginary trip with the above characteristics is a trip you often make.

  The questions are about a possible change in the way you travel, on a scale from 1 to 5, where:
  1: strong decrease
  2: slight decrease
  3: no change
  4: slight increase
  5: strong increase

- Question K: 1. If the parking fee increases from 3 to 4 euros an hour, would this affect your use of the car?
- Question L: 2. If the frequency of public transport increases (from every 10 minutes to every 5 minutes), so the total travel time is 16 minutes instead of 18 minutes, would this affect your use of public transport?
- Question M: 3. If the bicycle lanes are broadened, giving more comfort, would this affect your use of the bike? (see picture below)

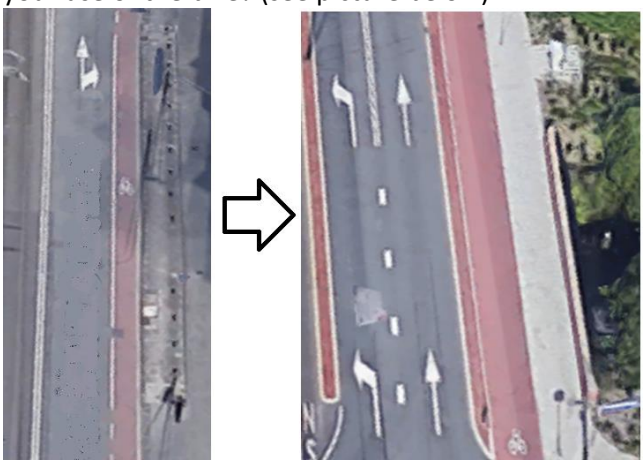

Figure 3: broadening of cycle lanes

- Question N: 4. If the parking lot near the city hall is full, leading to a total travel time (driving + walking) is 20 instead of 11 minutes, would this affect your use of the car?
- Question O: 5. If the price of a return ticket for public transport decreases from 2,80 to 1,90 euros, would this affect your use of the public transport services?
- Question P: 6. If the sidewalks are broadened, giving more comfort, would this affect your number of journeys by foot?
    - Answer options: 1 – 2 – 3 – 4 – 5

- Question Q: Which of the measures (changes) was the most important for you to change the way you would travel? [Most important]
- Question R: Which of the measures (changes) was the most important for you to change the way you would travel? [2nd important]
- Question S: Which of the measures (changes) was the most important for you to change the way you would travel? [3rd important]
    - Answer options: 1. increase of parking fee - 2. increase of frequency of public transport - 3. broadening of bicycle lanes - 4. increase of walking distance to parking spot - 5. decrease of price of a ticket for public transport - 6. broadening of sidewalks

The last section contained general questions.

- Introduction: This section contains of nine questions and is the end of the survey. Thank you again for taking part!
  P.S. please do not forget to click submit at the end of the form.
- Question T: What is your age?
    - Answer options: 16 – 17- 18 - … - 58 – 59 - 60+
- Question U: What is your gender?
    - Answer options: Female – Male
- Question V: Where do you live? (Country, City)
    - Answer options: Austria, Vienna - Austria, not in Vienna - Netherlands, Amsterdam - Netherlands, not in Amsterdam - Other country

- Question W: What is your estimated total household (bruto/before taxes) income is on average per month?
    - Answer options: less than 2500 euro / 2500-3000 euro/ 3000-5500 euro / more than 5500 euro / Prefer not to say
- Question X: What is your education level?
    - Answer options: Currently studying at university or hbo/Hochschule
      Finished primary education, some secondary education - NED: basisonderwijs, vmbo, mbo1, havo onderbouw, AUT: Volksschule, AHS-Unterstufe, neue Mittelschule, Hauptschule
      Finished secondary education, further education - NED: havo, vwo, mbo2, 3, en 4; AUT: AHS-Oberstufe, BHS, BMS, PTS, Lehre
      Finished higher education - NED: hbo of wo bachelor of master, doctor; AUT: Bachelor oder Master an einer Fachhochschule, Pedagogische Hochschule oder einer Universität, Doktorat
- Question Y: Do you own a bike?
    - Answer options: Yes – No
- Question Z: Do you have a driver's license?
    - Answer options: Yes – No
- Question AA: Do you own a car?
    - Answer options: Yes – No
- Question AB: Do you have a subscription on public transport services? (for example: Studenten-OV, Jahreskarte, Semesterkarte)
    - Answer options: Yes – No

Elaboration on and explanation of survey questions

Part 0. Introduction

Part 1. General preferences

Part 2. Fictive situation: trip to city hall

The changes in price for parking fee and return ticket for public transport are about 30% of the original price, which was 3 to 4 euros and 2,80 to 1,90 respectively. The change of 30% was chosen, because it was also used as measure in the paper of Pascal de Beer, Tiemersma, Van der Ploeg (2011) on a research regarding elasticities in public transport.

Part 3. General questions

The questions regarding income and education level have the same answer options as the graph from the document of OIS Amsterdam of 2015. They have split the income into four categories and education level into three. The education levels were split into ‘hoog opgeleid, midden en laag opgeleid’. According to CBS (s.d.) the definitions are:

- ‘Laag: basisonderwijs, vmbo, mbo1, havo onderbouw.
- Middelbaar: havo, vwo, mbo2, 3, en 4.
- Hoog: hbo bachelor, hbo master, wo bachelor, wo master, doctor.’ (CBS, n.d.)

I retrieved the similar education levels from Austria from Ausbildungskompass (n.d.).

Rough outcomes survey - General Questions:

Questions regarding Age, Gender, Residence, Income, Education, Bike ownership, Driver's license, Car Ownership, Public Transport Subscription

The first descriptive is age. The youngest respondent was 16, the oldest 53 years old. The mean was calculated using Microsoft Excel. Also, the characteristics of a boxplot are included in Table 1. In Table 2, the gender is listed. There were more female than male respondents. Also, the residence is shown in Table 3. There were three big groups, consisting more than 30 people: Austria, Vienna; Netherlands, not in Amsterdam and Netherlands, Amsterdam. In Table 4, the answers are listed from the question regarding the monthly household income, before taxes. In all groups based on residence, the biggest group earned less than 2500 euros per month. Table 5 is about the education level. Here, the biggest group reported to be currently studying at a higher education instance. Lastly, Table 7 to 10 give the responses to bike ownership, having a driver's license, car ownership and having a public transport subscription. From this numbers, the percentages were calculated and can be found in the Results & Analysis of the main report.

	Total	*Vienna*	*Amsterdam*	*Netherlands, not in Amsterdam*
mean	22,63157895	22,85714286	20,36842105	25,08571429
upper	28	28	24	25
1st quarter	23,25	24	21,25	24
2nd quarter	21	22	20	21
3rd quarter	20	21	19	20
lower	16	17	18	16

Table 2: Question T - Age analysis, characteristics of the boxplots

Age	*total*	*Austria, Vienna*	*Austria, not in Vienna*	*Netherlands, Amsterdam*	*Netherlands, not in Amsterdam*	*Other country*
Female	62	16	2	29	14	1
Male	53	19	2	9	21	2

Table 3: Question U – Gender

Residence	
Austria, Vienna	35
Austria, not in Vienna	4
Netherlands, Amsterdam	38
Netherlands, not in Amsterdam	35
Other country	3
Total	115

Table 4: Question V – Residence

Income per month	total	Austria, Vienna	Austria, not in Vienna	Netherlands, Amsterdam	Netherlands, not in Amsterdam	Other country
less than 2500 euro	84	26	3	31	21	3
2500-3000 euro	4	2	0	2	0	0
3000-5500 euro	6	1	0	2	3	0
more than 5500 euro	8	3	1	2	2	0
Prefer not to say	13	3	0	1	9	0
total	115	35	4	38	35	3

Table 5: Question W - Household income before taxes

Education level	total	Austria, Vienna	Austria, not in Vienna	Netherlands, Amsterdam	Netherlands, not in Amsterdam	Other country
Currently studying	86	23	2	35	23	3
Finished primary education	1	0	0	0	1	0
Finished secondary education	7	1	1	3	2	0
Finished higher education	21	11	1	0	9	0
total	115	35	3	38	35	3

Table 6: Question X - Education level

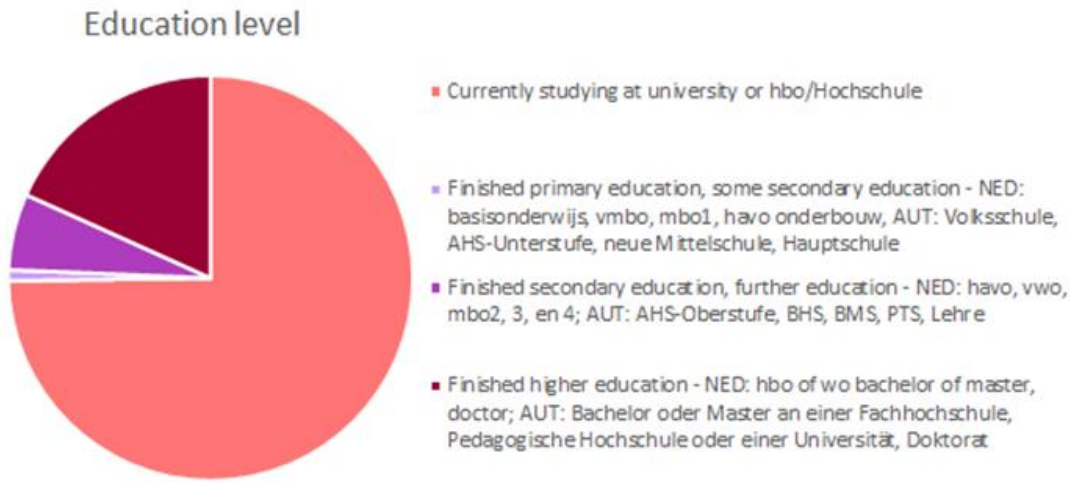

Figure 4: Division of education level of the sample size

bike	total	Austria, Vienna	Austria, not in Vienna	Netherlands, Amsterdam	Netherlands, not in Amsterdam	Other country
Yes	96	19	3	38	33	3
No	19	16	1	0	2	0
total	115	35	4	38	35	3

Table 7: Question Y – Bike ownership

driver's license	total	Austria, Vienna	Austria, not in Vienna	Netherlands, Amsterdam	Netherlands, not in Amsterdam	Other country
Yes	81	27	3	26	23	2
No	34	8	1	12	12	1
total	115	35	4	38	35	3

Table 8: Question Z – driver's license

car	total	Austria, Vienna	Austria, not in Vienna	Netherlands, Amsterdam	Netherlands, not in Amsterdam	Other country
Yes	13	4	1	2	5	1
No	102	31	3	36	30	2
total	115	35	4	38	35	3

Table 9: Question AA – Car ownership

PT subscription	total	Austria, Vienna	Austria, not in Vienna	Netherlands, Amsterdam	Netherlands, not in Amsterdam	Other country
Yes	91	34	2	26	28	1
No	24	1	2	12	7	2
total	115	35	4	38	35	3

Table 10: Question AB – Public transport subscription

Rough outcomes survey - Questions regarding measures (Likert)

There were six measures asked. In the table below, an overview is given what the questions were exactly. To every question, the answer options were on a Likert scale from 1 to 5 varying from strong decrease to strong increase. All the answers are shown in the Figure below.

Measure no.	*Question no.*	*Question*
1	K	1. If the parking fee increases from 3 to 4 euros an hour, would this affect your use of the car?
2	L	2. If the frequency of public transport increases (from every 10 minutes to every 5 minutes), so the total travel time is 16 minutes instead of 18 minutes, would this affect your use of public transport?
3	M	3. If the bicycle lanes are broadened, giving more comfort, would this affect your use of the bike? (see picture below)
4	N	4. If the parking lot near the city hall is full, leading to a total travel time (driving+walking) is 20 instead of 11 minutes, would this affect your use of the car?
5	O	5. If the price of a return ticket for public transport decreases from 2,80 to 1,90 euros, would this affect your use of the public transport services?
6	P	6. If the sidewalks are broadened, giving more comfort, would this affect your number of journeys by foot?

Table 11: Overview of measure numbers and questions in the survey

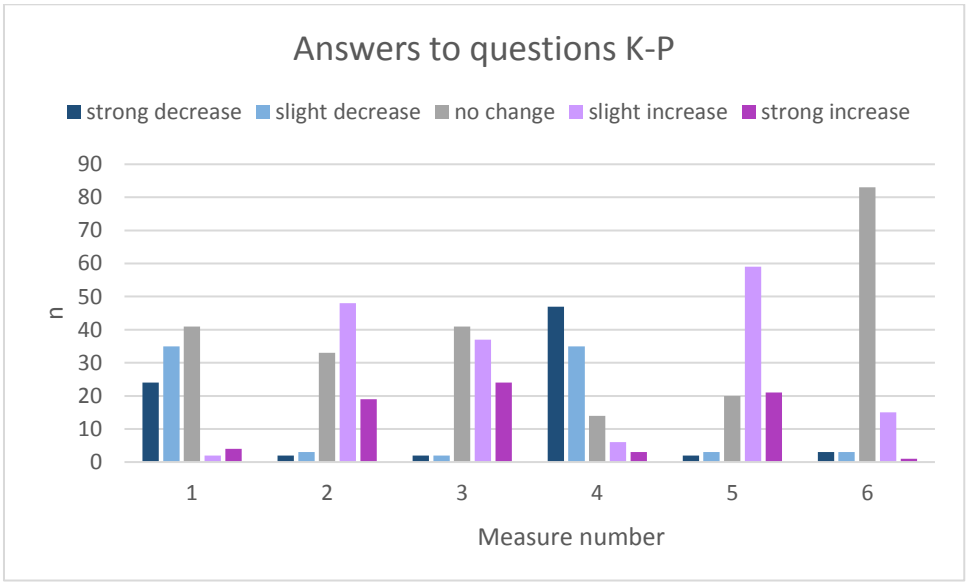

Figure 5: Reaction to measures

Relation Residence - Measures

Here, the relation between the residence and the reaction to the measures is investigated. In the tables, the measures are numbered from 1 to 6. The groups based on residence were Amsterdam (38 respondents), Netherlands, not Amsterdam (35) and Vienna, Austria (35), giving a total of 108. This is a nominal variable.

The answer options were on a Likert scale, thus the variable here is ordinal. Since the questions describe a measure in a certain direction (positive or negative for a certain mode), the answers could

also be expected to be in a certain direction. However, a small number (max. 8) of answers was in the opposite direction and some respondents (1 or less per question) left the answer blank. These people were put together into a group 'other or missing value' since the group 'population' per question was relatively small (not larger than 9 people). For the significance tests, this was done to make calculations easier. This adjustment could cause bias, because this is a simplification of the actual data.

The most common test between a nominal and ordinal variable is the chi-squared test. However, the chi-squared test was not applicable, because of in each test more than 20% of the expected values is less than 5 (Clinical Research Unit, n.d.). The significance was determined by doing the Fisher's exact test. The confidence level is chosen to be 95%, the most common value, leaving the alfa-value to be 0,05 (or 5%). When the outcome of the exact significance 2-sided is the same as or lower than this value, the outcome is significant. The outcomes of the Fisher's exact test are listed in the table below.

Measure no.	*Exact significance 2-sided (Fisher's exact test)*	
1	0,635	(63,5%)
2	0,031	(3,1%)
3	0,003	(0,3%)
4	0,090	(9,0%)
5	0,072	(7,2%)
6	0,252	(25,2%)

Table 12: Exact significant of each measure

The conclusion is that with the chosen confidence level of 95%, the difference in responding to a measure between the groups based on residence was significant for measures 2 and 3.

Measure 2 contained an increase of the frequency of public transport. Following from the bar chart, people from Amsterdam showed less willingness to increase their trips with public transport. The mode of people in Amsterdam was 'no change', whereas for other groups it was 'slight increase'.

Measure 3 was the broadening of bicycle lanes. Here the total mode was 'no change'. However, the mode for Vienna was 'strong increase', and for Netherlands not Amsterdam it was 'slight increase'.

For an analysis, please see the main report, chapter 4 Results & Analysis. For bar charts, crosstabulations and the chi-squared test & Fisher's exact test, please see the tables and figures on the following pages.

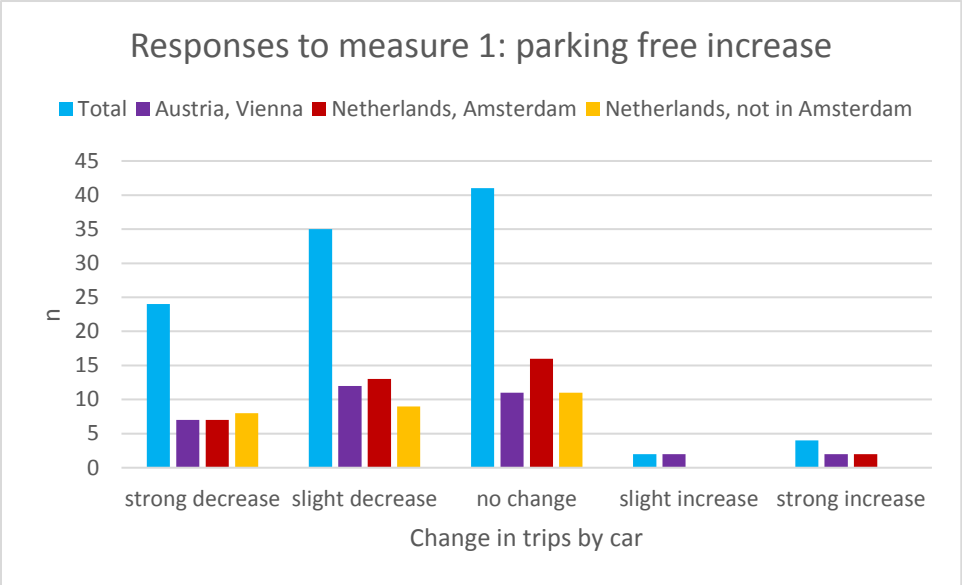

Figure 6: Response to measure 1

Residence * Measure1 Crosstabulation

			Measure1				
			strong decrease	slight decrease	no change	other or missing value	Total
Residence	Amsterdam	Count	7	13	16	2	38
		Expected Count	7,7	13,4	14,8	2,1	38,0
	Netherlands	Count	8	13	14	0	35
		Expected Count	7,1	12,3	13,6	1,9	35,0
	Vienna	Count	7	12	12	4	35
		Expected Count	7,1	12,3	13,6	1,9	35,0
Total		Count	22	38	42	6	108
		Expected Count	22,0	38,0	42,0	6,0	108,0

Table 13: Crosstabulation of residence vs. measure 1

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	4,662[a]	6	,588	,607
Likelihood Ratio	6,096	6	,413	,481
Fisher's Exact Test	4,451			,635
N of Valid Cases	108			

a. 3 cells (25,0%) have expected count less than 5. The minimum expected count is 1,94.

Table 14: Chi-square test & Fisher's exact test of residence vs. measure 1

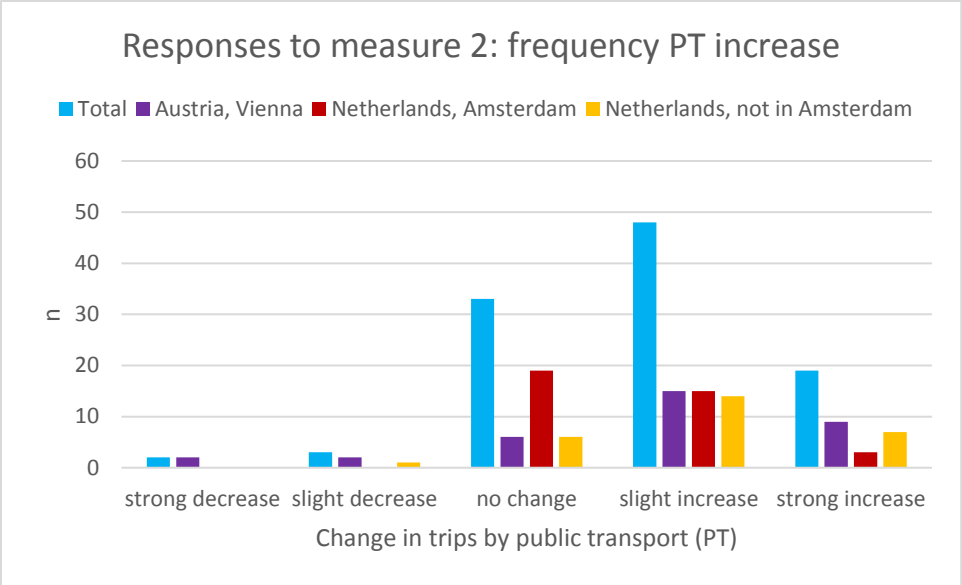

Figure 7: Response to measure 2

Residence * Measure2 Crosstabulation

			Measure2				
			no change	slight increase	strong increase	other or missing value	Total
Residence	Amsterdam	Count	19	15	3	1	38
		Expected Count	11,6	16,9	7,0	2,5	38,0
	Netherlands	Count	8	17	8	2	35
		Expected Count	10,7	15,6	6,5	2,3	35,0
	Vienna	Count	6	16	9	4	35
		Expected Count	10,7	15,6	6,5	2,3	35,0
Total		Count	33	48	20	7	108
		Expected Count	33,0	48,0	20,0	7,0	108,0

Table 15: Crosstabulation of residence vs. measure 2

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	13,672[a]	6	,034	,031
Likelihood Ratio	13,888	6	,031	,044
Fisher's Exact Test	13,154			,031
N of Valid Cases	108			

a. 3 cells (25,0%) have expected count less than 5. The minimum expected count is 2,27.

Table 16: Chi-square test & Fisher's exact test of residence vs. measure 2

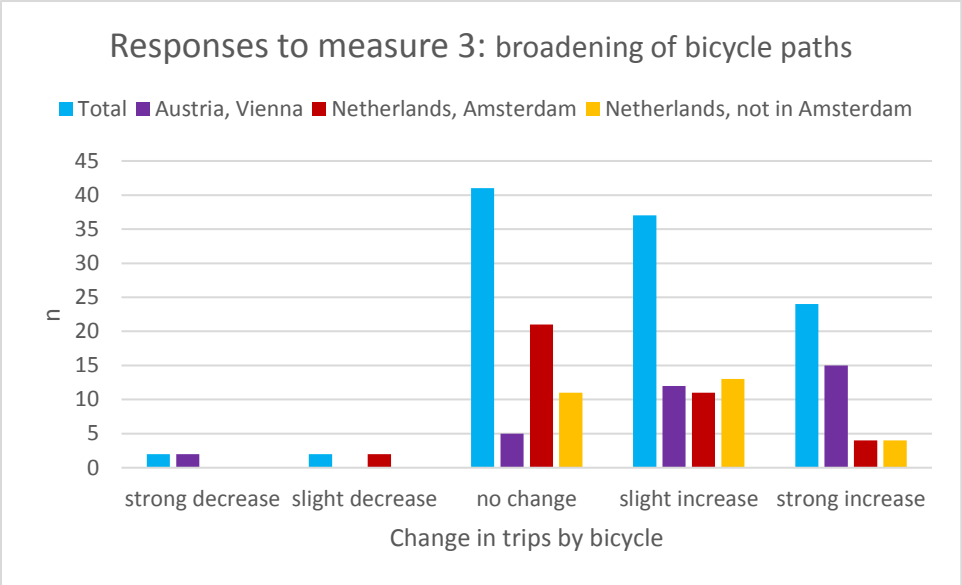

Figure 8: Response to measure 3

Residence * Measure3 Crosstabulation

			Measure3				
			no change	slight increase	strong increase	other or missing value	Total
Residence	Amsterdam	Count	21	11	4	2	38
		Expected Count	14,4	13,4	8,1	2,1	38,0
	Netherlands	Count	14	15	4	2	35
		Expected Count	13,3	12,3	7,5	1,9	35,0
	Vienna	Count	6	12	15	2	35
		Expected Count	13,3	12,3	7,5	1,9	35,0
Total		Count	41	38	23	6	108
		Expected Count	41,0	38,0	23,0	6,0	108,0

Table 17: Crosstabulation of residence vs. measure 3

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	19,363[a]	6	,004	,003
Likelihood Ratio	19,069	6	,004	,006
Fisher's Exact Test	18,427			,003
N of Valid Cases	108			

a. 3 cells (25,0%) have expected count less than 5. The minimum expected count is 1,94.

Table 18: Chi-square test & Fisher's exact test of residence vs. measure 3

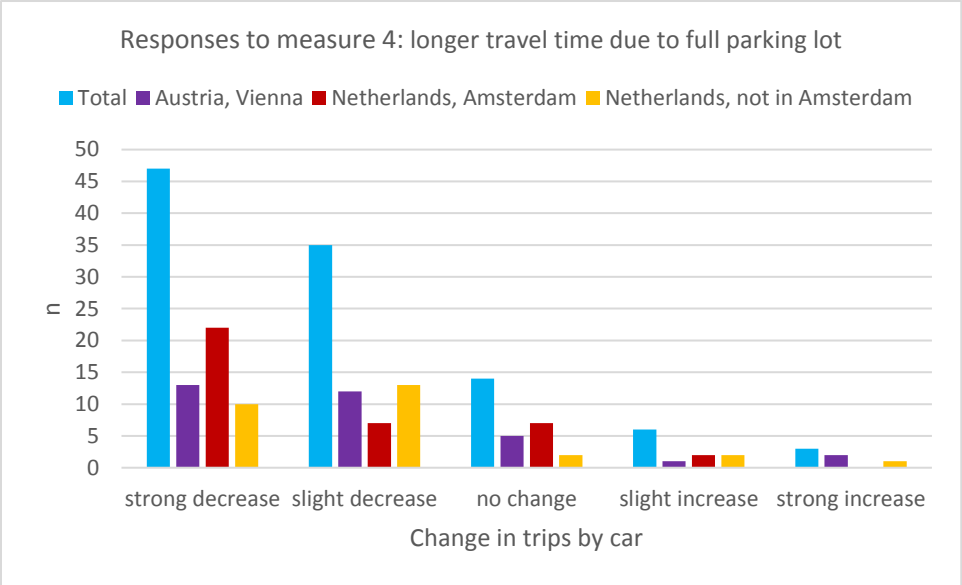

Figure 9: Response to measure 4

Residence * Measure4 Crosstabulation

			Measure4				
			strong decrease	slight decrease	no change	other or missing value	Total
Residence	Amsterdam	Count	22	7	7	2	38
		Expected Count	16,9	13,0	4,9	3,2	38,0
	Netherlands	Count	13	17	2	3	35
		Expected Count	15,6	12,0	4,5	2,9	35,0
	Vienna	Count	13	13	5	4	35
		Expected Count	15,6	12,0	4,5	2,9	35,0
Total		Count	48	37	14	9	108
		Expected Count	48,0	37,0	14,0	9,0	108,0

Table 19: Crosstabulation of residence vs. measure 4

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	10,520[a]	6	,104	,103
Likelihood Ratio	11,056	6	,087	,115
Fisher's Exact Test	10,633			,090
N of Valid Cases	108			

a. 6 cells (50,0%) have expected count less than 5. The minimum expected count is 2,92.

Table 20: Chi-square test & Fisher's exact test of residence vs. measure 4

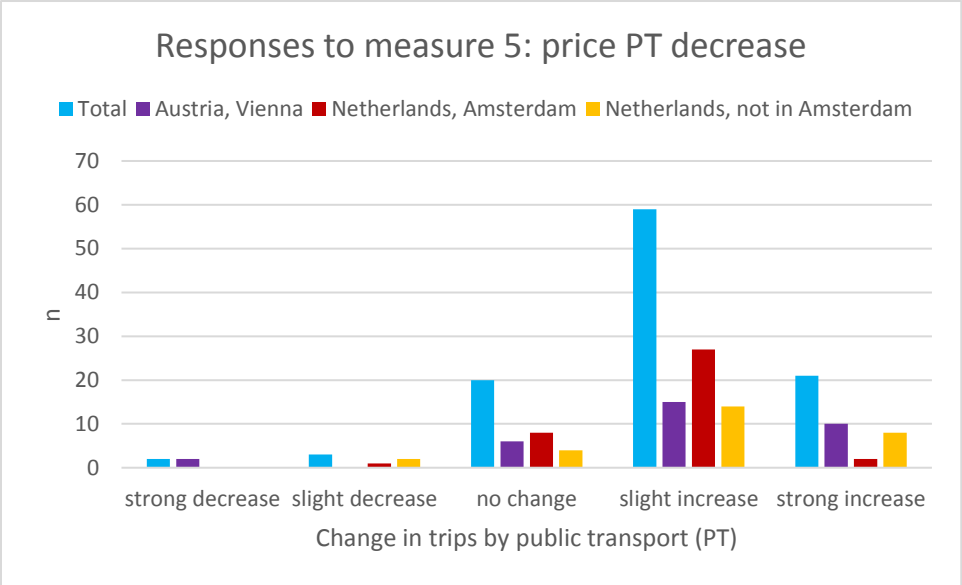

Figure 10: Response to measure 5

Residence * Measure5 Crosstabulation

			Measure5				
			no change	slight increase	strong increase	other or missing value	Total
Residence	Amsterdam	Count	8	27	2	1	38
		Expected Count	7,0	21,1	7,4	2,5	38,0
	Netherlands	Count	6	17	9	3	35
		Expected Count	6,5	19,4	6,8	2,3	35,0
	Vienna	Count	6	16	10	3	35
		Expected Count	6,5	19,4	6,8	2,3	35,0
Total		Count	20	60	21	7	108
		Expected Count	20,0	60,0	21,0	7,0	108,0

Table 21: Crosstabulation of residence vs. measure 5

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	10,241[a]	6	,115	,113
Likelihood Ratio	11,730	6	,068	,095
Fisher's Exact Test	11,074			,072
N of Valid Cases	108			

a. 3 cells (25,0%) have expected count less than 5. The minimum expected count is 2,27.

Table 22: Chi-square test & Fisher's exact test of residence vs. measure 5

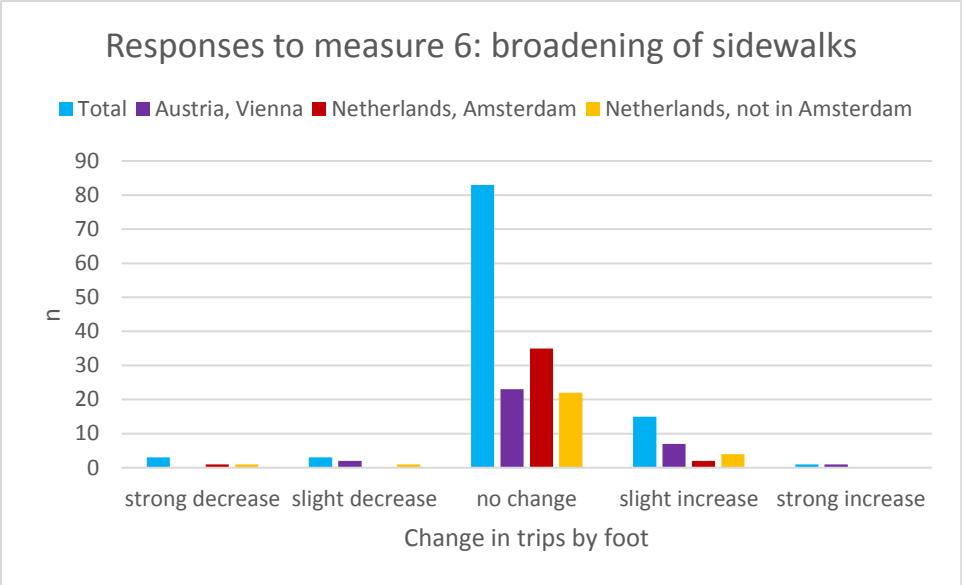

Figure 11: Response to measure 6

Residence * Measure6 Crosstabulation

			Measure6				
			no change	slight increase	strong increase	other or missing value	Total
Residence	Amsterdam	Count	35	2	0	1	38
		Expected Count	30,3	4,9	,7	2,1	38,0
	Netherlands	Count	27	5	1	2	35
		Expected Count	27,9	4,5	,6	1,9	35,0
	Vienna	Count	24	7	1	3	35
		Expected Count	27,9	4,5	,6	1,9	35,0
Total		Count	86	14	2	6	108
		Expected Count	86,0	14,0	2,0	6,0	108,0

Table 23: Crosstabulation of residence vs. measure 6

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	6,675[a]	6	,352	,368
Likelihood Ratio	7,690	6	,262	,372
Fisher's Exact Test	7,025			,252
N of Valid Cases	108			

a. 9 cells (75,0%) have expected count less than 5. The minimum expected count is ,65.

Table 24: Chi-square test & Fisher's exact test of residence vs. measure 6

Rough outcomes survey - Questions regarding most important measure

In the survey, questions were asked about the top three measures the respondent considered most important for changing his or her traffic mode. Firstly, the connection between the 'considered most important measure' and residence was investigated. Here, the conclusion was that the 1st important measure had a significant difference between the residences and the 2nd did not. Further on, the relation between only the 1st important measure and the household income, gender, bike ownership, driver's license, car ownership, and public transport subscription is researched. The significance between these nominal variables is determined with the Fisher's exact test.

The exact significance is listed in the table below. Again, the level of confidence is chosen at 95%, which means there is a maximum of 5% chance that this outcome was by accident. Following from this confidence level, two relations were proven significant.

Relation	*Exact significance 2-sided (Fisher's exact test)*	
1st important measure vs. residence	0,000	(0%)
2nd important measure vs. residence	0,995	(99,5%)
1st important measure vs. household income	0,374	(37,4%)
1st important measure vs. gender	0,248	(24,8%)
1st important measure vs. bike ownership	0,499	(49,9%)
1st important measure vs. driver's license	0,348	(34,8%)
1st important measure vs. car ownership	0,254	(25,4%)
1st important measure vs. public transport subscription	0,010	(1,0%)

Table 25: Exact significance of some relations regarding important measures

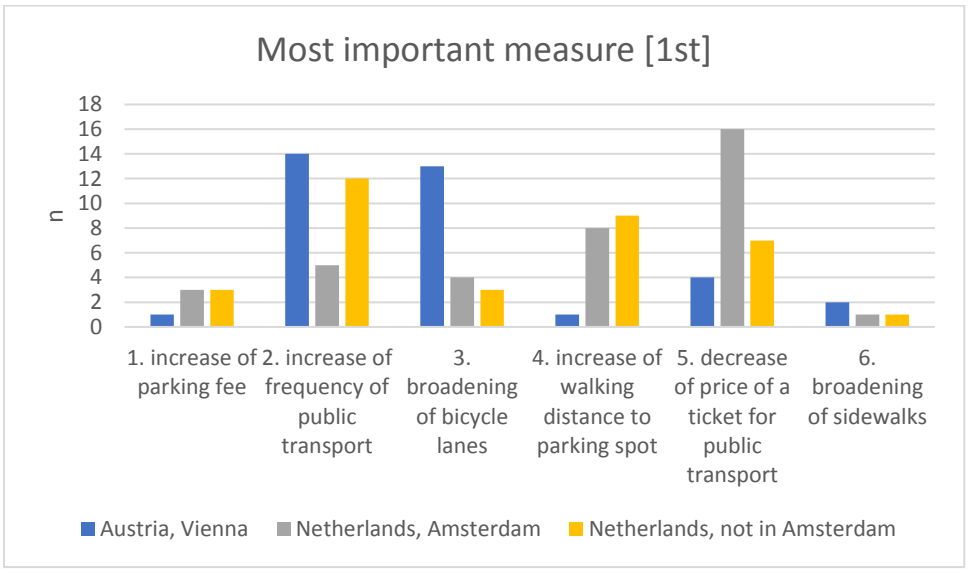

Figure 12: Most important measure [1st preference]

Residence * Importance1 Crosstabulation

Count

		Importance1						
		1	2	3	4	5	6	Total
Residence	Amsterdam	1	3	5	4	8	16	1	38
	Netherlands	0	3	12	3	9	7	1	35
	Vienna	0	1	14	13	1	4	2	35
Total		1	7	31	20	18	27	4	108

Table 26: Crosstabulation of residence vs. important measure [1st]

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	31,882[a]	12	,001	.[b]
Likelihood Ratio	33,866	12	,001	,001
Fisher's Exact Test	31,507			,000
N of Valid Cases	108			

a. 9 cells (42,9%) have expected count less than 5. The minimum expected count is ,32.

b. Cannot be computed because there is insufficient memory.

Table 27: Chi-square test & Fisher's exact test of residence vs. important measure [1st]

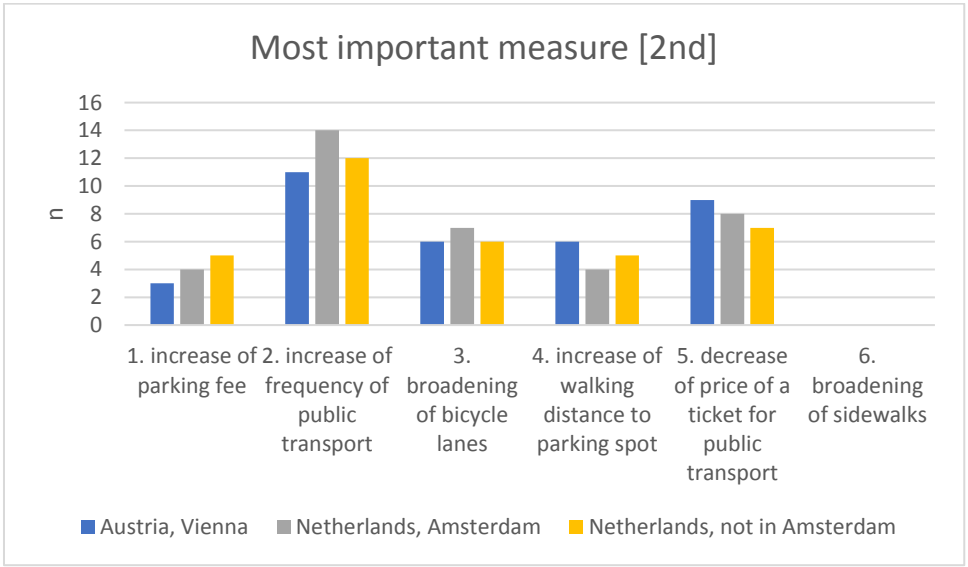

Figure 13: Most important measure [2nd preference]

Residence * Importance2 Crosstabulation

Count

		Importance2						
			1	2	3	4	5	Total
Residence	Amsterdam	1	4	14	7	4	8	38
	Netherlands	0	5	12	6	5	7	35
	Vienna	0	3	11	6	6	9	35
Total		1	12	37	19	15	24	108

Table 28: Crosstabulation of residence vs. important measure [2nd]

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	3,427[a]	10	,970	,995
Likelihood Ratio	3,669	10	,961	,995
Fisher's Exact Test	3,517			,995
N of Valid Cases	108			

a. 8 cells (44,4%) have expected count less than 5. The minimum expected count is ,32.

Table 28: Chi-square test & Fisher's exact test of residence vs. important measure [2nd]

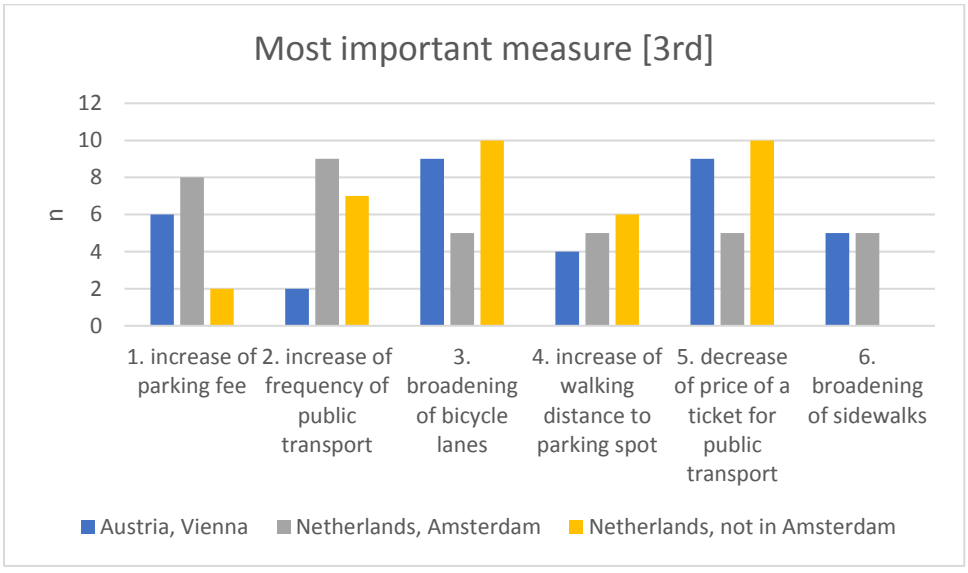

Figure 14: Most important measure [3rd preference]

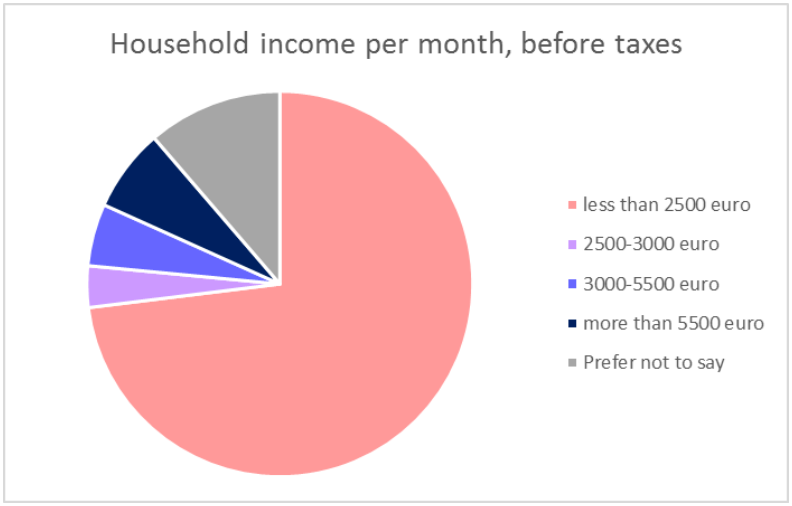

Figure 15: Pie chart of reported incomes by respondents

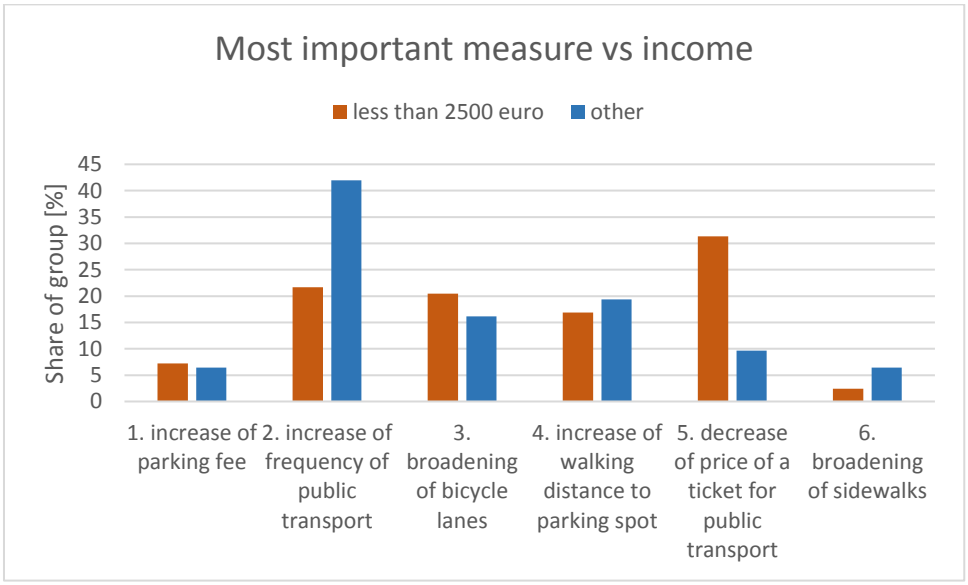

Figure 16: Most important measure vs income

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	21,371[a]	24	,617	.[b]
Likelihood Ratio	24,382	24	,440	.[b]
Fisher's Exact Test	24,933			,374
N of Valid Cases	115			

a. 30 cells (85,7%) have expected count less than 5. The minimum expected count is ,03.

b. Cannot be computed because there is insufficient memory.

Table 29: Chi-square test & Fisher's exact test of income vs. important measure [1st]

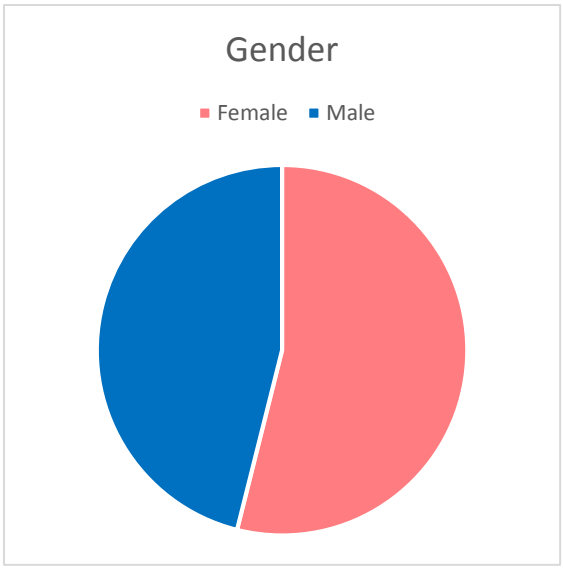

Figure 17: Pie chart of respondents' gender

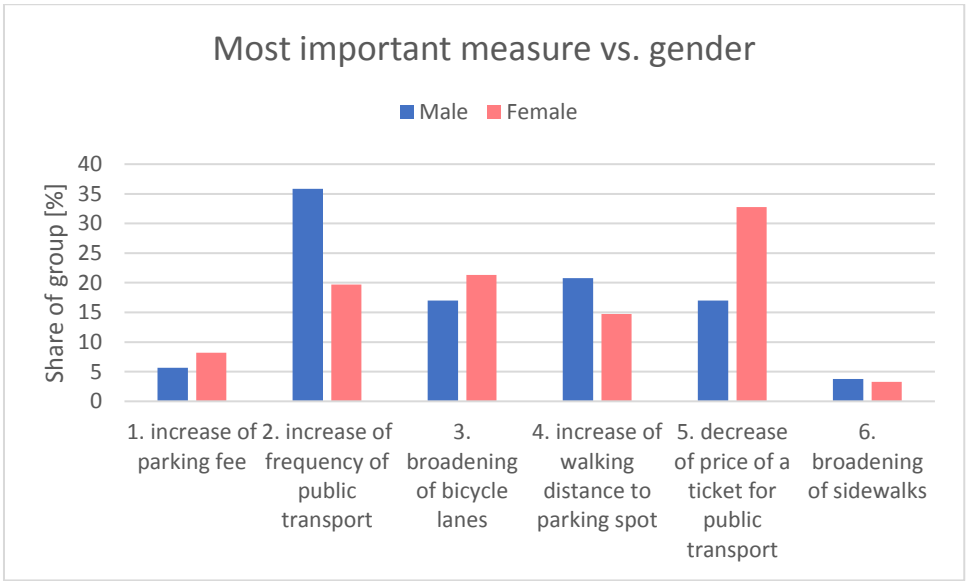

Figure 18: most important measure vs. gender

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	7,522[a]	6	,275	,268
Likelihood Ratio	7,991	6	,239	,305
Fisher's Exact Test	7,542			,248
N of Valid Cases	115			

a. 6 cells (42,9%) have expected count less than 5. The minimum expected count is ,46.

Table 30: Chi-square test & Fisher's exact test of gender vs. important measure [1st]

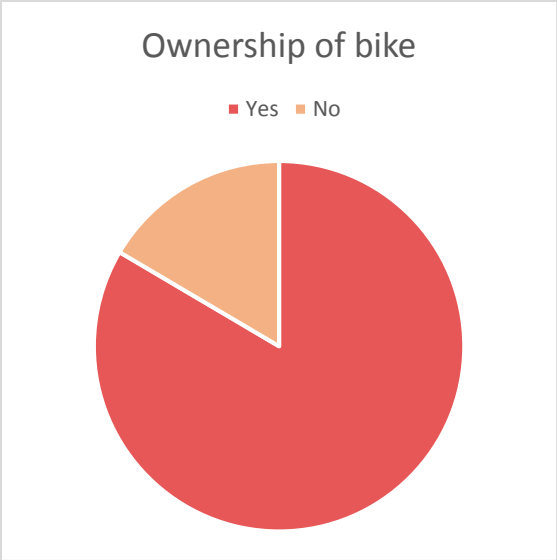

Figure 19: Pie chart of respondents' ownership of bike

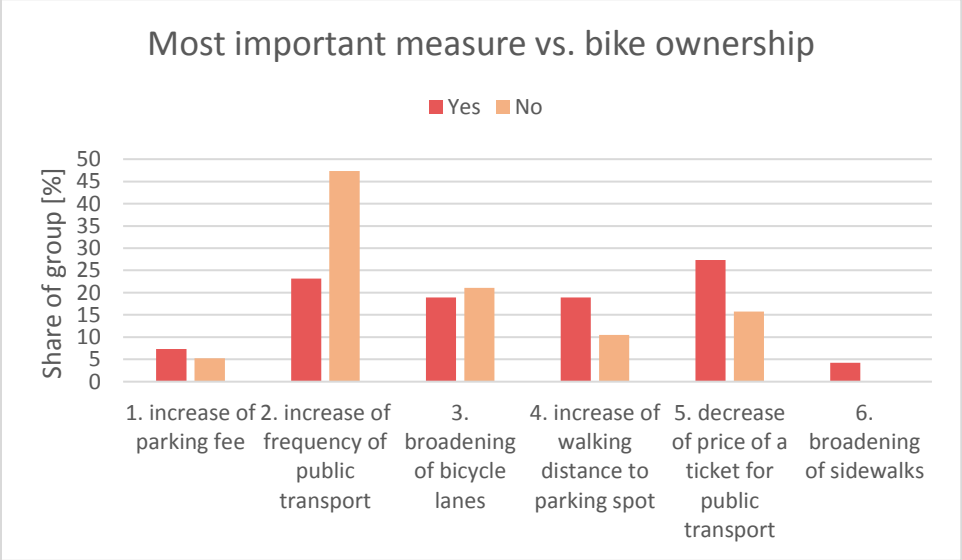

Figure 20: most important measure vs. bike ownership

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	6,064[a]	6	,416	,428
Likelihood Ratio	6,555	6	,364	,425
Fisher's Exact Test	5,237			,499
N of Valid Cases	115			

a. 8 cells (57,1%) have expected count less than 5. The minimum expected count is ,17.

Table 31: Chi-square test & Fisher's exact test of bike ownership vs. important measure [1st]

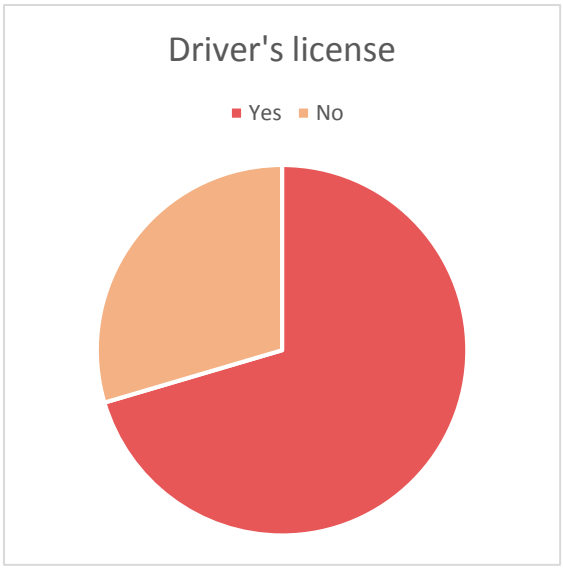

Figure 21: Pie chart of respondents' ownership of driver's licence

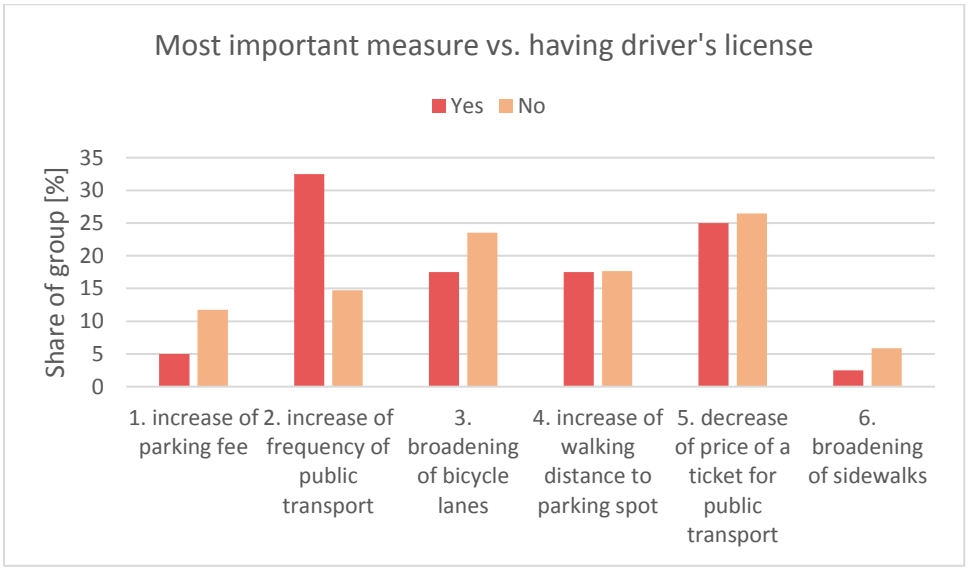

Figure 22: most important measure vs. ownership of driver's license

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	6,034[a]	6	,419	,434
Likelihood Ratio	6,414	6	,378	,462
Fisher's Exact Test	6,513			,348
N of Valid Cases	115			

a. 5 cells (35,7%) have expected count less than 5. The minimum expected count is ,30.

Table 32: Chi-square test & Fisher's exact test of ownership of driver's license vs. important measure [1st]

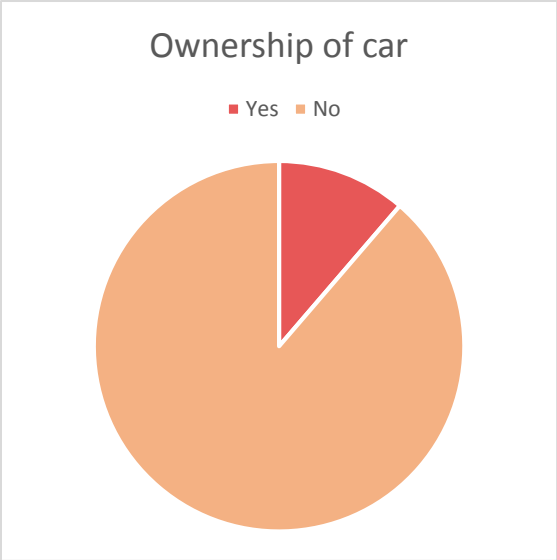

Figure 23: Pie chart of respondents' ownership of car

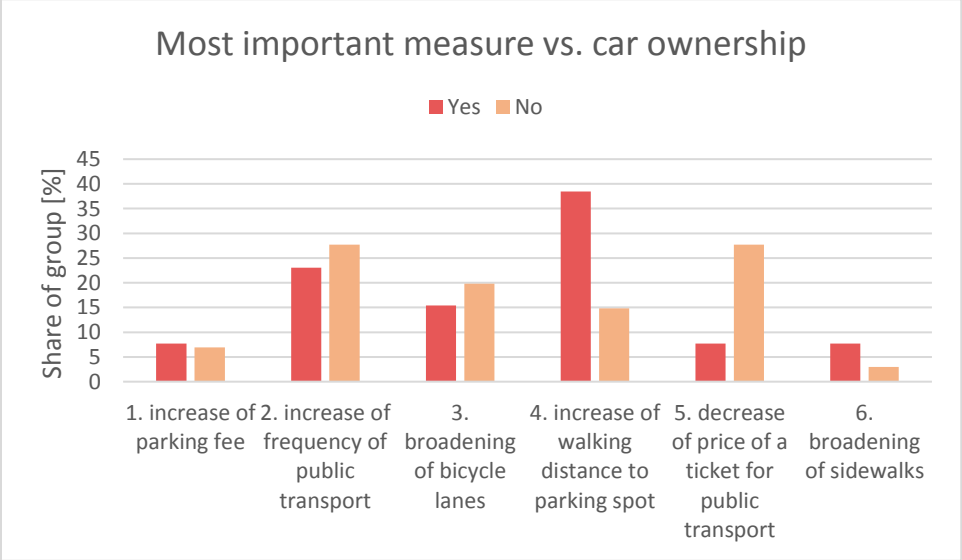

Figure 24: most important measure vs. car ownership

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	6,603[a]	6	,359	,346
Likelihood Ratio	6,315	6	,389	,424
Fisher's Exact Test	7,349			,254
N of Valid Cases	115			

a. 9 cells (64,3%) have expected count less than 5. The minimum expected count is ,11.

Table 33: Chi-square test & Fisher's exact test of bike ownership vs. important measure [1st]

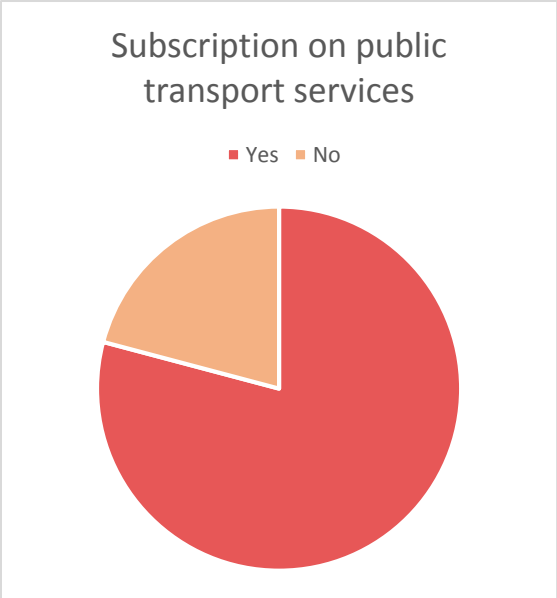

Figure 25: Pie chart of respondents' ownership of a subscription on public transport services

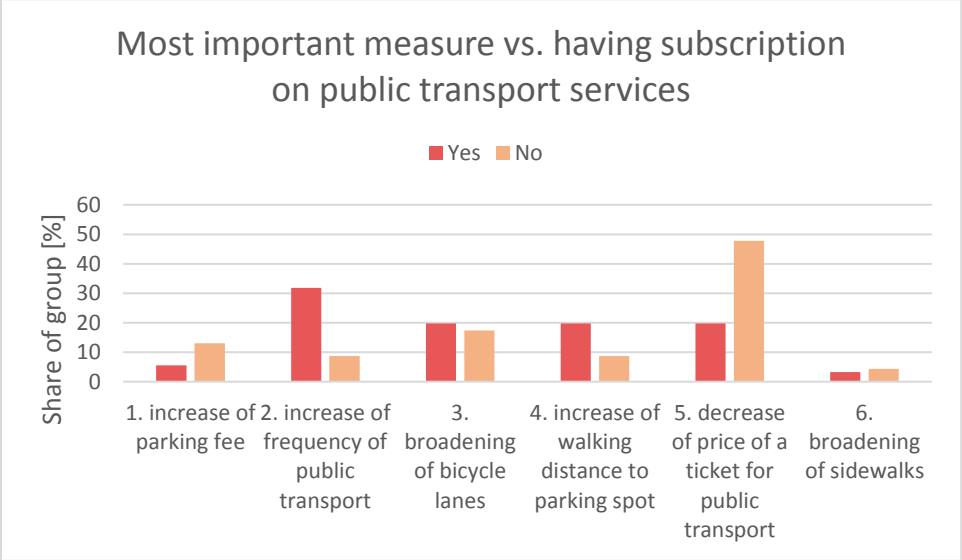

Figure 26: Most important measure vs. ownership of a subscription on public transport services

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	15,714[a]	6	,015	,013
Likelihood Ratio	15,535	6	,016	,019
Fisher's Exact Test	15,076			,010
N of Valid Cases	115			

a. 7 cells (50,0%) have expected count less than 5. The minimum expected count is ,21.

Table 33: Chi-square test & Fisher's exact test of ownership of public transport services vs. important measure [1st]

References

Clinical Research Unit. (n.d.). Betrouwbaarheidsinterval. Retrieved on 7 July 2017 from: https://wikistatistiek.amc.nl/index.php/Betrouwbaarheidsinterval

De Beer, P., Tiemersma, D., Van der Ploeg, R. (2011). Modal split onder druk? Gevolgen bezuinigingen openbaar vervoer in Amsterdam. Bijdrage aan het Colloquium Vervoersplanologisch Speurwerk 2011 24 en 25 november, Antwerpen. Retrieved from: http://www.cvs-congres.nl/cvspdfdocs/cvs11_047.pdf

OIS Amsterdam (2015). 6 Mobiliteit en Verkeer. Retrieved from: https://www.ois.amsterdam.nl/pdf/2015_svds_h06.pdf

CBS (n.d.). Opleidingsniveau. Retrieved on 22 May 2017 from: https://www.cbs.nl/nl-nl/artikelen/nieuws/2008/16/bijna-evenveel-hoogopgeleide-als-laagopgeleide-nederlanders/opleidingsniveau

Ausbildungskompass (n.d.). Bildungssystem. Retrieved on 22 May 2017 from: https://www.ausbildungskompass.at/

Appendix D: Supplementary maps of Vienna and Amsterdam

In this appendix, some figures are given as background material. The figures are numbered in the order of appearance in the main report.

The first figure suggest a connection between the cycling numbers and the weather conditions, of which the precipation (Niederschlag) and temperature (Temperatur) are indicated. Figure 2 and 3 show the expansion of the network of public transport and cars. In Figure 4, one can see that the parking fees have raised in Amsterdam, besides more tariffs were introduced. Figure 5 shows the development of the sales in annual public transportation in Vienna, the big increase from year 2011 to 2012 is of particular interest. Lastly, a modal split subdivision for Amsterdam is shown in Figure 6.

Fig. 6: Annual chart of cycle traffic at the Burgring permanent measuring point, June 2002 to June 2003

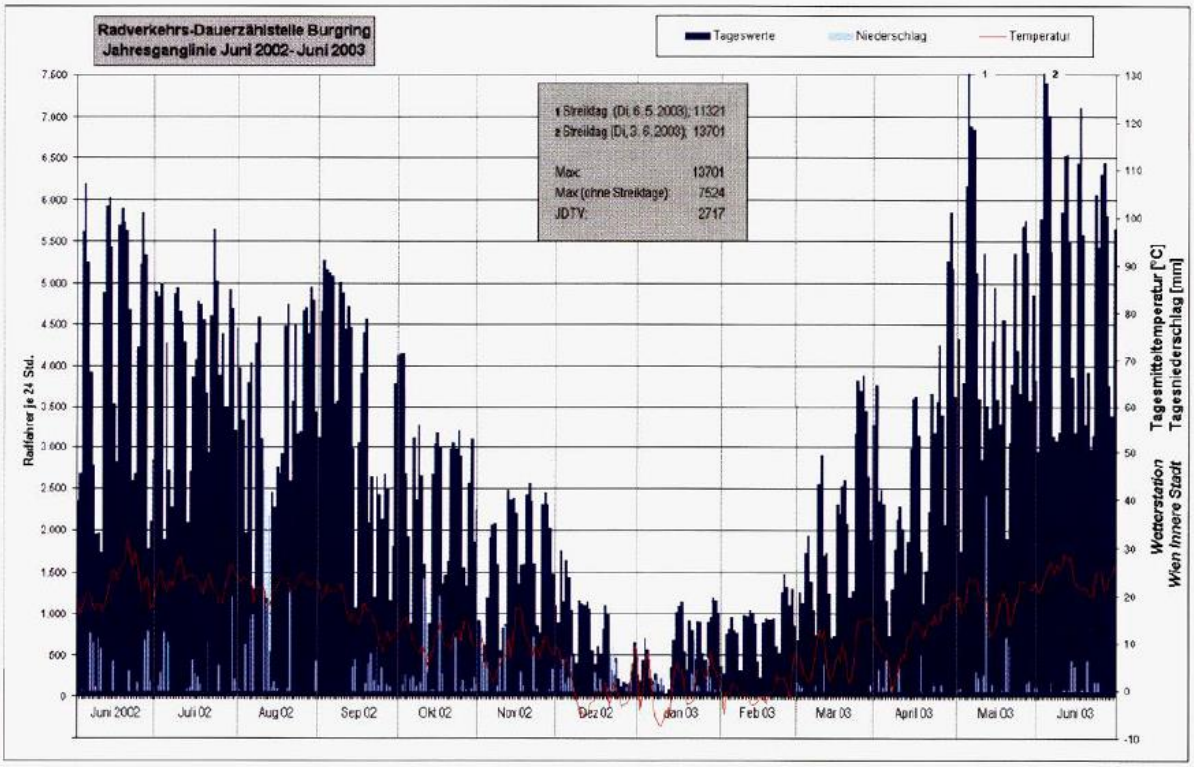

Figure 1: annual chart of cycle traffic (black) and temperature (red) in Vienna (Stadtentwicklung Wien, 2003)

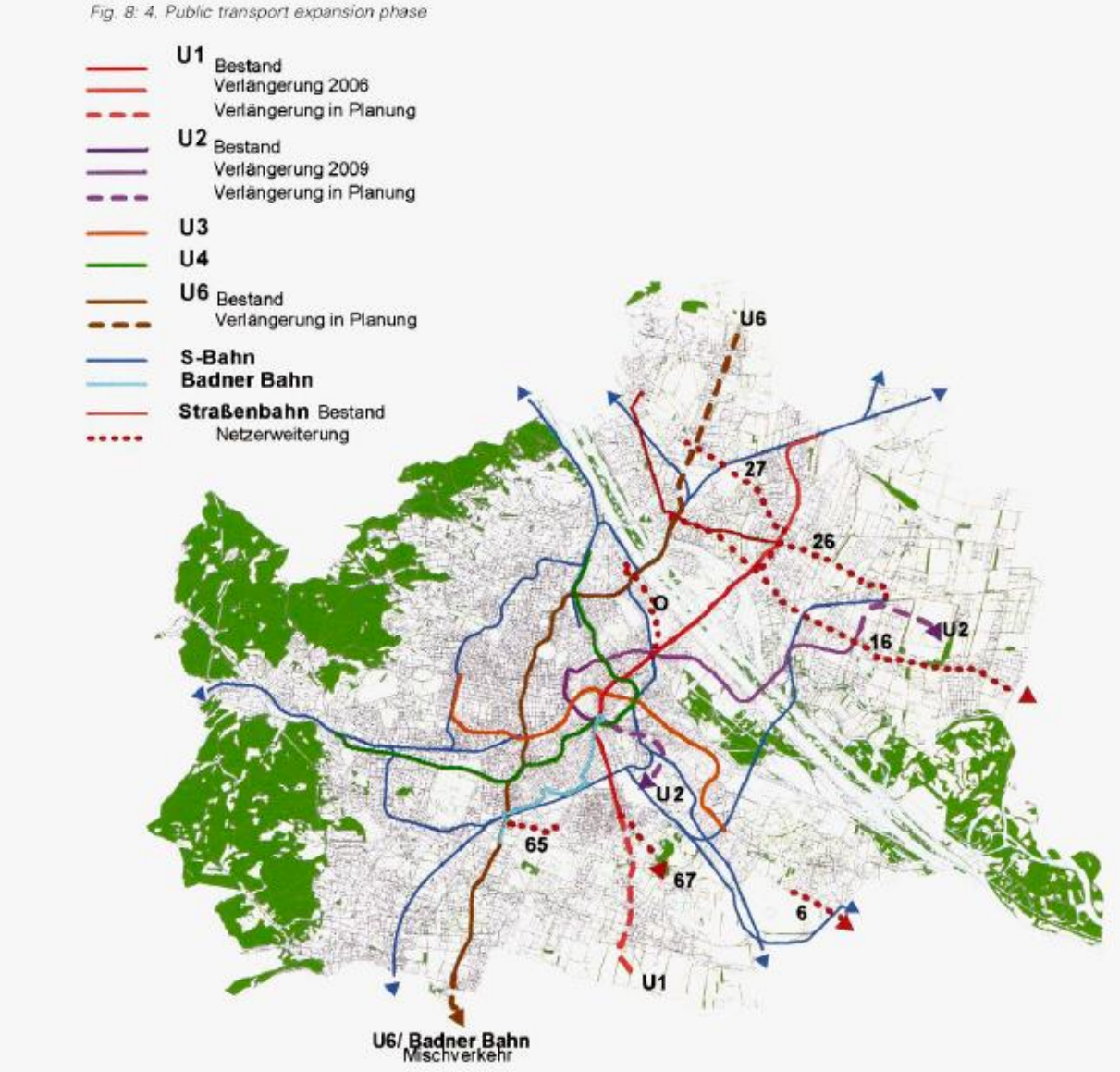

Figure 2: Public transport network expansion in Vienna (Stadtentwicklung Wien, 2003)

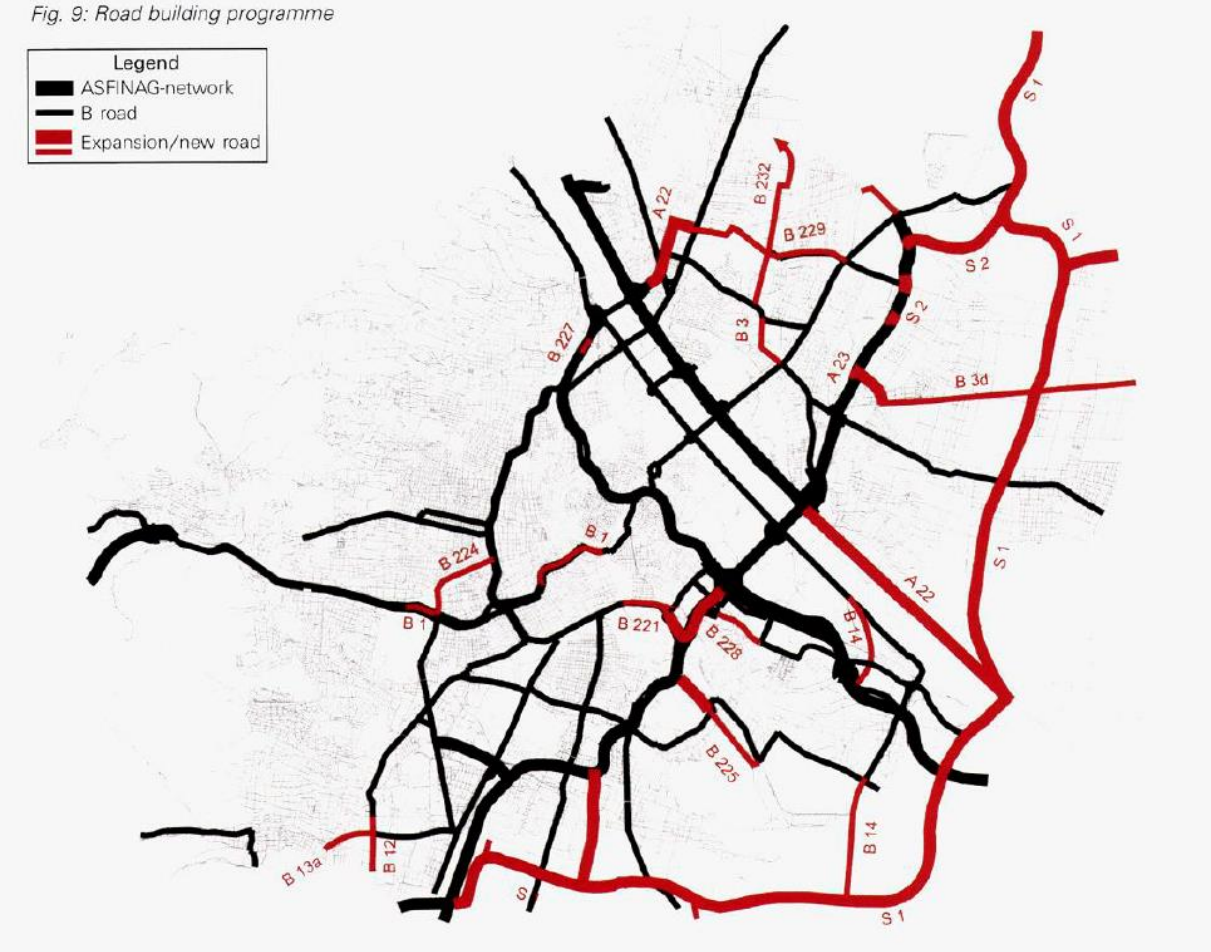

Figure 3: Road building programme in Vienna (Stadtentwicklung Wien, 2003)

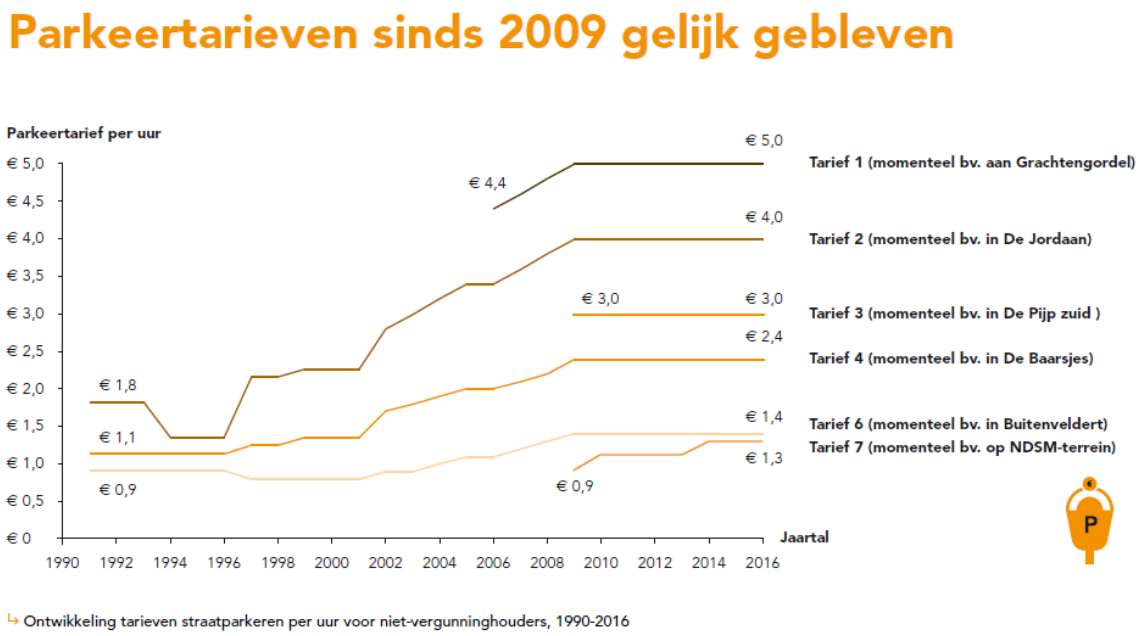

Figure 4: Development of parking fees in Amsterdam (Gemeente Amsterdam, 2016)

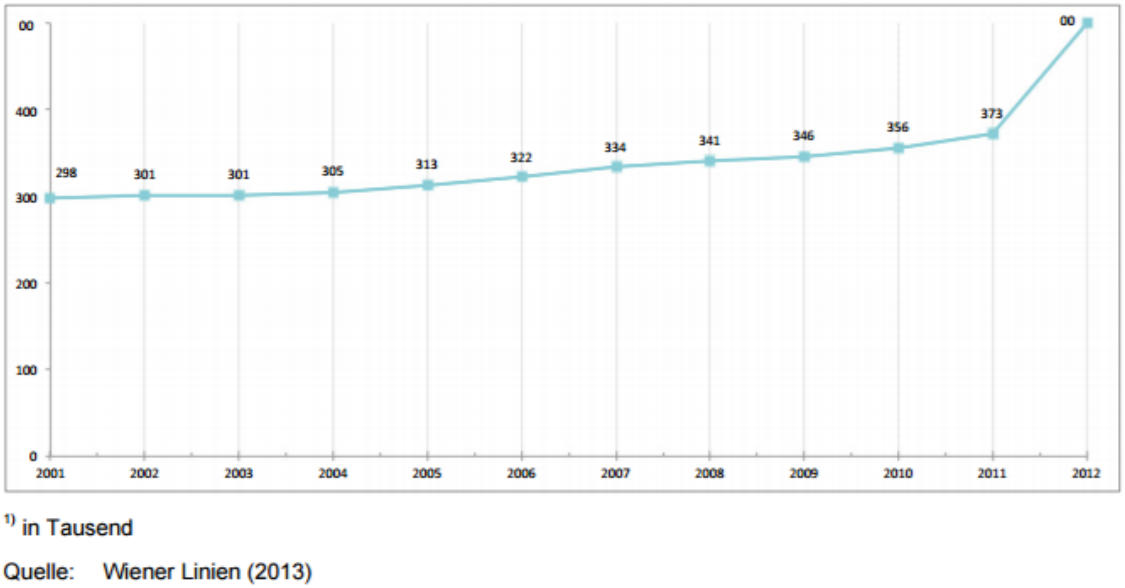

Figure 5: Sales development of annual public transport tickets in Vienna (Stadtentwicklung Wien, 2013)

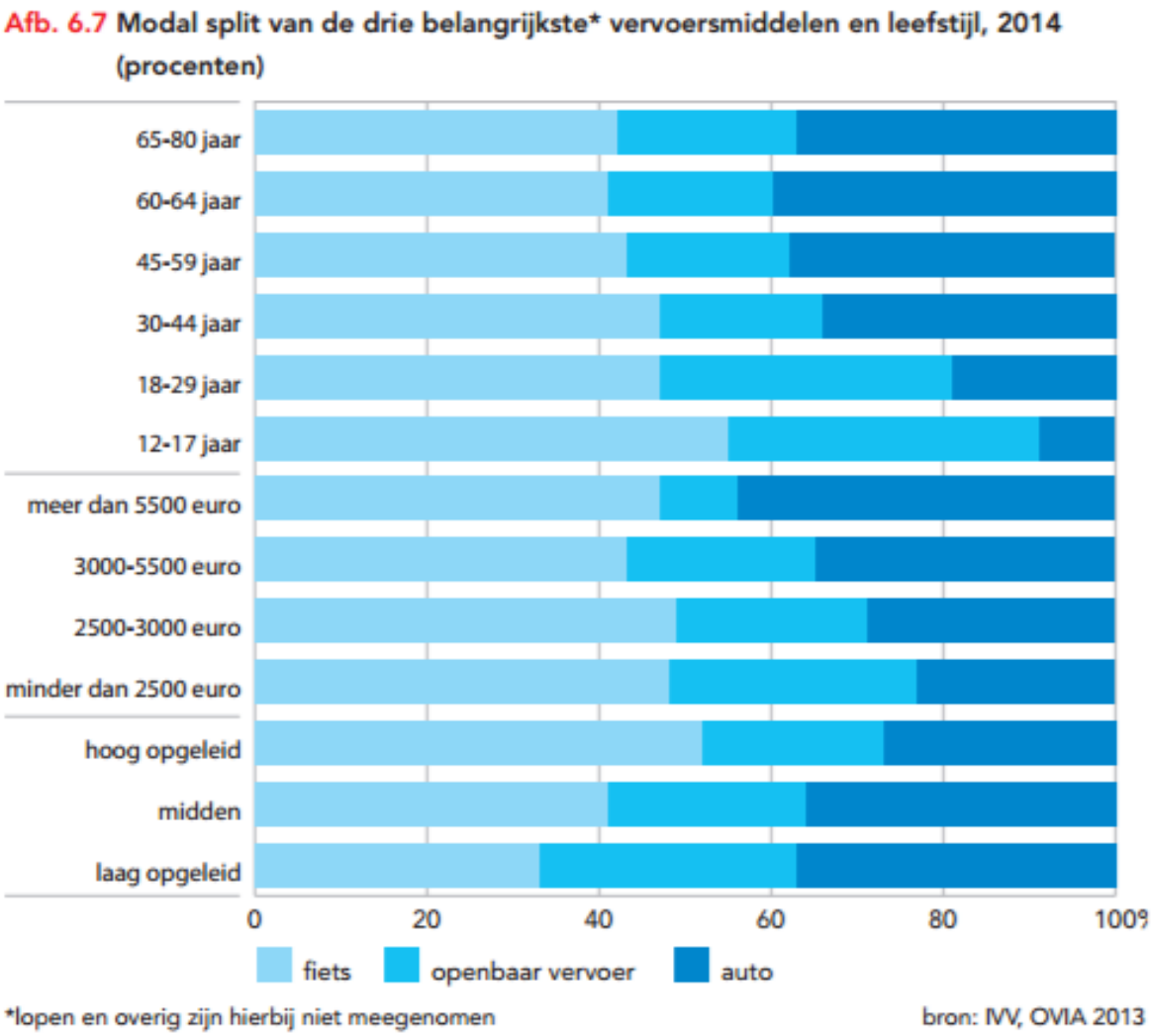

Figure 6: modal split subdivision towards amongst others age in Amsterdam (OIS Amsterdam, 2016)

References

Gemeente Amsterdam (2016). *Amsterdamse Thermometer van de Bereikbaarheid 2016.* Amsterdam, Nederland: Gemeente Amsterdam/Verkeer en Openbare Ruimte. Retrieved from: https://www.amsterdam.nl/parkeren-verkeer/bereikbaar/thermometer/

OIS Amsterdam, 2016. Amsterdam in Cijfers, Jaarboek 2016. Retrieved from: http://www.ois.amsterdam.nl/assets/pdfs/2016%20jaarboek%20amsterdam%20in%20cijfers.pdf

Stadtentwicklung Wien. (2013). Masterplan Verkehr Wien 2003 – Evaluierung 2013. ISBN 978-3-902576-74-3. Retrieved from: https://www.wien.gv.at/stadtentwicklung/studien/pdf/b008353.pdf

Stadtentwicklung Wien. (2003). *Transport Master Plan Vienna 2003. Abridged version* Vienna, Austria: Vienna City Administration, Municipal Department 18 – Urban Development and Urban Planning, Transport Planning and Regional Development Section. Retrieved from https://www.wien.gv.at/stadtentwicklung/studien/b007500.html