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A NEW IMAGINARY FOR URBAN TRANSPORT IN VIENNA

Understanding transport mode choices
as to effectively de-normalise car usage for enhanced sustainability
– A Case Study –

Maria Juschten

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Abstract

This thesis argues that the current urban transport in Vienna, which is characterized by extensive usage of cars, is too material-intensive (both in terms of input and output) and from a social perspective inherently un-urban. It therefore concludes that effective transport policy should aim at following a new imaginary, one that is based on the aim of dematerializing and “re-urbanizing” the mobility within Vienna. On an applied level, this means that, first, mobility services should be offered by using a minimum amount of non-renewable natural resources and producing a minimum amount of emissions and waste. Second, it should aim at following the ideals of urbanity, meaning (a) high density, (b) creativity, (c) collectiveness/conviviality and (d) democratic decision-making.

This goal as such might sound desirable to many people, yet to reach it requires substantial behavioural change from the part of consumers, hence transport users at the individual but even more at the cultural or collective level. Thereby, most current policies are guided by the Rational Choice Theory (RCT) and based on the assumption that humans act individually and rationally. With that assumption, a focus on infrastructure expansion and price mechanisms seems totally reasonable. Reality has shown however that these policies alone can only show a limited success compared to the financial investments they require. It is therefore argued that a further investigation of human decision-making in terms of transport mode choices and their potential application in policy-making is highly needed. This thesis will thereby focus on the extended Theory of Planned Behaviour (TPB) as used by Jillian Anable (2005) as contrasted to the Rational Choice Theory (RCT) as to analyse its usefulness for improved policy-making. 186 quantitative surveys have been conducted to test whether Anable’s segmentation model based on the TPB is applicable to the specific case of Vienna (RQ 1). This being successful, it has then been analysed using cluster analysis in SPSS whether similar meaningful groups of travellers with distinct attitudes, motivations and worldviews can be derived using the same statistical methods with the data generated from the surveys (RQ 2). Thereby, five car-owning and two non-car-owning groups could be identified. These groups have then been used to identify relevant starting points for policy-making towards the new imaginary (RQ 3). At a last stage, one exemplary policy measure (diminish convenience of driving) has been included in a system-map in MapSys in order to identify useful starting points for effective policy-making and to visualize the manifold impacts a policy can have on different actors within a particular societal frame.

Thereby, this thesis has aimed at making new contributions in various ways: first, by connecting it to the work of Anable. The fact that the results are so similar uplifts her contributions and confirms mine. The fact that these cluster groups are actually formable confirms the theoretical importance of this topic and the used approach. Second, by introducing the rather new methodologically approach of system-mapping. It has been proven highly valuable for analysing and understanding complex systems such as transport. Third, by illustrating the importance of top-down approaches in transport policy-making.

Key words: Dematerialisation, urbanity, sustainable transport, cars, Theory of Planned Behaviour, cluster analysis, system-mapping, policies, Vienna

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Cups of coffee consumed during the production of this work (approx.):

Contents

Abstract	III
Acknowledgements	IV
Contents	V
List of Abbreviations	VI
List of Figures	VII
List of Tables	VIII
1) Introduction	1
1.1) Relevance of the Topic & Personal Motivation	1
1.2) Brief Introduction to the Viennese Transport System.....	4
1.3) Research Question and Objectives	7
1.4) The goal of Interdisciplinarity – challenge and opportunity.....	8
1.5) Structure of the thesis	9
2) Framing a New Imaginary of Sustainable Urban Mobility	11
3) Theoretical Framework – Grasping Urban Transport Mode Choices	15
3.1) Overview of Mode Choice Theories with Focus on RCT and TPB.....	15
3.2) Policy Challenges Resulting from Behavioural Models.....	19
3.3) Extended Theory of Planned Behaviour by Anable	20
4) Methodology	24
4.1) Ontological, Epistemological and Methodological assumptions.....	24
4.2) Methods of Data Generation & Analysis	26
4.3) Research Credibility & its Limitations.....	32
5) The Case of Vienna: Empirical Research results	34
5.1) Results from Research I: Cluster Analysis.....	34
5.2) Results from Research II: Descriptive Analysis of Clustered Groups	38
5.3) System-Mapping of the Results for Group 3 – “Malcontent Motorists”	42
6) Discussion	44
6.1) Critical Considerations of Anable’s Theoretical Framework	44
6.2) Examining Policy Measures	46
6.3) Feasibility	51
6.4) Critical Discussion of this Research	52
7) Conclusion and Outlook	54
Bibliography	56
Appendices	62

List of Abbreviations

EC	-	European Commission
EE	-	Ecological Economics
GDP	-	Gross Domestic Product
Gha	-	Global hectare
GM	-	General Motors
MIPS	-	Material Input per Service Unit
MIT	-	Material Input Tax
P&R	-	Park & Ride
PBC	-	Perceived Behaviour Control
Pkm	-	Person-kilometre, kilometres driven per person & vehicle
PT	-	Public Transport
RCT	-	Rational Choice Theory
t (p. 19)	-	Ton
TPB	-	Theory of Planned Behaviour
UNEP	-	United Nations Environment Programme
WTA	-	Willingness to Accept
WTP	-	Willingness to Pay

List of Figures

Figure 1: Map of Vienna – administrative borders and metro lines, source: author's drawing, data: see map	4
Figure 2: Modal Split in Vienna between 1993 and 2010, source: author's illustration, based on: Hiess (2013)	5
Figure 3: The Theory of Planned Behaviour by Ajzen, source: http://hsm.sagepub.com/content/23/2/47/F1.large.jpg	18
Figure 4: Model of Extended Theory of Planned Behaviour, source: author's drawing, based on:	21
Figure 5: Illustration of my ontological assumptions, source: self-made	24
Figure 6: Map of chosen locations for survey conduction, source: author's drawing, data: https://open.wien.at	27
Figure 7: Matrix for generation of variables for development of system-map, source: Videira et al. 2014, p.63	31
Figure 8: Ward linkage coefficients for car owner clusters, source: generated in Excel	34
Figure 9: Ward linkage coefficients for non-car owner clusters, source: done in Excel	36
Figure 10: The analytical frame of the current imaginary for group 3, source: author's illustration.....	43
Figure 11: The role of one's social surrounding on car usage, source: author's illustration .	45
Figure 12: Bike lane in Vienna, source: http://cdn1.vienna.at/2012/10/mayssengasse_ja.jpg	47
Figure 13: System-map including the policies aiming at reaching the new imaginary, targeting specifically group 3; source: author's drawing	50
Figure 14: The mutually-reinforcing nature of capitalist structures and societal culture, source: author's drawing.....	52

List of Tables

Table 1: Overview of socio-demographic indicators for Vienna, source: www.statistik.at	5
Table 2: Quality attributes of Public transport or transport alternatives in general, source: Redman et al. (2013), p. 121	16
Table 3: Anable’s group segmentation and derived policy options, source: Anable (2005), pp. 76-77.....	23
Table 4: Time frame of survey conduction, source: author's notes.....	27
Table 5: Distribution of respondents regarding age and gender, source: author’s calculations	28
Table 6: Factors included in the cluster analysis, source: author’s illustration, based on: Anable (2005), p. 70	29
Table 7: Cluster centres for the two possible car owner solutions, source: author’s illustration derived from SPSS calculations	35
Table 8: Distances between the means of the different clusters, source: generated in SPSS.....	36
Table 9: Cluster centres for the two possible non-car owner solutions, source: author’s illustration derived from SPSS calculations	37
Table 10: Survey results of respondents, source: author’s calculations.....	38
Table 11: Socio-demographic and spatial data of respondents, source: author’s calculations.....	38

1) Introduction

1.1) Relevance of the Topic & Personal Motivation

Problem description

Fastening globalization has increased the overall global need for transport services, whereas urbanization has led to a densification of transportation. And although much of the global transportation volume is freight traffic, passenger travel, especially motorized private transport by car, is also responsible for a substantial part of travel-related emissions and resource needs. Especially the fact of cars being metabolistic vehicles with constant input needs (fuel and materials) and output generations (waste and emissions) makes this problem particularly relevant from a (ecological and social) sustainability-centred perspective (Spielmann & Althaus 2007, p.1125). Hence, motorized individual transportation (and related production) entails an important role in furthering climate change, resource degradation and social marginalisation of the Global South. But there has also been an increasing debate about the local implication of car usage, such as local air pollution, noise pollution, health-related issues and debates about the right usage of urban space and the influence of car-societies on urban power relations.

Various political and economic approaches target the environmental problems related to car use. The theory of ecological modernisation, regulation theory and the concept of the internalisation of externalities (e.g. carbon-trading) aim at decreasing the relative resource inputs and outputs of cars from aggregate income, also called decoupling (Antal & van den Bergh 2013, p.49). Yet, none of these has led to an absolute reduction of resource needs so far (Black 2010, pp.81–87, 150). Furthermore, none of these approaches addresses the social problems related to heavy car usage.

And although societal awareness about these issues has been rising throughout the last years, cars still belong to the picture of Vienna as they do in most other large cities in Europe and all over the world. Therefore, the Viennese government does include a reduction of car transport and transport-related pollution in their agenda. Most policy intervention in Vienna has been focusing on the provision of better public transport infrastructure. This becomes visible in the various planned and ongoing projects of extending the metro network and purchasing new and more efficient vehicles (Hiess 2013, pp.57–58). These initiatives surely have – among other factors - influenced the modal share of cars in the urban area to a certain extent and they are surely required in the future to keep existing public transport users. However, policy-makers have not investigated so far whether this alone will help promoting the use of public transportation. Instead, they have simply relied on the functioning of the neoclassical economic rational-choice theory, which states that utility is the only decisive factor in transport mode choices. Hence, people will automatically move towards public or non-motorized individual transport once the utility people gain from it (in terms of time, costs, comfort and convenience) is higher than for cars (Schwanen & Mokhtarian 2005). Nevertheless, the current success of these projects can be considered low compared to the level of financial expenditures of these investments. This can be explained when using theories other than the rational-choice model as to explain people's transport mode choices.

This is the point where this study joins in. It aims at testing and confronting both the beforehand-mentioned rational-choice theory and the theory of planned behaviour. The latter highlights the importance of social relations, norms and attitudes within decision-processes. It emphasizes the importance of “soft” and intangible associations such as freedom, status and progress in determining people’s transport mode choices. Advocates of this theory state that cars are deeply embedded in people’s all-day life and habits and therefore strongly shape people’s values and attitudes towards other means of transportation and in consequence their behaviour. Therefore, this thesis aims at investigating people’s mode choices and choice motivations in a way that allows to test both the existence of rationality and the importance of attitudes and values within mode choices. In order to be able to make generalizations (to a certain extent) about the behaviour of selected groups of people, quantitative methods, namely questionnaires, have been used.

The overall goal is to find out whether transport policy in Vienna could be more successful and less cost-intensive if different behavioural assumptions were integrated within the policy-making process. It is thereby interesting to mention that most of the negative implications of car usage are to be observed on a societal level (such as noise, pollution, infrastructure costs) whereas benefits are perceived by each individual separately (time saving, comfort, and freedom). Therefore, one can argue that top-down approaches could be more effective at dealing with attitudes and habits related to cars compared to bottom-up approaches. The latter are unlikely to be successful in transport issues where people do not feel reasonable for the negative outcomes of their actions and where sacrifices of a few leave more room for unsustainable behaviours of others. For this purpose, this thesis will end by offering different policy recommendations that could achieve reductions of individual car usage and discuss their feasibility.

The importance of the urban scale

The city can be defined as a settlement characterized by a “*high concentration of biophysical structures, inhabitants and socio-economic activities along with a minimum size*” (Weisz & Steinberger 2010, p.186). Throughout the last decades, cities have gained importance both in population numbers and economic as well as political power (Sassen 2005; Scott & Storper 2003). The year 2008 has been an important point in this regard, as for the first time in history, more than fifty percent of the world population was living in cities by then. This fact of a rather global scale serves as an introduction to the importance of the urban scale for socio-economic analysis. The subsequent part will illustrate in more detail the relevance of observing the urban scale for the topic of transport policy-making.

Cities are a crucial focus of observation from a socio-economic point of view. They are the centre of economic activities and concentrate political power - they are therefore an important starting point for effective sustainability-oriented policies (Puppim de Oliveira et al. 2013, p.138). Due to their function as centres of knowledge and innovation, cities are particularly capable of contributing to less material-intensive economies (Puppim de Oliveira, et al., 2013, p. 138). However, as discussed later on, they are also centres of consumption and therewith likely to absorb material-intensive and unsustainable lifestyles, which might be strengthened by the fact that the average income is higher in urban than in rural areas. For a more holistic understanding or current ecological problems at the global scale, it seems crucial to study the urban scale. Although cities are often considered creating a high

concentration of pollution, greenhouse gases, noise, waste and other unsustainable “goods” (Cook & Swyngedouw, 2012, pp. 1961-1962), this is rarely the case for Western European Cities. The latter export a high amount of their ecological footprint by locating unsustainable production sites to the Global South. Nevertheless, the consumption is indirectly still the main cause for global environmental problems as explained beforehand.

Cities are also a very interesting scope of observation from a political point of view. First, because they incorporate different levels of responsibility or roles. They are at the same time administrator, legislator, project manager, and purchaser and many more. These differing roles surely lead to goal conflicts but also to a second, more positive aspect: policy-proposals are much easier to implement or experiment with at the urban scale. Due to a smaller number of bureaucratic barriers and intermediaries involved, local governments are much easier to access. Third, due to the limited size of Western-European cities, they can be considered well-plannable or well-manageable spaces where elements of participatory or deliberate democracy are much more feasible than at the national scale.

Especially in terms of dematerialization or degrowth, not much micro-research exists so far. This is why the urban scale seems particularly important for such an inherently micro-related topic – urban mobility.

Personal motivation: why transport and why Vienna?

Various aspects motivated my choice for observing transport mode choices in Vienna. The main reason might be the move to Vienna as such. After having lived in bike-affine countries such as the Netherlands and Sweden for several years, the everyday life in a city full of cars has made me feel the difference between urban transport systems in various cultures.

Thereby, my academic and professional background in business with a focus on transport and logistics within the German Railways (Deutsche Bahn) has highlighted this inherent conflict of interests between societal and economic goals. On one side, there is the constant urge for growth (also within the automotive sector) strongly embedded in our current economic system; on the other hand it is impossible to ignore the negative socio-ecological consequences of such economic imperialism at different scales. Nevertheless, mobility is an important aspect of our current society and needs to be facilitated in a socially, morally and ecologically just manner. Thereby, the sole focus of current policies on infrastructure extensions seems neither economically efficient nor socially and ecologically reasonable considering the many land changes required for new infrastructure projects. Therefore, further research integrating “soft” and intangible factors influencing transport mode choices felt necessary and useful.

I chose to focus the research on the city of Vienna for several reasons: first, because Vienna is a city with similar cultural features as my home country, Germany. This facilitates the research and helps to get engaged with local authorities and residents of the respective districts as part of the empirical research. The second reason is that Austria as a “developed” country is one of those with the highest amount of resource consumption as well as waste output and hence the highest potential for dematerialization. The third reason is that although Vienna has a very well-developed public transport infrastructure compared to other European cities¹, and although the local Government tries to establish the image of an

¹ As stated within the Mercer Study, see: <http://www.imercer.com/products/quality-of-living.aspx>

environmentally-friendly and “smart” city, the usage of cars for daily commuting is still comparably high with 31 percent (Gielge et al. 2009). The fourth and last reason is the good accessibility and availability of data, resulting from the city’s newly launched Open Government approach which enables the public to gain free access to a wide range of up-to-date statistical and GIS data (Stadt Wien 2013b).

Research qualification

I am currently enrolled in two Master program, In Lund and in Vienna. The combination of these two programs with their very specific perspectives have contributed to the academic aspects of this thesis. Thereby, the Human Geography program Lund has provided me with a good understanding of socio-political perspectives, which have been complemented by the rather ecological economics and behavioural economics perspective I gained throughout my current studies of Socio-Ecological Economics and Policy in Vienna. Both studies have rather provided me with a certain “way to see the world” – which is strongly influenced by the lens of social and ecological sustainability - whereas most of the actual content-related research has been done on personal initiative.

1.2) Brief Introduction to the Viennese Transport System

a) Introduction to Vienna

Vienna is the capital of the Republic of Austria and is both the capital and one of the nine federal states of Austria. Due to its situation in the Northwest of Austria with high proximity to Bratislava, Vienna is part of the so called “Centrope region” (Vienna, Burgenland, Lower Austria, Bratislava and surrounding, Tmava, Győr-Mason-Sopron and Vas) and is therefore considered the “door to the East” (Hiess 2013, p.12). Both administratively and functionally, the city consists of 23 districts which are organized in a snake-like shape departing from the centre of the city (first district). Districts 1 to 9 and 20 are considered the inner districts lying within the “Gürtel” (“belt”, main road corridor), 10 to 19 the outer districts and 21 to 23 are the peripheral districts. Figure 1 illustrates Vienna’s administrative and general topography.

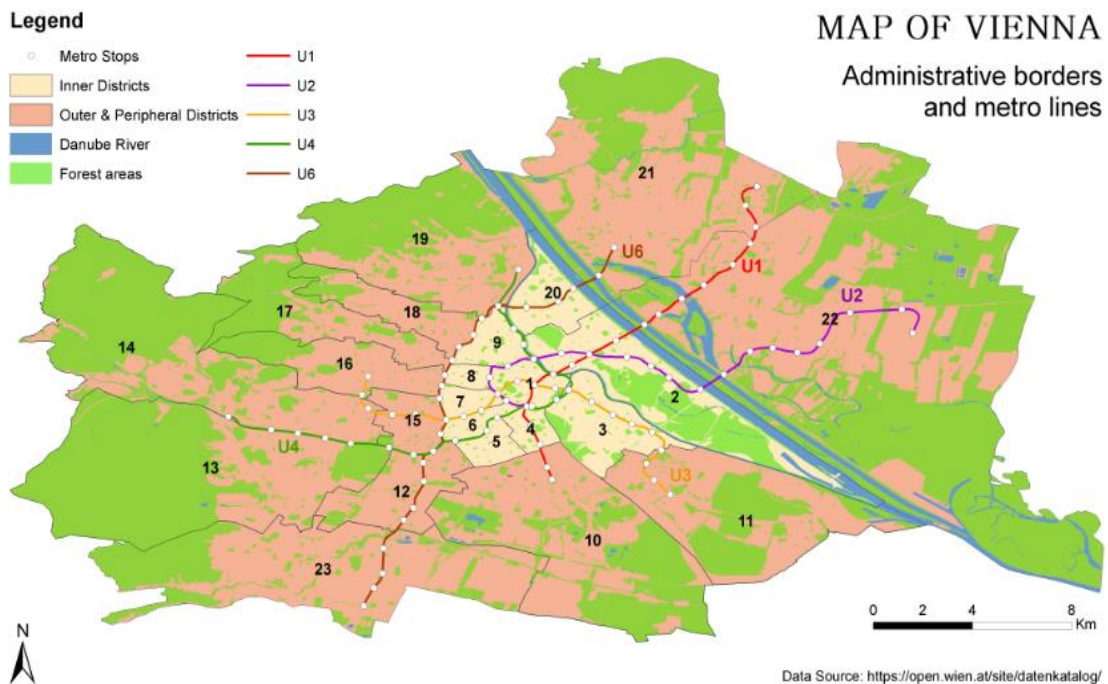


Figure 1: Map of Vienna – administrative borders and metro lines, source: author's drawing, data: see map

Vienna is characterized by a certain, yet comparably low heterogeneity among the districts. Whereas some are densely populated, others are not. On a very general level, this can also be applied to the transport system, which is generally very good, but surely better in certain districts than in others. For the course of this thesis, where the different motivations for car usage were to be analysed, it was tried to include respondents from a variety of locations.

A short overview of the variance between the districts regarding some relevant socio-economic indicators is given in the table below as to be able to classify and picture variance among the different districts (Statistik Austria 2014; Gielge & Plautz 2003; Stadt Wien 2009). However, based on Anable's findings, that socio-demographic features (except for age) did not have a strong impact on the "category" one belongs to, this thesis will not explain these differences in further detail for all districts.

	Total Vienna	Min	Max
Population	1.741.246	16.268	182.595
Population density (inh/km ²)	4.235	1.348	26.403
Average age (in years)	40,5	38,6	46,4
Average net income (in €)	21.236	16.416	34.333
% with University degree	15%	6%	36%
Cars per 1000 capita	390	302	1.055 (many corp. cars)
Household size	2,0	1,8	2,1

Table 1: Overview of socio-demographic indicators for Vienna, source: www.statistik.at

b) Development of transport usage in Vienna

Interestingly, increasing traffic is considered the most urgent environmental problem in Vienna (Petrovic 2013), before climate change and increasing resource scarcity. All those factors are heavily influenced by transportation, and hence by individual transport mode choices. Considering these statistics, one would expect that car ownership has been replaced by increasing trends towards other forms of transportation in the last decades. This has not been the case. The following chapter illustrates the developments of transport mode choices in Vienna, without initially trying to analyse the reasons for these developments (this will be part of chapter 5). The subsequent figure will thereby illustrate the development of Vienna's modal split between 1993 and 2010 and the government's prognosis for 2020.

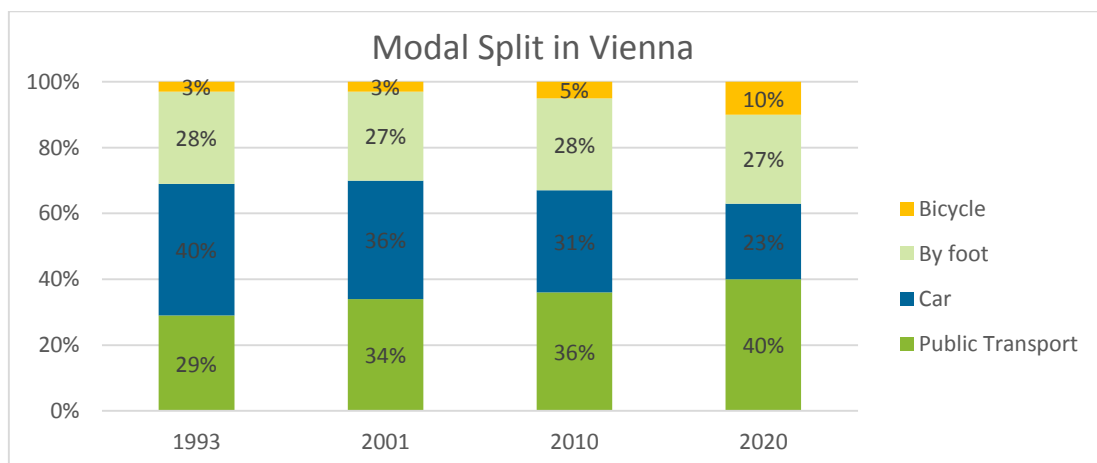


Figure 2: Modal Split in Vienna between 1993 and 2010, source: author's illustration, based on: Hiess (2013)

From a historical perspective, one can observe that the car ownership in Vienna has constantly and heavily risen in the past sixty years whereas the population stayed relatively constant. In 1951, the Viennese population owned 22.227 cars, mounting to 152.334 in 1961, 345.434 in 1971, 476.553 in 1981, 559.382 in 1991, 646.283 in 2001 and 675.300 in 2011. In 2008, 50% of Viennese population owned one car, 16% owned two or more cars and 34% did not own a car. The number of car-owning households has been decreasing historically (Stadt Wien 2009), yet the amount of cars within car-owning household has increased. It is observable that the ascent of the curve has flattened in the later decades, however, these numbers represent the current amount of cars being possessed and used in Vienna.

Furthermore, the historically increasing role of cars has been visible in Vienna's legal situation. The so-called "Stellplatzverpflichtung" (parking spot obligation) still foresees that for each newly-constructed apartment building, one new parking spot needs to be provided. Within 2001 and 2011, 75.000 new parking spots have been created, compared to only 29.000 newly-registered cars in the same period (Hiess 2013, p.21). This can be considered a continuous improvement of an officially politically undesired status – a paradox. There are attempts to change this law, but at this point in time, nothing concrete has been decided yet.

The development of bicycle ownership and usage on the other hand is less well-reported. No data exist considering the actual usage development; it is estimated at approximately 5% of all travels. The political goal is to lift the bike's modal split to 10%. Therefore, bicycle infrastructure has been constantly increasing throughout the last decades, from 190 km in 1980 to 835 km in 2000 to 1.259 km in 2014.

The modal split of public transport has increased throughout the last years. Especially since the strong price reduction for the yearly ticket in 2012 (from 449 to 365 €), the number of sold tickets has jumped up from 373.000 to 500.000 in only one year (Hiess 2013, p.23). The continuous investments in the extensive public infrastructure including the metro system, surely contribute to this slow but continuous success. Between 2001 and 2012, the number of passengers (which also includes tourists though) has risen from 730 to 907 million people a year (ibid, p. 23).

Another transport mode that has been increasing steadily is the one of collaborative consumption which includes both cars (car-sharing, car2go) and bikes (City Bikes: around 100 new stations). It is not clear though to which extent these have been used as a replacement to the private car (ibid).

As to set a basis for more effective policy-making, the subsequent chapter will give a short overview over existing measures aiming at decreasing car usage in Vienna. It is thereby concluded that they have not been sufficiently successful in changing modal shares when considering the amount of investments that have been used to follow this infrastructure-focussed policy approach.

c) Current initiatives aiming at shifting transport mode choices

The city of Vienna is very ambitious regarding their strategy of becoming an environmentally sustainable and highly liveable city. This is represented in the various political programs dealing with issues of energy and resource needs and emissions resulting from different activities. Furthermore, different studies prognosticating an increase of urban sprawl and rural-urban transport highlight the importance of political action (Hiess 2013, p.10).

The main initiative is called **“Smart City Wien”** and aims at continuously modernizing the urban environment, including housing, infrastructure, public services and transportation, human capital, public participation and the economy. Under the umbrella of the smart city concept, different projects have been implemented, of which the **“SMILE”** project is the most noteworthy in terms of sustainable mobility. Its goal is to improve the connectivity of different transport modes by offering online applications allowing the user to find the fastest route by combining all different available transport modes, including city bikes, car-sharing and walking. The goal is to optimize people’s level of information about available transport modes and their respective characteristics (such as time and costs). However, for economic reasons, none of these strategies aim at actively diminishing the purchase of cars, which is why they do not seem sufficient for the aim of this thesis.

On a more transport-specific level, the city of Vienna has established a **“Master plan transport 2003”**, which has set goals for the development of the urban transport sector up to 2020 (Hiess 2013). The goals that have been set are to increase the share of bicycles of the total Viennese modal split from five to ten percent, which could already be reached within certain districts. Therefore, one measure has been to continuously extend the network of bicycle lanes and surrounding bike infrastructure (Stadt Wien 2013a). Another goal within this master plan was to increase the share of public transport by extending the network. Furthermore, funding aimed at advancing research on innovative mobility, as well as research on electro-mobility and gas-fuelled cars. Interestingly, yet not surprisingly, is the fact that most measures and strategies undertaken by the local government focus on the expansion of transport infrastructure or the advancement of technology as to save fossil-fuel driven energy (ibid, p. 49). There are various current projects illustrating this policy approach. Within the metro network, five different lines exist which connect the various parts of the city. Two of them (U1 and U2) are subject to large extensions of their network aiming at connecting more peripheral areas of the city to the network. Another line (U6) is subject to extensive modernisation of the service infrastructure including train stations and bridges. Additionally, a totally new metro line, the so called U5, is currently being planned; the construction works are supposed to start by the end of this decade (Hiess 2013). The bus network as such has not been changed significantly in the past year, however, the Wiener Linien have just bought an entire fleet of modern air-conditioned buses, which are in use since summer 2014. Furthermore, the Master plan includes several other modernisation plans aiming at improving the quality and time-efficiency of public transport (ibid, pp. 57-58). None of the available projects acknowledges though that transport mode choices are dependent on many other factors, such as acquired habits, strong feelings and values associated with a certain transport mode, and personal situations leading to specific transport mode choices. However, when aiming at effectively dematerializing the urban transport sector, those factors have to be taken into consideration in order to fully understand people’s decisions. This is a crucial step towards developing and implementing effective, cost-efficient and beneficial policies for sustainable urban transportation.

1.3) Research Question and Objectives

The structure of the research follows the guideline proposed by Punch (2005, pp.33–37). He suggests researchers to ask themselves the following questions (highlighted in bold) to create logical, answerable and scientifically sound research questions.

Research Aim: The typical argument explaining a high rate of car usage is strongly focussing on instrumental mode choice factors such as insufficient infrastructure or too high costs of public transportation (European Commission 2013). As a conclusion of this, behaviour can be changed if only the government invests in better, safer and more flexible infrastructure, so that nobody would need to go by car. However, when looking at Vienna (which has a well-developed public infrastructure), it seems that infrastructure and income alone do not explain the high daily use of cars (Tudela et al. 2013, p.626). Hence the purpose of this research is to explore how travel mode choices are influenced by different instrumental, symbolic and emotional factors such as pleasure, social comparison, attachment, identity and attitudes among others. Assuming a heterogeneity of motivations among different groups of people, I would like to investigate whether the extended Theory of Planned Behaviour (TPB) is a suitable approach to understand travel behaviour for different groups of people. This seems of high use for developing concrete policy recommendations that address people differently according to their motivations and worldviews.

Research Area: Transport Psychology and Transport Policy

Research topic: transport mode choices, sustainable transportation, urban transport policy

The general research question is:

What are the driving forces behind existing transport mode choices for different groups of people in Vienna and how can these be addressed by urban policy-making?

The **specific research questions** that are going to be answered throughout the literature and empirical research are as follows:

(Q1) Is the extended TPB (as developed by Anable 2005) and group segmentation a suitable approach to understand and predict the factors that influence people's transport mode choices in Vienna?

(Q2) Based on the results of the questionnaire, which type of travellers can be encountered in Vienna and what are their specific mode choice motivations?

(Q3) How could policies address these distinct groups of people as to reach the new imaginary of urban transport?

The **data collection questions** are all specified in the methodology part 2.2.

The **hypotheses** guiding this thesis and its research are the following:

(A1) Transport mode choices are not purely rational and are influenced by many intangible symbolic and affective factors. An excellent infrastructure alone will not ensure a comprehensive shift towards public or non-fuel-based transport due to the power of habit and car-affinity.

(A2) There is no such thing as "one average consumer" or one universal explanation for transport mode choices. A segmentation of people seems useful to acknowledge the variation in people's motivations and allow for more individualized and therewith effective policy-making.

(A3) For policies to achieve a modal shift, the respective sociological and psychological factors need to be understood and addressed when striving for change.

1.4) The goal of Interdisciplinarity – challenge and opportunity

The question of this thesis is of a truly inter-disciplinary and international nature. No consumption (such as transport mode) choice is independent of one's cultural, historical,

geographical, social and even economic and legal background. The topic of car (over-)use can therefore be analysed from a variety of scientific perspectives. Ecologists could study the environmental implications (such as local pollution and climate change); urban planners could investigate the local infrastructure and the reasons for its over-demand; engineers could study existing transport systems and technologies with regard to its efficiency; economists could analyse the role of the car industry within the Austrian, European and global economy; political scientists could try the effects of different political and legal structures on the relevance of cars within a society; sociologists could try to understand group behaviour occurring in traffic jams; philosophers and geographers might ask how these usage patterns affect people's relationship to the urban space and psychologists could study the reasons for strong car attachment and concrete effects of traffic jams and other stress situations. This thesis has been highly motivated by the aim of integrating insights from some of these disciplines. When addressing the question of transport mode choice, it appears crucial to understand that various factors influence how people make choices. This in-depth and holistic understanding is the pre-requisite for developing policies that enable change. The goal is thereby to bridge the gap between two very common approaches in science. On one hand, there is the Positivist approach (as used by neoclassical economists) working with strongly reductionist and escapist models that are easily translatable into policies though; on the other hand there is the Realist or Constructivist approach (as used by Sociologists) which strives for high realism but often fails to deliver realizable proposals based on their insights. Admittedly, this thesis has revealed certain difficulties related to interdisciplinary work that I was not aware of before. First, there is an even stronger need for self-limitation considering that so many different perspectives and aspects could theoretically be elaborated which would exceed the frame of any paper. Second, it seems that to a certain extent, depth gets lost because of the desire to show the breadth and complexity of the respective topic. Third, the connection between the different perspectives also needs to be made, which is of great interest but often very complex.

1.5) Structure of the thesis

The first chapter includes this introduction which aims at illustrating why it is relevant to study transport mode choices. It furthermore gives an overview of why extensive car usage in general but especially in urban areas represents a problem in the perspective of sustainability. It outlines current research on transport mode choices, illustrates its shortages and continues by presenting the concrete research goal of this thesis. Moreover, the aim of interdisciplinarity is highlighted, which has been a great inspiration but also a great challenge within this project.

The second chapter aims at briefly illustrating the manifold problems related to heavy car usage, beyond the commonly used argument of polluting CO₂ emissions. It thereby focusses on two aspects that are considered crucial within the current transport imaginary: high material-intensity (in terms of input and output) and inherent un-urbanity when defining urbanity as spaces of density, collectivism, interaction and creativity. Based on this criticism, the new imaginary of urban transport – or the ideal of sustainable transportation (beyond zero-emission goals) is derived. Thereby, this thesis supposes individual values and attitudes to be crucial for people's transport mode choices. Assuming that these are strongly influenced by social structures and cultural norms, this chapter aims at illustrating how cars

could historically gain such a significance within society, way beyond their instrumental function. Given that this role has been created artificially, this thesis believes that a shift towards the new transport imaginary is possible by trying to understand people's mode choice motivations. Thus, the third chapter looks into different transport behaviour theories.

The third chapter provides the actual theoretical framework for the empirical study and looks into different theories explaining urban transport mode choices. It is divided in three sub-chapters. The first sub-chapter first gives an overview over existing theories that try to explain and predict people's transport mode choices. It thereby focuses on two very dominant theories (the RCT and the TPB) and outlines their strengths and weaknesses and their potential usage in transport policy-making. The second sub-chapter illustrates the policy implications or proposals that can be found within the literature for each of the two theories. Concluding that both theories are not sufficient to understand people's motivations and shape their behaviours, Anable's model of segmentation is presented as a valid alternative to the pre-dominant theories within the third sub-chapter. Her theory uses an extended model of the TPB but assumes that no theory or policy should be built around one average consumer. She therefore developed a cluster analysis grouping people into six distinct groups of unique perceptions, motivations and worldviews, which are the basis for individualized and effective policy-making. The model she developed serves as framework for this thesis.

Within the fourth chapter, the methodology of this paper is explained. This includes the ontological and epistemological assumptions made throughout the research. Later on, the specific methods for data generation and data analysis are explained in more detail, covering the questionnaire and its descriptive and statistical cluster analysis as well as the incorporation of these results into a systems-mapping approach which can be considered the base for potential policy proposals. The chapter finishes with considerations about the limitations of this research.

The fifth chapter includes the empirical case study undertaken in Vienna which aims to see whether Anable's model is applicable to Vienna. Therefore, an introduction to Vienna is given. After that, the status quo regarding people's transport mode choices and governmental projects and initiatives regarding transportation is illustrated. Until today, most political action follows the neoclassical theory of behaviour and focuses exclusively on the extension of public transport infrastructure. They thereby disregard the importance of emotional, affective and habitual motivations for choosing a mode of transportation, as highlighted by the TPB among others. The empirical work is done in form of a survey that aims at testing the presented theory developed by Anable. At the end of this chapter, the results from the qualitative study in Vienna are presented in form of a statistical cluster analysis followed by a descriptive analysis of these cluster groups. These results are then integrated into a systems-map which builds the basis for group-specific policy-making.

The sixth chapter aims at responding and discussing to the stated research question. It therefore connects the results from the empirical study with the presented theory. In the first part, Anable's theoretical framework will be put in relation to the present outcomes. Secondly, the different policy strategies are proposed that integrate the acquired knowledge. Finally, these proposals are discussed concerning their practical feasibility.

The seventh chapter then summarizes and concludes the findings of this thesis and gives a short outlook on possible future research.

2) *Framing a New Imaginary of Sustainable Urban Mobility*

The following chapter aims at developing a new Imaginary of urban transport in Vienna which is ought to be aspired with the proposed policy measures. This is based on the author's perception of the current debates on urban car usage which are believed to be very one-sided. The European commission states that "*the main environmental issues in towns and cities stem from the domination of oil as a transport fuel, which generates CO₂*" (European Commission 2008, p.2) and therefore concludes that energy efficiency and CO₂ reduction are the most important measures to achieve a sustainable transport sector (European Union 2011). Hence any political or economic action that achieves to reduce or minimize the emissions of the latter (e.g. through electro-mobility) is considered sustainable for the future of mobility. This thesis argues against this viewpoint and aims to illustrate that there are various other problems attached to heavy individual car usage which cannot be simply replaced by electric cars. Believing that a sole replacement appears insufficient, the focus of this thesis turns towards people behaviour and how it is influenced by social structures and personal attitudes. This chapter hence defines what the author means by "sustainable transport" throughout this work. Furthermore, it justifies the chosen research questions and the theoretical model applied throughout the research which emphasize the strong importance of values, attitudes and social relations.

The current imaginary – social and ecological problems attached to car usage

The first criticism of the current imaginary is its material intensity. Vienna is a place of "*specialized production, transformation and consumption*", no space of "dirty" resource extraction though (Weisz & Steinberger 2010, p.185). Yet, its absolute resource needs have been increasing since decades, with only a short interruption during the economic crisis of 2008. The promise of a "decoupling economy" (of material input in relationship to GDP output) can hence only be held in relative (%), yet not in absolute terms (Petrovic 2013). At the moment, the Austrian ecological footprint accounts for 4.9 global hectares (gha) per person, of which 1 gha is used for mobility and transport-related infrastructure (Footprint.at 2013). This footprint describes "*the estimated land area required to produce the resources we consume and to absorb the wastes we generate*" (Green Alliance 2005, p.5). Given that an average of 1.8 gha is considered sustainable, Austrian mobility uses too much global land mass to extract resources and fuels to feed their transport metabolisms. To understand the social-ecological implications of these local actions, it is crucial to examine the global hinterland of cities, where resources and goods are created (Hinterberger & Stocker 2004).

When looking at the concrete impacts of urban transportation, several shortcomings can be identified in former research. First, global implications of local transportation are not taken into consideration. Most studies exclusively focus on the effects of transport on urban climate and health-related issues. Second, ecological considerations are limited to greenhouse gas emissions resulting from the production and the consumption of transport vehicles. The various other ecological effects of transportation such as land-grabbing for resource exploitation and infrastructure building are commonly disregarded. Ecological and social well-being are thereby strongly interconnected, as many of these ecological problems will also create social costs (e.g. health problems, natural disasters, economic vulnerability).

It is not possible to fully grasp them, let alone to calculate them in monetary terms (Hinterberger & Luks 2001, p.110). Hence sustainable mobility does not only require a reduction of polluting output (waste & emissions), but also of material throughput.

The second criticism is related to the inherent un-urbanity of the current transport system. The definition of the term urbanity goes back to the Roman Empire. The term *urbanus* – urban thereby entails a number of characteristics describing the ontology of the old Roman city in times of the republic - the respective culture and lifestyle of its well-educated and bourgeois inhabitants and the socio-spatial structures they live in (Neumann 2002, pp.1–2, 11). There are many socio-cultural characteristics associated with the classical term urban such as tolerance, freedom, social networking, diversity, openness, politeness, and intellectuality among others. For the course of this chapter, some more space-related characteristics are considered that only entered the discourse in the 20th century. Within the socio-ecological and the polit-humanistic approach, the following characteristics are considered crucial to the definition of urbanity (Siebel 1994, pp.5–7; Neumann 2002): (a) Dense areas of living with a high concentration of population and built spaces, (b) Liveliness of spaces, (c) Interaction and discourses among citizens, (d) Heterogeneity of people and (e) Dialectics between privacy (individualism) and conviviality (collectivism).

Car-based mobility contradicts these characteristics in many ways. (1) First, because they have facilitated urban sprawl in the 1960s and 70s (supported by increasing income of middle-class families) and therewith decreased **urban density** (Tittle & Grasmick 2001, p.317). At the same time, the general density of housing occupation has decreased in Vienna throughout the last decades. This space appropriation represents the base for long-lasting car dependency and oil-price vulnerability (Weisz & Steinberger 2010, pp.187–188). (2) Another aspect is **liveliness of spaces** which is strongly connected to the aspect of **interaction and discourse** among people. Liveliness can only exist in spaces where people meet. A highway full of cars is not lively because cars are not living beings. And as much as the physical presence of human beings is the pre-requisite for liveliness, so it is for discourse and interaction. The denser a space is, the higher is the necessity to negotiate about its use, to get in contact and to exchange. Car traffic is so regulated (through universal instruments such as traffic lights, signs) that there's not much need for inter-personal interaction or interaction with the space as such. The issue of discourse becomes particularly important for the negotiations about the usage of and the right to urban spaces considering that power relations play a crucial role in infrastructure planning. (3) Furthermore, one can say that modern cities are places of enhanced **individualism** as opposed to the ideal of a **collective urban society**, as illustrated by the decreasing number of people per apartment for example. In a very individualist society, transport means are preferred that require no compromises, low interaction and maximal personal utility (regarding time, comfort, flexibility, freedom etc.). People therefore might support investments in car infrastructure, which are to their personal benefit, without considering the potentially negative impacts on social equity and sustainability. Urban mobility should however reflect the collective right of all citizens to access certain resources and infrastructure in an equitable and sustainable way (Harvey 2008, pp.23–24). To summarize this chapter, one can say that a *re-urbanization* of mobility in Vienna requires policies strengthening a sense of collectivism and conviviality, the reduction of urban sprawl, enhanced democratic discourses and creativity as to transform car-dependent structures and power relations.

Developing a new imaginary

Following the problem analysis of the current imaginary, a new idea of sustainable urban transport would need to fulfil two criteria. First, it should be low in terms of material intensity, hence dematerialized. The term “dematerialization” has first been brought up by Schmidt-Bleek in the 1990s. In a very broad and general way it can be defined as the idea of producing goods or services (such as mobility services) with decreasing resource flows as to diminish “human/societal/economic interventions into nature” (Aachener Stiftung Kathy Beys 2014; Hinterberger & Luks 2001, pp.111–116). Haberl et al. (2004) as well as Paech (2005) in turn define it as a “*separation of economic and social well-being from the use of biophysical resources*”. Furthermore, it can be characterized by a replacement of low-quality by high-quality material as to increase the durability and quality of goods (Herman et al. 1989, p.1). Given the impossibility of absolute recycling due to increasing energy and material entropy (Ayres 1999; Georgescu-Roegen 1975, pp.351–355), this thesis believes the concept of dematerialisation to be feasible only in combination with an absolute reduction of material-intense consumption. An absolute decrease can also be called “im-materialisation” (Li et al. 2010, p.265; Tapio et al. 2007). Based on the work of Buhl (2014) and the Finnish Ministry of Environment (Lähteenoja et al. 2006), the following order appears when ranking transport modes by their Material Input per Service Unit (MIPS, per pkm) (see appendix 2): (1) Walking, (2) cycling, (3) tram/metro, (4) buses and shared cars and (5) individual cars.

Second, an imaginary of sustainable transportation should be socially just and follow the ideas of urbanity as defined before, hence dense, collective, lively/animated and smart. This means that transportation should be usable for everyone independent of financial capabilities leading to a redefinition of the purpose of streets - away from car-exclusive to more collective multi-purpose spaces. This goes along with the criterion of density. If every transport participant (pedestrian, cyclers, and car drivers) uses an individual lane, much space is wasted. However, it is important to mention that to a certain extent, a separation also allows for higher safety of more vulnerable traffic participants and a higher speed of (also public) vehicles. Furthermore, sustainable transport should be more collective and succeed in bringing communities closer together which in turn could foster new social narratives of sharing and caring. Considering that urbanity and quality of urban life are characterized by high liveliness of spaces, a focus on transport means allowing for interaction (such as bicycles) seems desirable. In any case, decision processes should be transparent and democratic, hence a collective process of low hierarchies and very integrative discourses (Harvey 2008, p.38). And last, transport should be smart in the sense that it is adapted to specific characteristics (e.g. no focus on biking in mountain cities).

The overall goal would be that the societal idea of transport undergoes a cultural shift as to “*de-naturalize motorized individual traffic*”, hence de-normalize car usage (Manderscheid 2013, p.6). This new imaginary shall enhance the overall liveliness in the city by relying on collectivism, social inclusion, a localisation of the economy and true ecological sustainability.

Changing the imaginary – reversing history

The strong role that cars have within our current society is embedded in various historical developments. The subsequent section cars gives a brief overview of how cars as rather new mode of urban transportation have entered urban spaces and transformed urban culture by tracking both the historical roots and the current effects of this development.

A first influential factor was the rise of Fordism in the beginning of the 20th century. During this time, higher salaries and decreasing prices resulting from mass-produced goods lead to an increasing purchasing power and therewith consumption. It is evident that this new mode of production and consumption led to a rising material use in industrialized states (Herman et al. 1989). Throughout this time, car ownership shifted from a privilege for a few rich to a possibility for the broad mass. Yet, in the first days of the car, it was associated mainly with noise, congestion and traffic deaths (Manderscheid 2013, p.286) and was not socially-supported due to the high amounts of traffic deaths. But how did this change?

A second very influential factor was the pre-dominance of capitalism and its application on urban spaces in the USA. As explained by Norton, streets have been understood a *“public amenity for uses considered public”* until the 1920s (Pinch & Bijker 1984; Norton 2008). By 1930, streets have been transformed to *“consumer commodities bought and paid for by their users and to be supplied as demanded”* (Norton 2008, p.17). This transformation, led by the car producer and user lobby, has succeeded in creating waves of re-organization of the urban space. The freeing of streets from playing children and pedestrians was also justified by the gasoline tax which paid for the provision of these new infrastructures. The latter argument opposes the position that the success of cars is only caused by the respective demand and superiority of its technology (Manderscheid 2013, pp.285–287) and highlights the importance of power struggles and the successful link of the car with values such as progress and freedom. For the latter to happen, one particular event has been very influential. This event, the third influential factor, was the Futurama world exhibition in 1939/40. It was used as a big marketing scene by General Motors (GM) and aimed at attaching people emotionally to cars. Their intention was to shape people’s associations with cars, highlighting its role of promoting *“technological progress, social prosperity and freedom”* (Manderscheid 2013, p.287). They did this by visualizing a utopian car city, free from all social and economic problems of that time, leaving the people with a good feeling about the presented visions. And indeed, they succeeded in transporting a new - emotional - dimension to the use of cars. A fourth influential factor was the rising importance of the automotive lobby, consisting of car producing companies and car users. They convinced the public that the problem of congestion and traffic death is related to a mismatch of demand and supply. Their demand was hence that the state should supply adequate street infrastructure so that the automotive sector could flourish and fulfil the people’s demands (ibid).

The fifth and last factor is the one that links this formerly US-American story to the European continent. According to Norton, this happened in the post-WWII time, when Europe faced the outcomes of great destruction and the hope for a new beginning. Thereby, the American dream and its visions on lifestyle represented great hope for the time of reconstruction and was therefore easily absorbed.

As a conclusion of this development, one can say that it has required a large amount of political and social work to create the common association of car-driving with values such as freedom, individuality and progress among society. As a consequence, by now, *“it appears to be an inescapable desire of humans to privately own a car and to overcome geographical distances as fast as possible (...)”* (Manderscheid 2013, p.284). But at the same time, this story shows that attitudes and values are influenceable and that they are strongly shaped by social structures and institutions. This is the base for the theoretical framework of this work which looks at behavioural models of transport mode choices and their influence on policy-making.

3) *Theoretical Framework – Grasping Urban Transport Mode Choices*

A shift away from the old towards a new imaginary, requires new urban policies. The successful implementation of the latter, however, has proven to be highly problematic because people often did not change their behaviour as they were expected to do, which became visible in the case of Vienna. One main reason for this might be that the expectations (concerning human decision-making) were simply wrong or inadequate. Successful policy-making depends on adequate predictions which is why the study of human behaviour and the underlying decision-processes seem central to the discourse on transport policies in the direction of a new, more sustainable imaginary. This will be the focus of this chapter.

Within current research on transport mode choices, a variety of different theories and extensions of these theories exists². The first goal is thereby to give an overview of the very different sets of arguments on why people use cars (or not). The second goal is to illustrate that policy-making strongly depends on the chosen model of human behaviour. Depending on what assumptions one makes about the motivations for transport mode choices, the policy action will look differently. The third goal is to propose the extended TPB including the travel group segmentation developed by Anable as a valid opposition to currently dominant theories such as the RCT and the general TPB.

3.1) Overview of Mode Choice Theories with Focus on RCT and TPB

According to Ben-Akiva (1985, p.32), choice theories contain four elements through which they can be differentiated. These are (1) Who is the decision-maker?, (2) What are the considered alternatives?, (3) Which attributes of alternatives matter or are considered?, (4) What is the decision rule based on which the choice is made? The existing theories mainly differ in terms of the decision-maker and the decision rule.

The question of the decision-maker can be described with the structure-agency problem. There is an ongoing debate to whether humans are capable of making their own deliberate and independent choices or whether they are purely influenced and shaped by their social environment. This debate on whether behaviour is created through socialisation or autonomy becomes visible in the different behavioural theories. Thereby, it has to be noted that the possibility of a mixture of both is recognized. The question of the decision rule is the key element of each mode choice theory and is answered differently by each of them.

Whereas most theories (such as the RCT and the TPB as explained later on) assume people to make reasoned choices about their travel mode choice, some theories suggest that affective factors such as pleasure and associated emotions can be the most relevant ones (Steg 2005; Gatersleben & Uzzell 2003; Anable & Gatersleben 2005). Gibbons & Gerrard (1995) also criticize this reasoning-axiom by stating in their "Willingness Model" that some behaviours are purely emotional and caused by spontaneous desires. They thereby conclude that not all behaviour is predictable or well explainable because much of the behaviour depends on the behavioural willingness of a person in the specific circumstance that he/she

² A very general but comprehensive overview of this variety can be found in Darnton's reference report (Darnton 2008)

finds him-/herself in (e.g. social pressure going against one’s original intention). Other researchers have highlighted the importance of habit and trip-chaining, hence the complexity and amount of different trips made within the day (De Witte et al. 2013). Stradling et al. (2000) on the other hand argues that travel mode choices are made through the “*interaction of ‘opportunity’, ‘obligation’ and ‘inclination’*” (Anable 2005, p.66).

Rational Choice Theory & Critique

The theory of revealed preferences, also called economic consumer or rational choice theory is based on the main assumption that humans are rational actors. The centre of this theory – and the sole decision-maker - is the so-called homo economicus, an amoral individual agent. This model can be characterized by different axioms of revealed preference (Ben-Akiva & Lerman 1985; Gowdy & Mayumi 2001; Layard & Walter 1978), which are: (1) the invariance of preferences and wants, meaning that preferences stay constant for each type of decision throughout the time period of analysis (2) non-satiation, meaning that desires can never be totally fulfilled or satisfied and (3) lexicographic preferences meaning that people have a strict preferential order between the available alternatives. Besides these main axioms, the homo economicus is understood as a (4) individual self-interested decision-maker whose choices are not influenced or dependent on its social or ecological environment. Furthermore, it is assumed that this rational man (5) has access to full information, for example about all the different transport modes and their respective cost and other characteristics. Based on this full information and the revealed preferences, rational choices can be made without uncertainty, knowing about all consequences and impacts resulting from that choice. Within the RCT, considered alternatives are all these that are technically and personally feasible or accessible. This feasibility includes both the availability of certain infrastructures as well as personal abilities (in terms of health), legal requirements (e.g. driver’s license) and financial abilities. In most studies, this includes cars, different public transport modes, cycling and walking. There are various studies aiming at determining which exact factors influence the level of utility gained from car usage and its respective alternatives. Ben-Akiva among others only considers instrumental factors such as travel time, travel costs and comfort to be relevant for his model (Ben-Akiva & Lerman 1985, p.32); Jain et al. (2014) would add the safety dimension to this list. Redman et al. (2013) defined a set of physical and perceived quality attributes, as illustrated in the table below. This is used within the RCT by saying that people use these variables to calculate their personal utility for the respective transport modes. As described by Clifton & Handy (2001, p.4), “*choices that individuals make about travel depend on the utility of each alternative relative to the utilities of all alternatives*”.

	Attribute	Definition
Physical	Reliability	How closely the actual service matches the route timetable
	Frequency	How often the service operates during a given period
	Speed	The time spent travelling between specified points
	Accessibility	The degree to which public transport is reasonably available to as many people as possible
	Price	The monetary cost of travel
	Information provision	How much information is provided about routes and interchanges
	Ease of transfers/ interchanges	How simple transport connections are, including time spent waiting
	Vehicle condition	The physical and mechanical condition of vehicles, including frequency of breakdowns
Perceived	Comfort	How comfortable the journey is regarding access to seat, noise levels, driver handling, air conditioning
	Safety	How safe from traffic accidents passengers feel during the journey as well as personal safety
	Convenience	How simple the PT service is to use and how well it adds to one's ease of mobility.
	Aesthetics	Appeal of vehicles, stations and waiting areas to users' senses

Table 2: Quality attributes of Public transport or transport alternatives in general, source: Redman et al. (2013), p. 121

Environmental and other attitudes as well as social norms are not considered explicitly within this model. Nevertheless, they are included implicitly through the role of preferences. If my social status or reputation (as an ecologist for example) is related to a certain mode choice (e.g. biking), then this influences one's preferences in a way that I gain a higher utility from biking. Hence every choice is understood to be rational because of the "black box of preferences" which are just there and are revealed through specific behaviours or decisions. The origins of preferences as such are therefore not studied, also because they are considered "*exogenous to the model*" (Darnton 2008, p.5). At best, they are explained as consequences of "*differences in people's attitudes and personality traits*" as done by Johansson & Heldt (2006).

The main point of critique of this model is its assumption that people decide based on their personal utility-function, independent from any social, cultural or environmental context. This displays the strong methodological individualism commonly applied in economics. The role of institutions as an important factor when taking decisions is completely disregarded. For the transport sector, this means that it is not imaginable that someone uses a car even though it might not represent the most rational, utility-maximizing option for him. Different psychologists, sociologists and behaviouralists have dealt with the axiom of rationality and found evidence that most preferences are endogenous, deriving from "*social context, individual histories, and conscious preference development*" (Anable 2005; Büchl-Krammerstätter 2009; Gowdy & Erickson 2005, pp.213–214). Tversky and Kahnemann among others have shown that framing has a high impact on people's decisions, falsifying the axiom of preference invariance (Tversky & Kahneman 2007; Gowdy & Mayumi 2001; Angner & Loewenstein 2009). The second axiom of non-satiation seems particularly interesting for transport mode choices and is strongly related to the dogma of unlimited growth. This axiom has already been proven wrong for material needs, yet it seems even more impossible for transport services. All services by definition require an input of time from the part of the consumer. Considering that available time is limited, service desires cannot be infinite. This axiom hence contradicts our biophysical limits. Furthermore, it is to be mentioned that the notion of infinite wants is not universal throughout all human cultures. This shows that it cannot be a characteristic of a so-called "human nature" (Mayumi 2001, pp.8–10). The axiom of full information assumes that everyone is aware of all the different available alternatives as to assess their qualitative attributes and from that calculate the utility function. These functions however might be completely wrong considering that mainly past experiences are taken into consideration. A bus ride might have been terribly uncomfortable during rush hour in summer, leading me to the conclusion that the comfort utility from buses is very low. This generalization based on incomplete information however leads to irrational decisions. Other studies that reveal that car users systematically underestimate travel time and costs by car while overestimating travel time and costs for alternatives support the critique on human rationality (Innocenti et al. 2013).

General Theory of Planned Behaviour & Critique

Interestingly, most economists even acknowledge the findings from experimental economics, psychology, and anthropology among others that conclude that psychological and sociological factors have a strong influence on transport mode choices. Nevertheless, economists and policy-makers continuously consider this model unalterably as the basis for policy-making by arguing that it still "*captures basic features of decision-making*" (Gowdy &

Mayumi 2001, p.224). Following this contradiction, one can conclude that a new model needs to be applied when aiming at developing effective and realistic policies for a socio-ecological transition of the urban transport sector. Many theories have been built upon this knowledge (Eriksson 2008; Donald et al. 2014; Steg 2005). The alternative which will be presented subsequently is the extended TPB as developed by Ajzen in 1991. The TPB is a theory of attitude-behaviour relations which explains mode choices through a set of multidimensional attitudes, values and norms that influence people’s intentions and therewith their behaviour. It thereby assumes that travel mode choice is a reasoned process based on attitudes and barriers to different behaviours. The illustration below shows the general model of the TPB.

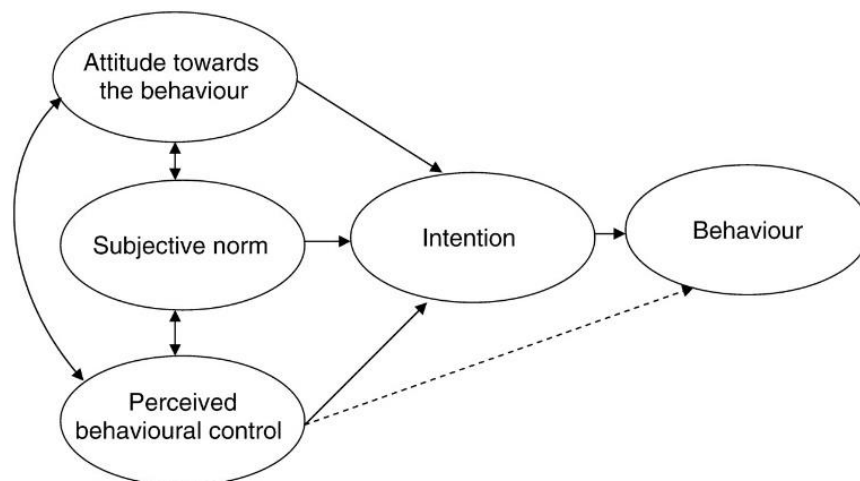


Figure 3: The Theory of Planned Behaviour by Ajzen, source: <http://hsm.sagepub.com/content/23/2/47/F1.large.jpg>

Attitude includes the general reflection or opinion about a particular behaviour or choice regarding the desirability of expected consequences when choosing it (such as: when choosing a bus, I expect to stand in a shaking, crowded, hot vehicle). *Subjective norms* describe the perceived social pressure to make a certain choice (Steg 2005). *Perceived Behaviour Control* (PBC) is defined as the “a person’s self-rated ability to perform a particular behaviour” in terms of capabilities, abilities and resources. This can be a very subjective judgment on one’s ability such as “I’m physically incapable of riding a bike up this hill”, influencing the likeliness of a certain choice. According to PBT, a transport mode is chosen if it is perceived positively, if users feel social pressure to use it and have the required skills to use it. As stated by Ajzen (1991) and Donald et al. (2014), the TPB considers behavioural intention to be the decisive factor within transport mode choices. By stating that “*intention is strongly related to behaviour*” it is assumed that “*if intention can be predicted, behaviour can also be predicted*” (ibid, p. 40).

One common critique is related to the assumption that all behaviour is based on some sort of intention through a process of reasoning. While this is surely a useful critique, it seems hard to apply this to policy-making which always require a certain level of prediction about people’s reactions to a certain policy change. Reisch et al. (2008) also criticize that this model ignores a vast range of emotions (such as indignation, anger, guilt, excitement) that are involved in decision-making processes. Furthermore, the TPB was criticized for their proximity to classical consumer theory in the way that it assumed people to behave based on a reasoned (hence somewhat rational) process, which assumed people to be expecting, evaluating and maximizing (ibid).

3.2) Policy Challenges Resulting from Behavioural Models

The following subsection tries to illustrate the policy-relevance of the behavioural model applied within (sustainable) transport policy-making. This sub-chapter relates to the third research question by asking how politics can adopt a certain behavioural model into policy-making. Depending on the assumptions made about human behaviour, the answers to this question will strongly differ. Hence, no policies should be implemented without considering human decision-making processes. But as shown within chapter 3.1, various – strongly differing – understandings exist which lead to totally different policy conclusions. This sub-chapter aims at giving a brief overview of the policy-implication that could be derived from adopting either the Rational Choice Theory (RCT) or the Theory of Planned Behaviour (TPB) in urban transport planning. The policy measures mentioned in the subsequent part are derived from different sources; they are based on desk research both about the assumptions made within the model and the respective policies proposed. Therefore, the different articles or books applying one of the two behavioural models were screened or their concrete policy proposals. Some policy implications are also derived from the attendance to public lectures or discussions and lectures within the Master’s course of “Actors, Behaviours and Decision-Processes” at the Vienna University of Economics and Business.

Policy-implications of the RCT as to reach new imaginary

As described previously, RCT assumes people to make choices based on the mathematical calculations of their personal utility. The utility however strongly depends on the Black box of preferences which do not change and cannot be understood but only revealed through respective choices. Therefore, policy-measures proposed within this frame are built on this axiom of rationality. Accordingly, the new imaginary (or more sustainable mobility) can only be reached by decreasing the utility derived from car usage and respectively increasing the utility derived from using alternative modes. Given that the utility function only considers instrumental motives for transport mode choices (the “rational motives”, hence time, costs, comfort, reliability, actual safety etc.). The goal of policies based on this model are to improve the quality of transport alternatives in respect to these aspects and to ensure that information on all transport modes are available. More concretely, policies based on the RCT could include:

- Investments in infrastructure as to increase the utility of non-car transport modes (Hiess 2013)
- Investments in new and more sustainable technologies (Black 2010)
- Higher prices of unsustainable modes of transport and vice-versa (ibid)
- Increase the comfort and convenience of public infrastructure (higher frequencies, reliability, temperature etc.) (Chang & Jay 2012)
- Inform people about the social and environmental consequences of their transport mode choices to increase their level of information.
- Use social marketing measures to change people’s unknown preferences (Barr et al. 2011)

Policy-implications of the TPB as to reach new imaginary

The TPB on the other hand assumes people to make their choices based on intentions which are an aggregate or consequence of personal attitudes, social norms and the perceived (not necessarily real) behavioural control. Hence policy-proposals based on this theory aim at

changing people's attitudes towards different transport means (by acknowledging that these attitudes might derive from very irrational sources such as personal experiences, word-to-mouth propaganda, social status etc.) and therewith eliminate those behavioural controls. Because people are not assumed to be rational but rather a product of their social environment, many policies based on this theory target the underlying values and norms of people's decisions and the social structures people are embedded in. Policies based on this theory, among others, are:

- Engage people in debates and public discourses & encourage building of environmental values
- Increase awareness on negative effects of undesired behaviours, at the individual and societal level as to influence social norms (Ellingsgaard et al. 2013, pp.7–8)
- Limitation of car-related advertisements as to decrease importance of media and social pressure (proposal brought up within the Degrowth Conference)
- Instead: base marketing around imitation around environmentally-friendly transport for reputation and status-seeking (van den Bergh, 2011, p. 884)
- Positive agenda encouraging optimism rather than fear and despair (Monbiot 2014)

As stated before, the Viennese government strongly follows the rational-choice approach, assuming people to deliberately decide for their preferred mode of transportation. As stated within the ontology, this thesis does not believe in unbounded human rationality and strongly beliefs in the importance of social relations and institutions within decision-making. The purpose of this thesis is hence to test the segmentation model that Anable has been built upon the extended TPB. This will be done within the empirical study, undertaken for the concrete case of Vienna.

3.3) Extended Theory of Planned Behaviour by Anable

Several authors have aimed at extending this theory as to include factors that influence behavioural intention such as different types of norms and the belief in other people's willingness to cooperate in making transport more sustainable. Furthermore, there have been efforts to include habit in the model as to acknowledge research showing that the impact of intentions, attitudes and norms is weaker when car-use is a strong habit (Klößner 2013; Eriksson 2008; Donald et al. 2014; Anable 2005). For the further course of this thesis, this expanded model as applied by Anable has been used due to its greater realism and comprehensiveness. The model she has developed is based on several ground: it uses the TPB as a general basis but also derives segments from other literature on transport psychology and furthermore got informed by observations and focus groups undertaken with visitors of the Trust Fund properties. Both extensions (by Donald and Anable) are very similar and follow the scheme of the model illustrated in Figure 4 underneath. The decision-makers are thereby believed to be partly rational in the sense that they make reasoned choices based on the different values attitudes and intentions (Anable 2005). However, they are not understood as isolated individuals making self-interested choices but rather as strongly embedded in social interrelations and a specific cultural and spatial environment, which is believed to influence their attitudes, norms and values. Therefore, cars are believed to not only fulfil instrumental functions (such as fast transport) but also symbolic and affective functions (e.g. status or pleasure) (Steg 2005).

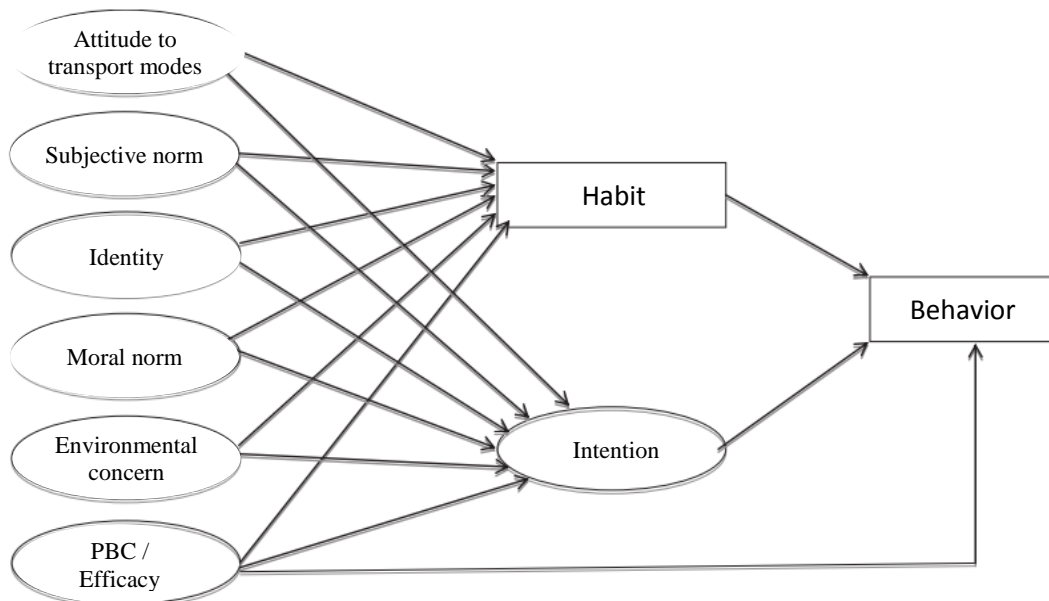


Figure 4: Model of Extended Theory of Planned Behaviour, source: author's drawing, based on: Anable (2005) and Donald (2014)

The expanded TPB argues that five additional factors strongly influence someone's intention and therewith the person's behaviour. These factors are (1) Moral norm, (2) Environmental concerns, (3) Efficacy, (4) Identity and (5) Habit. Moral norm thereby describes the feeling of personal commitment or obligation to contribute to environmental issues in this case. Environmental attitudes relate to one's worldview and knowledge about environmental problems which eventually lead to moral norms, hence a sense of obligation to live environmentally-friendly. Efficacy is strongly related to the PBC and describes the belief about how much can be achieved when living environmentally-friendly. Identity is meant in the sense that the behaviour of other people influences one's behaviour, according to some studies even more than subjective norms in form of social pressure. Habit is used as a sort of barrier to behavioural intention. Once behaviour is habitual, chances are lower that attitudes or norms will change it.

Anable's main contribution in her work is not the model as such, which has been developed by integrating various studies undertaken by different researchers into the TPB. Her main contribution is the establishment of segments, hence groups of people that in her view share a common and unique "combination of preferences, worldviews and attitudes" (Anable 2005, p.65). This derives from the standpoint that there is "little point in addressing the average consumer" because it does not exist (ibid). This acknowledges that the same choices (=car usage) can be made for very different reasons, whereas the same motivations and worldviews can also lead to different behaviours. If policies are designed for such an average consumer they might fail because they do not really address nobody except for the impersonal statistical average of the aggregate. Throughout her research, she has undertaken questionnaires which have been analysed using a cluster analysis method. The goal was to identify groups that vary significantly regarding the different factors included in the model, hence different attitudes, norms etc. and the resulting intentions and behaviours. Within this study, 666 questionnaires have been answered by visitors of properties of the National Trust Fund which are situated near Manchester, in the Northwest of the UK. These properties are assigned national conservation heritage and are a popular site for 12 million

yearly visitors. Given this popularity, the responsible managers faced the problem of conserving natural landscapes on one side while on the other hand inviting – often motorized – visitors to enjoy this area which creates a paradox relationship. People have to act environmentally unfriendly to enjoy a site of natural protection. In order to reduce the amounts of visitors arriving on their site by car by offering viable alternatives, Anable's study was done in order to understand the *"motivations, constraints and attitudes of its own visitors"* (ibid, p. 68). The study as such was done before 2004, a clear time frame is not provided within her article. The sample population has been approached at the entrance/exit of a National Trust Fund property. They have been asked to answer a short intercept survey (which has been conducted by 1.222 respondents). Of those 1.222 respondents, 666 agreed to take the longer questionnaire home and later returned a usable survey. The longer questionnaire consisted of 105 attitude statements, plus 25 statements on "life values" as defined by Rokeach (1968) and 9 statements on potential policy options within the Trust Fund properties. The answers to all these statement have then been entered a Factor Analysis (Principal Component Analysis) in SPSS to *"identify the smallest number of sets of highly correlated variables and to create a set of factors to be treated as uncorrelated variables in further analysis"*. Thereby, seventeen factors with a high internal reliability (Cronbach's Alpha > 0,65) could be derived which have been used for the cluster analysis. The cluster analysis procedure Anable applied (Two-stage approach: first a hierarchical analysis, then a non-hierarchical K-means procedure) has been followed throughout this research. Therefore, a more detailed description of the undertaken procedure can be found within chapter 4.2. The finished cluster groups have then also been profiled and compared with regard to the attitudes and values of the respective groups.

Throughout her research, six groups of car users have been identified, of which four were car-owning and two non-car-owning (ibid, pp. 69-74). Briefly described, these groups are:

- (1) *Malcontent Motorists* (30%) use the car although they feel are increasingly frustrated in doing so. They strongly intent to change their behaviour but feel restricted in their intention because of bad infrastructure for example.
- (2) *Complacent Car addicts* (26%) would theoretically have alternatives to car usage but feel no obligation or incentive to change their behaviour. Behaviour follows internalized habits and they see no reason why car usage should be reduced.
- (3) *Aspiring Environmentalists* (19%) do not want to give up car usage entirely but have already diminished their usage considerably or never used it much.
- (4) *Die Hard Drivers* (18%) have no intention at all to change their transport behaviour and feel very reluctant towards all other modes of transport. They claim to be very concerned about environmental problems, yet they show the highest level of car dependency.
- (5) *Car-less Crusaders* (4%) do not use cars for values such as environmental concerns.
- (6) *Reluctant Riders* (3%) would likely own a car if health & financial reasons allowed for it.

Based on these groups, Anable has set up a table illustrating the drivers to use alternatives to the car, constraints on using these alternatives, the chances for a future switch and the policies that could address the respective group based on their particular characteristics (Anable 2005, pp.76–77). The results can be found in Table 3. These policy implications will be discussed in more detail for one specific cluster group in chapter 6.2. Therefore, the subsequent empirical study done in Vienna aims at testing whether this model could be a fruitful contribution to transport policy-making in Vienna (Research questions Q1 and Q2).

	Drivers to use alternatives	Constraints on using alternatives	Change potential	Policy Options
Malcontent Motorists	*Congestion (negative attitudes towards the car) *Moral obligation to use the car less	*Perceived control *Psychological attachment to the car	Moderate	*promote moral obligation and positive qualities of PT *promote negative aspects of cars
Complicit Car Addicts	*Positive qualities of PT	*Psychological attachment to the car	Low	*Education into negative effects of car use and the monetary costs of car use
Die Hard Drivers	None	*Weak perceived control *Lack of moral imperative *Strong behavioural and social norms *Strong car attachment *Unfavourable attitude towards all alternatives	Very Low	*Weaken stereotypical images of PT users *Hard push measures (non-fiscal)
Aspirin Environmentalists	*High moral norm *Strong perceptions of efficacy *Positive attitude towards PT *Some negative views of car *Slightly favourable norms *Wants to set example	*Strong perceived control *Attachment to practical benefits of car use *Actual behaviour control *Lack of knowledge of where alternatives exist	High	*Promote positive aspects of alternatives (fitness, adventure, fun for children) *Reinforcement of environmental message *Promote the difference individual actions can make *Provide alternatives to the car & information on the latter
Car-less Crusaders	*High moral norm *Strong perceptions of efficacy *Strong perceptions of control *Positive behavioural and subjective norms *Pos. attitude to PT	*Actual control (lack of alternatives and some age/fitness problems regarding cycling)	Very High	*Provide alternatives to the car *Information on alternatives will be used *Reinforcement of environmental message *Reinforcement of + aspects of PT and bike
Reluctant Riders	*Lack of car ownership (actual control) *Moderate moral obligation to use car less *Some positive views on public transport	*Weak perceptions of control *Fondness of car travel	Very High	*Promote positive attributes of PT and coach travel (scenery, sociability, relaxation) *Provide information on alternatives

Table 3: Anable's group segmentation and derived policy options, source: Anable (2005), pp. 76-77

4) Methodology

4.1) Ontological, Epistemological and Methodological assumptions

Within the course of this research, several ontological and epistemological assumptions underlie the theoretical analysis and empirical application. They strongly influence the course of argumentation and therewith leave room for wide-spread criticism if not made explicit. To avoid this and to give a clearer picture of what I consider to be the existing unities of the world system, I subsequently aspire to make my ontology and epistemology explicit.

Ontology

At first, one important assumption is those about the relationship of nature and society. I consider society to be no separate unity that only serves as a supplier of services such as resource and life provisions and sink opportunities. I rather perceive society and the economy to be part of and dependent on the environment. Nevertheless, it ought to be said that the environment's health also depends on our social, political and economic decisions, in a way that humanity would in theory be capable of destroying the world's biophysical functioning or stability (Røpke 1999, pp.400–401). Another aspect of this world view is the strong linkage between society and the economy. Whereas most researchers consider the economy to be a sub-system of the society, I find them to be strongly intertwined (cf. Spash, 2012). There is barely any part of society not being part of at least some economic decision-making, but evidently, there could neither be an economy without the society constructing and shaping it. This ontological assumption explains the inclusion of (behavioural and macro-) economic theory within this thesis; it is considered an important aspect of all socio-ecological problem and therefore part of the solution. Most socio-ecological problems can be understood as a consequence of perceiving the economy, society and the environment as separated and isolated sub-systems with a very anthropocentric view on the environment. Spoken more metaphorically, all humans are sitting in the boat called nature. By using natural resources as if they were "just there to serve us" one forgets that they keep our boat floating. The subsequent illustration visualizes this conceptualization.

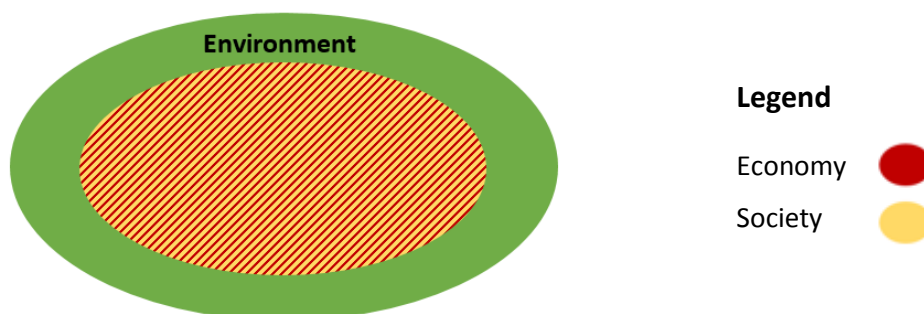


Figure 5: Illustration of my ontological assumptions, source: self-made

Second, the unit of observation is the individual, yet the individual is perceived as strongly embedded in a certain cultural, social, historical and political context. This assumption deviates from the methodological individualism that is commonly adopted in neoclassical economics and assumes that people make choices independently of each other (Gowdy & Erickson 2005, p.212; Hodgson 2008, pp.128–129). Furthermore, the relationship between

the different entities is perceived to be non-mechanistic. Just because one variable changes (e.g. price of fuel), it doesn't necessarily lead to a determined change of another variable (e.g. car usage intensity).

Third, the individual as such is understood to be non-rational in their decision-making which differs from the current economic understanding of a homo economicus of revealed preferences. The author believes that all these axioms are culturally transmitted and neither objective nor value-free. It is therefore assumed that people can indeed change their behaviour if values, desires or preferences change. Similarly to this, it is assumed that the consumer's material desires and preferences are created by a certain societal image and values which appear real in the respective context but are socially constructed after all. In this process, formal and informal institutions play a crucial role.

Epistemology

Concerning my epistemological assumptions, I follow Spash's idea of a critical realist science (Spash 2012; Sayer 2009). Each policy makes predictions about human behaviour based upon assumptions about the latter - this is inevitable. These assumptions can be reduced to very little aspects making them easy-to-apply for policy-modelling, yet highly unrealistic. Thereby, the sum of the parts is considered to equal the whole, meaning that the behaviours of the whole society can be understood by studying the individual behaviours. On the other end of the spectrum, assumptions can correspond highly to the real human behaviour by taking various factors into account, yet this makes any type of generalization (up to any scale) difficult, which in turn precludes any fast and effective policy-making at the urban scale. Within this understanding, the whole is larger than the sum of all individual parts. This means that the behaviour of the society cannot be understood by studying the individual behaviours and motivations alone, because there are additional factors such as interdependencies, social relations, norms and institutions that strongly influence societal behaviours. Considering that a full understanding of all factors influencing behavioural choices is impossible to attain, this thesis will position itself somewhere in the middle. Being aware of the limitations of too reductionist and generalizing research methods, both seem necessary to a certain extent for the overall purpose and practical adequacy of this thesis (Sayer 1984, pp.56–57). Nevertheless, this thesis does include systemic aspects of transport mode choices into the research as to develop a more realistic understanding of complex human behaviour. It seems thereby important to mention that no statement made within this thesis is supposed to be perceived as universally or objectively true. The notion of objective and universalist social sciences is rejected, which can be argued by the fact that all social scientists face the problem of double hermeneutics as discussed by Andrew Sayer (1984; 2000, pp.17–18). Therefore, no social science can be free of misinterpretations and inaccuracies due unavoidable social interactions as part of the research process.

Methodology & Methods

The knowledge as such is created in an inductive way, meaning that it is derived from the empirical study. This seems appropriate when studying human behaviour because it is subject to change depending on the respective cultural, historical, political and economic context. Therefore, only empirical research can identify current motivations of decisions and behaviours.

In line with the first purpose of the study (Q1 and Q2) – to make somewhat generalizing statements about different aggregates of people (segments / groups) in Vienna – a quantitative set of methods is used. More concretely, questionnaires have been chosen that have then been analysed using statistical cluster analysis. For the second purpose of the study (Q3) – to find out about the existing and potential future integration of behavioural knowledge into policy-making – a qualitative set of methods is used, namely system-mapping as a way to illustrate inter-relationships between different variables and actors.

4.2) Methods of Data Generation & Analysis

The choice of transport modes for daily commuting is a complex process due to the variety of possible choices (transport means) and the large sets of possible reasons to choose one or the other (Beirão & Sarsfield Cabral 2007, p.480). These reasons in theory display either rational (infrastructure or time-/cost-related) or emotional (value-/attitude-/habit-related) motives or a combination of both. For them to be analysed, a mixed-methods approach, hence a combination of quantitative methods (questionnaires) and qualitative methods (systems-mapping) seems beneficial (Clifton & Handy 2001; Cook & Swyngedouw 2012). Quantitative methods are advantageous as to ensure a certain breadth of analysis. In the course of this thesis, this is important as to identify the different groups of travellers with distinct attitudes, norms, travel motivations and other characteristics. Aiming at developing a tool for more effective policy-making, the qualitative analysis will look into one of the identified sub-groups with a systems-mapping approach as to identify the potential drivers of change or the basis for policy intervention.

a) Questionnaire development & performance

The survey design has been guided by different studies found within the available literature (Anable 2005; Beirão & Sarsfield Cabral 2007; Tertoolen et al. 1998). Different readings focussing specifically on the design of quantitative surveys have also been taken into consideration (Punch 2005; Haas 2014).

The survey covered eight different questions with various sub-statements dealing with the aspects covered within Anable's extended Theory of Planned Behaviour that ought to be tested. As stated before, this theory includes three levels: (1) the factors influencing intention, (2) behavioural intentions and power of habit as intention-restricting aspect and (3) the actual behaviour. The potentially influential factors within (1) are (a) attitudes towards the different means of transport, (b) subjective norms, (c) moral norms, (d) environmental attitudes, (e) efficacy, (f) identity and (g) perceived behavioural control (Anable 2005, p.68). Surveys have been chosen as an appropriate method because they allow gaining quantifiable data on rather qualitative questions about people's choices, motivations and socio-spatial interactions (Haas 2014, p.7). The survey questions have been posed in German, considering that many, especially older Austrians are not comfortable answering in English, which would complicate the study. An English translation of the whole survey can be found in appendix 1.

Before the actual conduction of the survey, a pre-test was made within the ninth district. The goal was to test whether the questions are understandable for all respondents, whether it's possible to answer them within less than ten minutes and whether the selected locations are suitable to meet potential respondents. This pre-test was done with 25 surveys and led to several changes within the survey design as to also include insight from the respondent's answers that could not be covered within the first version of the questionnaire.

The case study was undertaken both online and in-person to reach different types of respondents and increase the variety of answers given. As to make sure that the study covers people with different type of travel motivations, hence both instrumental and affective factors, respondents from different areas of the city were addressed. All in all, about one third (31%) of all surveys have been done in person asking people in the streets. This was done with the aim of reaching a bigger variety of age groups and not only students. The location of the personally conducted surveys were chosen with respect to different criteria: (1) a central district which is characterized by excellent public infrastructure as to include affective factors (therefore, district nine has been selected, although some respondents did not actually live there), (2) places of high public relevance to meet enough potential respondents. These locations were chosen due to its high relevance throughout all age groups and social classes. Adequate places were supermarkets, small shopping streets, residential areas and public spaces including restaurants and cafés. A map illustrating the chosen locations can be found in Figure 6. . To ensure that people from different life stages are met, the surveys have been conducted at different days and times. A list of the chosen time frames can be found in Table 4.

	Date	Day of the week	Time frame
1)	26/06/2014	Thursday	5pm to 7pm
2)	28/06/2014	Saturday	11am to 3pm
3)	29/06/2014	Sunday	10am to 12am
4)	30/06/2014	Monday	2pm to 5pm

Table 4: Time frame of survey conduction, source: author's notes

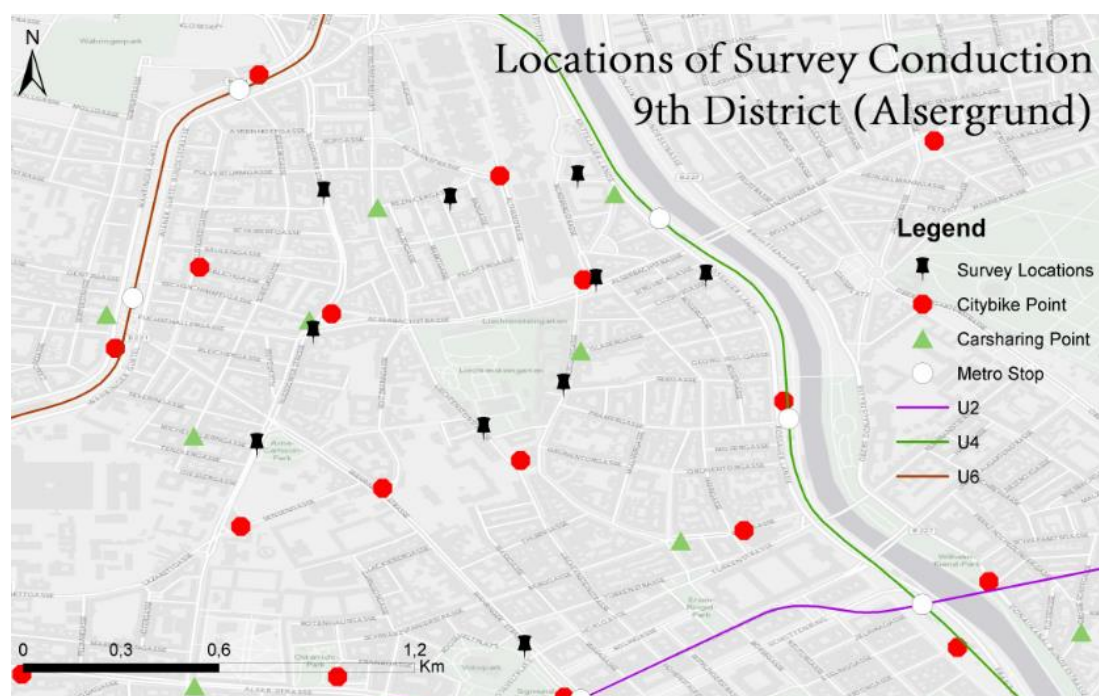


Figure 6: Map of chosen locations for survey conduction, source: author's drawing, data: <https://open.wien.at>

Apart from that, the surveys have also been published online, in a Vienna-specific group on Facebook. Facebook as widely used social medium allowed to reach a high diversity of potential respondents, although generally, the online survey was done by rather younger

respondents. The online survey attracted respondents from all 23 districts. In total of all surveys, about half of the respondents (52%) live in one of the central districts (1-9; 20) with generally good access to fast public infrastructure. The other half (48%) live in one of the out-lying districts (10-19) or the peripheral districts (21-23) with lower quality of public transport infrastructure. This division seems adequate to reach a variety of mode choice motivations.

Another important aspect of the conduction of the survey was the selection of suitable participants, representing a large share of the population of the selected district. The selection criteria have been defined based on the study undertaken by Beirão and Cabral (Beirão & Sarsfield Cabral 2007, pp.479–481). The most important aspect was to investigate both car-users and non-car users as to clearly identify reasons for the respective mode choice. Another criterion was to find respondents from all different age groups between 18 and 70, as to represent different life stages (student, working /unemployed, retired) and the transport choices they favour. However, the emphasis was put on younger people due to the fact that their habits are not as set yet and because of a certain probability that they might still buy cars throughout their life-time to come. A certain level of gender equality was also considered within the paper version, although more women filled in the online survey, which could not be influenced. The following table displays the distribution of respondents throughout age groups and the other selection criteria.

	Car-owners	Non-car-owners	All
All	123	63	186
Female	76	45	121
Male	47	18	65
Age groups			
18-25	43 (35%)	36 (57%)	79 (42%)
26-40	50 (41%)	22 (35%)	72 (39%)
41-65	27 (22%)	5 (8%)	32 (17%)
> 65	3 (2%)	0 (0%)	3 (2%)

Table 5: Distribution of respondents regarding age and gender, source: author's calculations

b) Statistical Analysis: Cluster and descriptive analysis

For the analysis of the survey data, different statistical tools have been used. In a first step, the data have been conditioned to conduct a cluster analysis in SPSS. This was done with the aim of testing whether a segmentation (=development of meaningful groups of traveller types with distinct sets of attitudes, motivations and worldviews) as conducted by Anable is possible in the case of the generated data from Vienna. In more detail, this involved the following steps of data preparation and analysis.

1) According to the 17 factors that Anable received through the factor analysis in a statistical program, I sorted my questions and sub-questions and allocated them accordingly. Column two in the table below shows how many questions or sub-questions have been allocated to each of the factors. Then, the values for each category have been calculated. An important step thereby was to check whether for each category, the same scoring scale was used. Generally, all factors have a score from 1 to 5. Thereby, 1 represents the most pro-environmental and anti-car sentiments whereas 5 represents the most car-affine sentiments.

Some of the answers needed to be “turned” (=6 – x) as to fulfil this criterion. Not all 17 factors have been used within my analysis; three have been excluded, four additional ones have been added (the last four in the list). The used factors are as follows:

Factor	Nr. of questions loading on factor
MORALS – moral obligation to use the car less	1
ATTACH – attachment to the car for leisure	2
ENJOY – enjoyment / pleasure of driving	2
EFFICACY – belief in making a difference with one’s behaviour	2
PBC - perceived behavioural control	5
SACRIF – willingness to pay for pro-environmental behaviour	1
EXTERNL – perception of negative effects of car use	3
SNORMS – influence of social norms on behaviour	3
PROCAR –attitudes towards cars / belief in freedom to use it	3
CYCLING – attitudes towards cycling	3
GREENID – green identity	3
NATURE – view on or value of nature	1
ECOPUR – “green” purchasing choices	2
INTENT – intention to reduce car usage	4
INSTR/AFF – role of instrumental vs. affective factors	11
HABIT – degree of internalization of behaviour	7
POLIC – openness to policy-proposals aiming at reducing car usage	6

Table 6: Factors included in the cluster analysis, source: author’s illustration, based on: Anable (2005), p. 70

2) Based on these calculations, a large excel table was generated consisting of 186 lines (one per respondent) and 18 columns (the value of each respondent for each of the 18 factors). An additional column was added to the list including the information on the amount of cars in the household of each respondent. The table has then been split into two: car-owners and non-car-owners. Not having access to a car is such a strong actual behaviour control that it could outweigh any attitudinal factors. Therefore, two separate excel sheets have been made to be able to conduct a separate cluster analyses for each of the two categories.

3) These factors have then been entered into SPSS to conduct a two-way cluster analysis. First, a hierarchical cluster analysis was done using the Ward-method and the Euclidian distance. The Ward linkage was used to determine the most suitable number of clusters where the distance between the cluster groups is maximal and the distance within the cluster groups minimal. This ensures a high meaningfulness of the created cluster groups. Knowing the best number of clusters, the second step was to conduct a non-hierarchical cluster analysis has been conducted using the k-means method. This method has calculated the centres of each cluster with the shortest distances between all cases within the respective cluster. The result of this can be found in Table 10.

4) The ANOVA test has been conducted to calculate the significance of the created clusters. High significance values show that both the size of the groups and the distances between the different groups are meaningful enough to consider the retrieved groups as different enough from each other.

5) In a later stage of this part, the segments have been analysed using descriptive analytical methods as to analyse the received data for each respective group. Thereby, each of the seven groups will be characterized in more detail regarding their specific scoring on the different factors. This will be contrasted to Anable’s cluster group results.

c) System-mapping for policy proposals

The last step within the methodological work will allow to build a bridge between the results from the statistical survey analysis and the objective of making policy-proposals which are strongly based on the behavioural knowledge derived from the surveys as to move towards a new imaginary of urban transportation. This method makes use of a system-thinking approach, which allows to identify and visualize the complexity of the topic of urban mobility for example (Videira et al. 2014). Thereby, system maps are defined as conceptual toll allowing to trace “causal chains of effects [...] through a set of variables characterizing a dynamic issue” (ibid, p.61). This in turn can be of great avail for policy-makers as it allows to see and consider the greater picture around a very specific field of policy-making. Furthermore, it also allows to identify a larger amount of potential actors within the decision-making processes (Sekulova et al. 2013, pp.60–61) and understand the various impacts a single policy measure can have on these actors. This can also include potential negative side-effects that need to be considered before implementation.

Within the course of a research seminar in Barcelona³ I worked with two other researchers using the system-mapping method (also called Causal-loop diagram) and a program called “MapSys”. The goal was to approach the topic of car usage in urban areas.

Within the map, the various variables and their respective causal relationships and interdependencies are illustrated through arrows containing a positive or negative polarity. Positive polarity (+) describes a same-type relationship, whereas negative polarity (–) describes a reverse relationship, meaning that:

Positive polarity	=	If A ↑, then B ↑	AND	If A ↓, then B ↓
Negative polarity	=	If A ↑, then B ↓	AND	If A ↓, then B ↑

³ The seminar was part of a summer school for young researchers organized by the Research & Degrowth (R&D) institute of the Universidad Autonoma de Barcelona

Thereby, feedback loops represent an important type of relationship, displaying circular causalities. Positive feedback loops show reinforcing relationships (--> exponentially growing) whereas negative feedback loops are considered balancing relationships (--> equilibrium point) (Sedlacko et al. 2013).

The creation of the map has consisted of different steps, within which different sources have been integrated or served as inspiration. These steps were as follows:

1) First, an introduction was given by Francois Schneider and Filka Sekulova on the functioning of the causal loop diagrams / system-maps. This also included the work with existing system-maps as developed within the RESPONDER project and different journal articles (Sedlacko et al. 2013; Videira et al. 2014). Having chosen the topic of car usage within Vienna, this step also included an extensive literature research on the topic and involved mechanisms (Trunk 2010; Hiess 2013; Gielge et al. 2009; Gielge & Plautz 2003; Kupec 2012).

2) Based on this knowledge from the R&D institute, the literature research and different statistical data from the government of Vienna, a brainstorming session was done, in which all potentially relevant key words were written down. They have then been listed and sorted by topic as to cluster several key words under the umbrella of one heading. This formed a list of potential variables for the system map.

3) This list has been used to create a matrix where the relationships between the listed variables has been explored based on the literature knowledge and own experience. Thereby, the variable having a direct impact on another one was marked with a "1". If there was no or only an indirect relationship, the field was marked with a "0". The variables with the highest impact on others were then used for the mapping. The number was not fixed but depended on what seemed logical and feasible. The matrix looks as follows:

Proposal effect: from ↓ on →

		A	B	C	AS	%
Variable A	A		1	0	1	50
Variable B	B	0		1	1	50
Variable C	C	1	1		2	100
	PS	1	2	1		
	%	50	100	50		

Figure 7: Matrix for generation of variables for development of system-map, source: Videira et al. 2014, p.63

4) Given the list of variables to include, we took the matrix again and looked at the amount of outgoing arrows (all "1" in the horizontal line) and incoming arrows (all "1" in the vertical line). Variables with more outgoing arrows were then placed at the periphery of the system-map, whereas variables with most incoming arrows were placed at the centre to increase the legibility of the map. Afterwards, the arrows and feedback loops have been placed and small

adjustments to the positions have been made in order to keep the map as legible and clear as possible.

For the course of this project, this first template from Barcelona has been used and modified to include insights from this empirical study. For the most significant and largest group of car travellers, the Malcontent Motorists, I aimed at understanding and illustrating existing causal (qualitative) relationships between the different variables affected by or actively influencing car usage and car-affinity.

4.3) Research Credibility & its Limitations

All data used for the statistical analysis (except for the survey data), are provided by the Government of Vienna, as part of their newly established Open Government Data-strategy (Stadt Wien 2013b). This ensures a high level of reliability, coverage, conformity of used data collection methods and recentness of data. All data were generated between 2011 and 2013.

Due to the limited time frame of this thesis, only 186 samples, 50 in person and 136 online in a Vienna-related group on Facebook. The selection and composition of the samples asked in person has been well thought through as to achieve a high level of representative power (see participant criteria in 2.2). Nevertheless, there are certain limitations to the credibility and representativeness of the used data and those generated within my own research.

Data Quality (Validity & Reliability)

A first important aspect is the validity of the data provided from other sources. Do they really show what they claim to show? If the used data are based on wrong assumptions and unclear methodologies, the results based on these data might be useless. However, it is not always possible to generate primary data especially if the amount of data exceeds the frame of a study (Maantay et al. 2006, pp.282–284). In order to ensure a high validity and credibility, all quantitative data have been derived from governmental sources. Another aspect influencing the credibility and reliability of used data is the respective timeframe and methodology used for their generation. Different data might be acquired under different circumstances, which would definitely diminish the accuracy of the outcome. However, it is not always possible to ensure the consistency of the data regarding the used methods and especially regarding the time of data generation.

This aspect of validity is even more critical for the data that were generated within the frame of this project. Data retrieved from questionnaires have a high potential for validity-related problems. The answers might strongly depend on the current constitution of the respondent, his/her personal understanding of high or low, its ease of making clear decision – or rather sticking to the middle; and at the very basis: whether the respondents understood the questions the same way. All these factors might diminish the credibility and validity of the used quantitative data. To increase the validity, the survey has been based upon a concrete theoretical model and pre-defined research questions and objectives. Furthermore, the survey has been proof-read by the supervisor and a teacher to ensure the clarity of questions. Also, all respondents have been approached in a standardized manner to not influence them but give the necessary explanations for correct understanding when necessary.

Methods of data generation and analysis

One first limitation can be found within the survey-making as such. Although it has been tried to translate the dimensions from Anable's model of the TPB into valid questions for the

survey, full adequacy is hard to reach. This is especially difficult when undertaking the survey in a different language than the designed model or theory because translations often lead to a decreasing adequacy. Besides this, one requirement to the survey was to keep it within two A4 pages considering that most people are reluctant to fill in longer surveys and show decreasing interest in filling them in honestly and thoughtfully. Furthermore, surveys pre-frame the questions to be asked and the potential answers that can be given. Potential deviations from the survey content cannot really be taken into consideration (Clifton & Handy 2001, p.3).

Furthermore, the surveys were partly undertaken personally. This might have an influence on people's answers in terms of correctness because respondents are in some socio-psychological relationship to the survey taker. Furthermore, it needs to be mentioned that there is no value-free analysis, even less when doing face-to-face research. Questions might be unconsciously value-laden although extensive peer-review (through teachers, friends and neutral people) aimed at diminishing this factor. The current personal situation of the survey respondents surely also influences the outcome. For reasons of frame, this cannot be considered in further detail.

To analyse the survey results, I used descriptive and statistical methods of analysis. The calculation of pure allocations of results might be less critical. However, the calculation of correlations within the cluster analysis is very critical in terms of limitations. It is very important to mention that a correlation does not necessarily represent a causality. It only shows that two aspects tend to occur together, but not that they depend on each other. Furthermore, the questions used within my survey are not exactly the same as used by Anable which might cause deviations from the model. The fact that questions might have been allocated differently towards the various factors might also have caused divergence in the results.

Nevertheless, the results of the statistical analysis and proposal of potentially adequate policies rely on such correlations – a fact that can surely be criticized.

Research ethics & generalizations:

At a general level, it is important to mention that every researcher is a theory-laden and biased individual coming from a specific cultural, social and geographic background. This highly influences the underlying assumptions of the research and the chosen approaches. To be aware of this fact is particularly important when undergoing qualitative research, in which the researcher is in close interaction with his or her object of research. According to Sayer, these double hermeneutics of Social Sciences and the researcher's theory-ladenness limit the possibility for objective research free of values (Sayer 1992, pp.31–45, 57).

Another important limitation of this research is its suitability for generalization. Especially when undertaking quantitative research, asking questions about attitudes, values and habits, it is crucial to keep in mind they are often tied to a specific geographical, historical and therewith cultural context. And this cultural context can even differ within different regions within Austria, considering the role of Vienna as the capital and a multi-cultural global city with its specific urban culture. The proposed policies seem appropriate as a response to these context-specific characteristics, yet a generalization towards other places might be misleading. So generalizations have to be made with prudence, also because of the rather small amount of samples (Haas 2014; Klöckner 2013, pp.1034–1036).

5) The Case of Vienna: Empirical Research results

This study aims at testing whether the segmentation and theoretical model developed by Anable is applicable to the specific context of Vienna in order to explain and possibly predict transport mode choices and behavioural changes within the Viennese society. The objective is hence to confirm or falsify the assumptions that (a) transport mode choices are not purely rational and are influenced by many intangible factors such as values, attitudes and behaviours as stated within the extended TPB and (b) a segmentation of people seems useful to acknowledge the variation in people's motivations in policy-making. Another objective is then to see, what meaningful groups of travellers can be identified within the cluster analysis and how they can be useful for policy-making. For the last purpose, the method of system-mapping is applied.

5.1) Results from Research I: Cluster Analysis

Following Anable's argumentation, the segmentation procedure has been conducted separately for car owners and non-car owners. Thereby, car owners are defined as all those respondents who have access to a car within their household. The reason for this differentiation is that non-car ownership is such an influential behaviour control (hence barrier to car usage) that it would overrule the importance of all attitudinal factors which would cause misleading results. Hence, the cluster analysis has been done twice. The interpretations of the different results from the SPSS analysis are based on former knowledge and on Burns' & Burns' instructions on cluster analysis (Burns & Burns 2009).

Results for car owners

The results of the Ward-linkage coefficients (SPSS) for the data I used suggest to create either two or five clusters for car-users. Figure 6 illustrates this by showing the position of the "elbows" indicating the points where one more group leads to relatively less additional explanatory value.

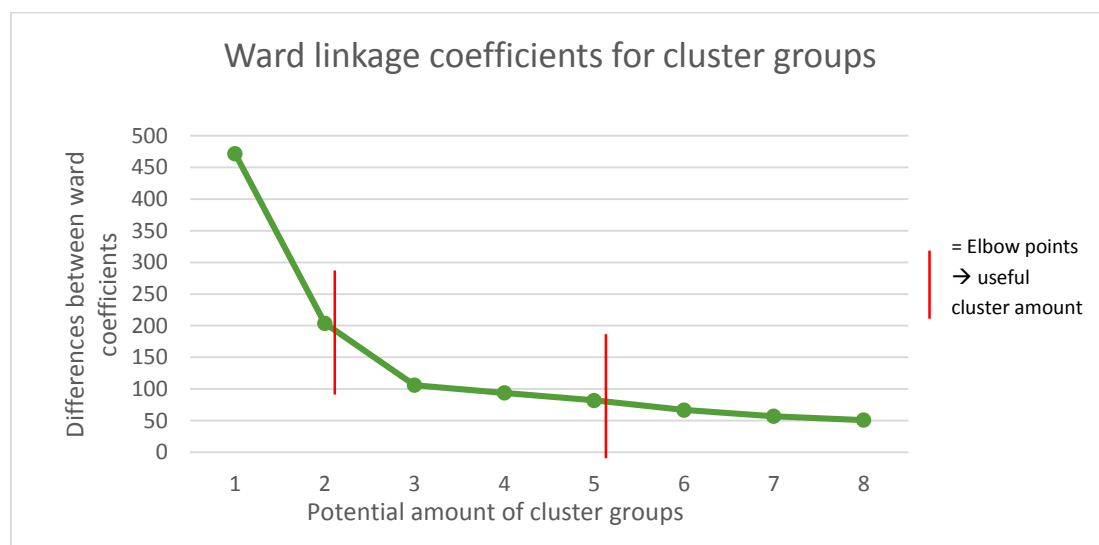


Figure 8: Ward linkage coefficients for car owner clusters, source: generated in Excel

Depending on the chosen amount of cluster groups, the cluster centres for the included variables and the affiliation of all respondents to a cluster group differ. The following table shows the respective cluster centres for each variable for the two options. As stated before, the scores rank from 1 to 5, whereas lower scores represent rather pro-environmental or “anti-car/pro-alternative mode” sentiments. Higher scores hence represent rather car-affine sentiments. The 2-cluster version seems to allow a more simple analysis of the characteristics of each group, yet misses out on certain combinations of variables. The 5-cluster version manages to illustrate this diversity, yet might make policy-making more difficult due to the increased complexity.

Factor	Cluster centres for the 2-cluster solution		Cluster centres for the 5-cluster solution				
	Cl. 1	Cl. 2	Cl. 1	Cl. 2	Cl. 3	Cl. 4	Cl. 5
MORALS	2	4	2	4	3	5	4
ATTACH	4	4	3	3	5	4	4
ENJOY	3	4	3	4	3	4	3
EFFICACY	2,1	3,5	1,7	4,0	2,5	3,5	2,9
PBC	2,6	3,2	2,4	3,0	2,6	3,5	3,1
SACRIF	2	3	2	4	2	2	2
EXTERNL	2,7	3,8	2,3	3,4	2,9	4,2	3,5
SNORMS	3,9	4,2	3,6	4,0	4,2	4,4	3,8
PROCAR	2,5	3,7	2,1	3,2	2,7	4,1	3,3
CYCLING	2,7	3,4	2,6	2,9	2,6	3,4	3,6
GREENID	1,9	2,6	1,7	3,4	2,2	2,7	2,0
NATURE	2	3	1	3	2	3	2
ECOPUR	2,0	2,6	1,7	3,8	2,2	2,6	2,0
INTENT	2	3	2	2	2	3	3
INSTR/AFF	2	3	2	2	2	3	2
HABIT	3	4	3	3	4	5	4
POLIC	2	4	2	3	1	4	4

Table 7: Cluster centres for the two possible car owner solutions, source: author’s illustration derived from SPSS calculations

From both options, the 5-cluster version has been chosen for the further analysis as to illustrate how different car usage motivations can be in a more differentiated way.

For the chosen version, the ANOVA test showed F-values above 1 (more precisely: between 5,5 and 64,7) for all variables indicating that the distances between the means of the different clusters are significant. This is an indicator for the usefulness and meaningfulness of the created clusters. All variables also show a significance value of 0,000 showing the significance of the retrieve results. The 2-cluster version showed less significant results which is another reason to choose the 5-cluster one.

The distances between the different clusters can be seen in the table below. They show that clusters 1 and 4 are the most distinct from each other whereas cluster 1 and 3 as well as 3 and 5 are rather close to each other for different reasons.

Distances between the cluster centres of the final solution

Cluster	1	2	3	4	5
1		5,757	3,037	6,768	4,324
2	5,757		4,387	4,234	3,859
3	3,037	4,387		4,730	3,207
4	6,768	4,234	4,730		3,057
5	4,324	3,859	3,207	3,057	

Table 8: Distances between the means of the different clusters, source: generated in SPSS

The 123 respondents who have access to a car in their household, have been assigned to the five different cluster groups as to maximize the distance between the clusters yet minimize them within the clusters. Therefore, cluster sizes differ in dependence of the position of the respondent’s “point” in the multi-dimensional coordinate system. The five clusters have the following sizes:

- Cluster 1 (Group 1) 25 respondents
- Cluster 2 (Group 2) 11 respondents
- Cluster 3 (Group 3) 34 respondents
- Cluster 4 (Group 4) 27 respondents
- Cluster 5 (Group 5) 26 respondents

Results for non-car-owners

For non-car owners, the results of the Ward-linkage coefficients suggest to create either two or three clusters for car-users. The figure illustrates the position of the two elbows.

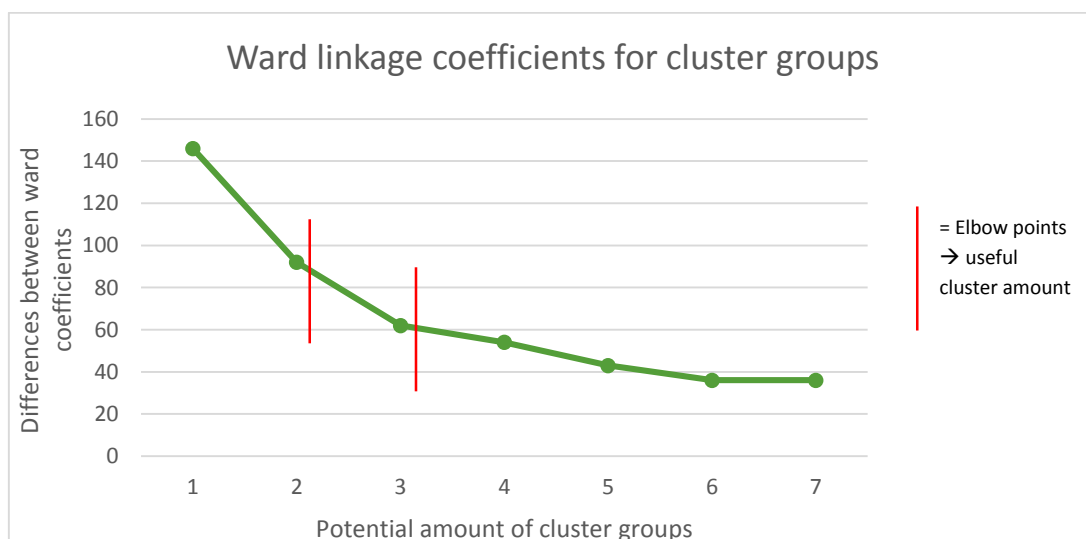


Figure 9: Ward linkage coefficients for non-car owner clusters, source: done in Excel

The following table shows the respective cluster centres for each variable for the two options. The variables “attachment to cars”, “enjoyment of cars” as well as “habit to use the car” have been excluded from the analysis because they exclusively target people with access to a car.

Variable	Cluster centres for the 2-cluster solution		Cluster centres for the 3-cluster solution		
	Cl. 1	Cl. 2	Cl. 1	Cl. 2	Cl. 3
MORALS	3	2	4	2	3
ATTACH	n.a.	n.a.	n.a.	n.a.	n.a.
ENJOY	n.a.	n.a.	n.a.	n.a.	n.a.
EFFICACY	3,0	1,9	3,7	1,6	2,8
PBC	2,5	2,2	2,3	2,1	2,6
SACRIF	3	2	4	1	2
EXTERNL	2,7	2,5	2,9	2,5	2,7
SNORMS	3,4	3,6	3,2	3,6	3,5
PROCAR	2,6	2,3	2,9	2,2	2,5
CYCLING	2,8	2,3	2,5	2,1	2,9
GREENID	2,4	1,6	3,0	1,4	2,1
NATURE	2	1	3	1	2
ECOPUR	2,4	1,6	3,3	1,5	2,2
INTENT	3	1	3	1	3
INSTR/AFF	2	2	4	2	2
HABIT	n.a.	n.a.	n.a.	n.a.	n.a.
POLIC	3	2	2	2	3

Table 9: Cluster centres for the two possible non-car owner solutions, source: author's illustration derived from SPSS calculations

From the two options, the 2-cluster version has been chosen for the further analysis. The reason is based both on the statistical results and on the context of this thesis. It aims at illustrating how this segmentation analysis and the later-on applied system-mapping approach can be used to develop more effective policies that target very specific groups of people as to motivate them to use the car less. Considering that this group does not possess a car, they might not be the main target of policy-making. They are still considered though (in form of 2 cluster groups) as to address those respondents who might not own a car because of insufficient financial means (e.g. students) but do have car-affine attitudes.

As before, the ANOVA test showed F-values above 1 for all variables indicating that the distances between the means of the different clusters are significant. Also, all variables show very low significance values indicating a high significance of the variables. However, not all variables show a significance value of 0,000 which has two major reasons: (1) the sample size for non-car owners is relatively low with only 63 samples leading to a smaller significance of the results and (2) some questions within the survey rather target car owners and are therefore not less significant in explaining the behaviour. The distances between the clusters can be disregarded in this case because there are only two. The sizes of the groups are as follows:

Cluster 1 (Group 6) 21 respondents

Cluster 2 (Group 7) 42 respondents

The subsequent section will define these clusters in more detail and explain how they differ both in terms of attitudinal aspects and socio-demographic characteristics.

5.2) Results from Research II: Descriptive Analysis of Clustered Groups

Table 10 gives an overview of the survey results of the different cluster groups. As stated before, the values range from 1 to 5 whereby 1 represents rather environmental-friendly / anti-car sentiments and 5 represents very car-affine sentiments. The results of this table and the subsequent characterization of groups are the basis for the confrontation of my cluster groups with those established by Anable. The numbers in bold represent the strongest car-affine group value(s) for the respective factor.

Resp.	Car owning groups						Non-car owning groups		
	All	Group 1	Group 2	Group 3	Group 4	Group 5	All	Group 6	Group 7
	123	25	11	34	27	26	63	21	42
MORALS	3,29	1,72	3,91	2,82	4,81	3,58	2,49	3,19	2,14
ATTACH	3,88	2,64	3,45	4,53	4,41	3,85	2,43	n.a.	n.a.
ENJOY	3,33	2,84	3,55	3,06	4,15	3,23	3,02	n.a.	n.a.
EFFICACY	2,76	1,66	4,05	2,49	3,52	2,87	2,25	3,00	1,87
PBC	2,88	2,41	2,96	2,58	3,46	3,07	2,32	2,52	2,21
SACRIF	2,24	1,60	4,18	2,15	2,22	2,15	2,00	2,81	1,60
EXTERNL	3,23	2,35	3,36	2,92	4,16	3,46	2,58	2,71	2,52
SNORMS	4,05	3,64	3,97	4,23	4,44	3,85	3,52	3,38	3,60
PROCAR	3,07	2,12	3,20	2,74	4,13	3,27	2,37	2,59	2,25
CYCLING	3,03	2,59	2,91	2,64	3,38	3,64	2,45	2,84	2,25
GREENID	2,25	1,69	3,39	2,20	2,65	1,96	1,84	2,41	1,56
NATURE	2,06	1,36	2,64	2,00	2,81	1,77	1,73	2,29	1,45
ECOUPUR	2,30	1,72	3,82	2,24	2,61	1,98	1,94	2,55	1,63
INTENT	2,47	1,76	1,91	2,21	3,44	2,73	1,98	3,24	1,36
INSTR/AFF	2,34	1,88	2,45	2,18	3,11	2,15	2,05	2,38	1,88
HABIT	3,50	2,52	2,55	3,53	4,63	3,62	1,92	n.a.	n.a.
POLIC	2,73	1,68	3,36	1,38	3,96	3,96	2,13	2,81	1,79

Table 10: Survey results of respondents, source: author's calculations

The following tables gives an overview of the socio-demographic and spatial data of the different cluster groups. These data form the base for the description of the socio-demographic and spatial features of each group.

Respondents	Total	Car owning groups						Non-car owning groups		
		All	Group 1	Group 2	Group 3	Group 4	Group 5	All	Group 6	Group 7
		123	25	11	34	27	26	63	21	42
Gender	Male	47	9%	6%	22%	17%	18%	18	9%	18%
	Female	76	16%	6%	17%	13%	12%	45	12%	25%
Age	in years	33,8	29	31	33	35	40	27,2	28	27
Monthly Net Household Income in €	< 1.700	26%	56%	27%	24%	7%	19%	62%	52%	67%
	1.700 < x > 2.700	26%	20%	36%	21%	30%	31%	24%	24%	24%
	2.700 < x > 4.200	24%	16%	27%	32%	15%	27%	6%	5%	7%
	> 4.200	14%	4%	9%	9%	37%	12%	2%	0%	2%
	no answer	11%	4%	0%	15%	11%	12%	6%	19%	0%
Cars	ø per household	1,3	1,2	1,2	1,3	1,7	1,2	0	0	0
	Km / year	16.820	8.413	15.833	15.648	27.478	13.500	1.420	2.043	1.147
PT card	% of respondents	67%	83%	64%	82%	44%	46%	89%	86%	90%
Location of respondents	Inner Districts	50%	44%	73%	41%	52%	58%	57%	48%	62%
	Outer Districts	37%	48%	27%	38%	26%	42%	37%	48%	31%
	Peripheral Districts	12%	8%	0%	21%	22%	0%	6%	5%	7%

Table 11: Socio-demographic and spatial data of respondents, source: author's calculations

Based on these data, the following unique groups can be differentiated:

a) Car-owning groups

Group 1 – Similar to “Aspiring Environmentalists” (20%)

- Low personal attachment on or dependency of the car, low enjoyment of driving
- Use the car mainly for instrumental reasons (such as bad access to infrastructure)
- Don't use cars for daily commuting (low km per year and high availability of PT ticket) but rather for weekend and family trips and special occasions
- In contrast to Anable's findings: positive associations with PT and biking
- As with Anable's group, respondents display strong green identity: they are the most environmentally-concerned group of car owners with high willingness to sacrifice for moral values
- As all car-owning groups: rather car-affine social environment but the lowest degree
- Similar to group (3), they are very open to policies addressing car over-usage and improving public infrastructure

Socio-demographic and spatial features

- Lowest income of all car-owning groups
- Slight overweight of female respondents
- Younger age groups in average
- Many respondents living in outer districts compared to average

Group 2 – Non-environmentalists (9%)

- Very weak environmental values and concerns and no willingness to sacrifice for the sake of the environment
- No understanding for any “It's good for the environment”-argumentation
- High car attachment and more enjoyment than all other groups except for group (4)
- Weakest efficacy illustrating that they don't believe their behaviour could make a difference
- Behaviour is similar to group (4), yet they do not claim to have a green identity
- Use cars on a regular, but not daily basis for the main reasons of comfort and flexibility
- They do not have very negative perception of alternatives but would probably not switch for environmental but other reasons
- Rather reluctant to policies aiming at changing current modal split but not too much

Socio-demographic and spatial features

- Average household income
- Equally male and female
- Average age within sample
- Many respondents living in inner districts compared to average

Group 3 – similar to “Malcontent Motorists” (28%)

- Rather high morals and intentions to reduce current car usage
- Fairly developed green identity and above average willingness to sacrifice for it but less than group (1) and (7), but somewhat less green than Anable's group
- Not very high enjoyment of car travel and strong frustration about externalities (congestion, safety of car travel)

- Rather positive towards other means of transport yet high behaviour control, for example through car-affine social environment
- Don't use car for daily commuting (high availability of PT ticket) but for pretty much all other occasions, car usage relatively strongly internalized
- In contrast to Anable's corresponding group, respondents seem very open to policies improving public/cycling infrastructure and hardening car usage

Socio-demographic and spatial features

- Rather high household income
- Slight overweight of female respondents but relatively equal
- Average age within the sample
- Many respondents living in peripheral districts compared to average

Group 4 – similar to “Die-Hard Drivers” (22%)

- Enjoy driving the car the most and show the strongest attachment to cars
- They claim to be concerned about environmental issues but opposed to Anable's characterisation, are not particularly willing to sacrifice (time or money) for its protection.
- Have very strong car-affine environments
- Use the car for very affective and/or emotional reasons such as pleasure and status and use it as nearly the sole mean of transport on a daily basis
- Feel very negative towards alternatives to the car (PT and cycling for example)
- Very similar to Anable's group, they believe in the right for car usage and don't see moral problems attached to it
- Perceive the highest constraints (PBC) in changing their behavior
- Have no intention to change their current car usage
- Reluctant to any sort of policy which decreases convenience of car usage or improvement of infrastructure

Socio-demographic and spatial features

- Highest income of all groups
- Overweight of male respondents
- Higher age groups in average
- Many respondents living in peripheral districts compared to average

Group 5 similar to “Complacent Car-addicts” (21%)

- Strong attachment to cars and positive attitude towards it but comparably low enjoyment of driving in Vienna
- Their attachment to cars is less created by enjoyment of driving as group (4) but more by indifference and habit similar to group (3)
- They claim to use the car for rather instrumental reasons but are very reluctant to any policies addressing these infrastructural issues
- Car usage is strongly internalized as habit
- Very car-affine social environment
- Feel very negative about any alternative and do not intent to change their behaviour

- Opposed to Anable's characterization, they at least claim to be environmentally-concerned and make green consumption choices
- Similar to group (4), very reluctant to public policies

Socio-demographic and spatial features

- Average income
- Slight overweight of male respondents
- The oldest age group
- Many respondents living in inner districts compared to average

b) Non-car-owning groups

Group 6 – Similar to “Reluctant Riders” (33%)

- Don't use car much but show low commitment to environmental values and perceive cars as less pollutant than group (7)
- Not much willingness to sacrifice for environmental problems
- Have less negative associations with car usage and less positive ones with PT than group (7) but use PT on a daily basis
- Low level of efficacy: do not feel that their behaviour could change much
- As stated by Anable, respondents could be potential future car users (with somewhat similar motives than group 5) when income rises and therefore particularly important for policy-making, their income seems to pose an actual control to their behaviour
- Yet, seem rather reluctant to policies targeting reduction of car use, similar to group (2)

Socio-demographic and spatial features

- Low income (probably high percentage of students)
- Slight overweight of female respondents but relatively equal
- Rather young people
- Many respondents living in outer districts compared to average, not many in the peripheral districts

Group 7 – Similar to “Car-less Crusaders” (66%)

- Very strong green identity and environmental values similar to group (1)
- Have rather negative associations with cars and very positive associations with alternative modes of transportation
- If car usage, then for highly instrumental reasons because alternatives are not available; therefore have the lowest km/year of all groups
- Similar to group (1) and (3), open to policies changing modal split and are very willing to change if alternatives are provided

Socio-demographic and spatial features

- By far lowest income of all groups
- Largest group among female respondents
- Age: rather young people
- Respondents living to equal shares in inner and outer districts, not many in the peripheral districts

5.3) System-Mapping of the Results for Group 3 – “Malcontent Motorists”

The following subsection aims at visualizing the interrelationship between the different variables within a system-map. This will be done in preparation for the policy-proposals as to identify the specific variables or “shift levers” which could be the base for different policies. Based on the conclusions that motivations diverge, this will be done only for one exemplary group, namely the “**Malcontent Motorists**” (group 3). There are different reasons for choosing this group: first, they are the largest group among car-owners, second, they show a moderate to good potential for behavioural change and third, their motivation is particular interesting considering the combination of high car attachment and low driving enjoyment as well as high perception of car-related externalities.

As explained before, this specific group is characterized by strong attachment to cars and internalized usage without actually enjoying driving in Vienna that much. The reasons that were given for their car usage were pre-dominantly lack of access to public infrastructure, time saving as well as freedom and flexibility. The car is thereby not used for daily commuting but pretty much for any other activity (shopping, leisure trips, family activities etc.). Respondents do display concerns about environmental problems and willingness to sacrifice for the latter and also a rather strong desire to reduce current car usage, which illustrates the frustration of their current car-dependency. The fact that this group belongs to the above-average income group and that it is embedded in a very car-affine social environment makes this shift very difficult. The most relevant of these personal influential factors (habit, social environment, high income and car attachment) have been included in the map.

The systems-map also includes the more general factors influencing or being influenced by car usage as to illustrate how personal decisions have societal impacts. Applying the methodology of system mapping I illustrated the causes (as derived from the empirical research) and consequences (as derived from the theoretical part) of car usage. The desire to participate in the pre-dominant hedonistic lifestyle implies that higher income increases the car usage within the city. This has fundamental effects on the ecological and social sphere. For instance, the expanding consumption of cars leads to a higher demand of material and energy inputs which also creates noise, pollution and waste. With respect to the social sphere, the usage of cars for personal transportation enhances the individualization of society. This influences social exclusion, health, liveability of the cities and the willingness to participate in community activities. Furthermore, as can be seen in Figure 10, Feedback loop (F1) refers to a reinforcing cycle which shows that the power of the automotive sector increases if more cars are being used in the city. The automotive sector creates an affinity towards cars, for example by the use of advertisement. An enhancing car affinity fosters the actual usage of cars which again increases the power and influence of the automotive sector. The second feedback loop (F2) concerns the connection between car usage and individualism. In this reinforcing cycle, car usage leads to an increase of individualism within the society. Cars are seen as personal spaces deterring people from communicating and interacting with others. This decreases the collective attitudes within society and further enhances the car-affinity which again leads to an increase of the usage of cars. It can be assumed that a decrease of collectivism directly decreases the liveability of the city and enhances social exclusion. At the same time rising individualism leads to an increase of the urban sprawl which again increases the use of cars. These are just some of the relationships illustrated in the map.

The next chapter will take this map and propose potential policies that will explicitly deal with what has been identified as influential factors for car usage and will try to shape the latter. These influential factors are: (a) Power of the automotive sector, (b) Convenience of driving and (c) Individualist cultural values

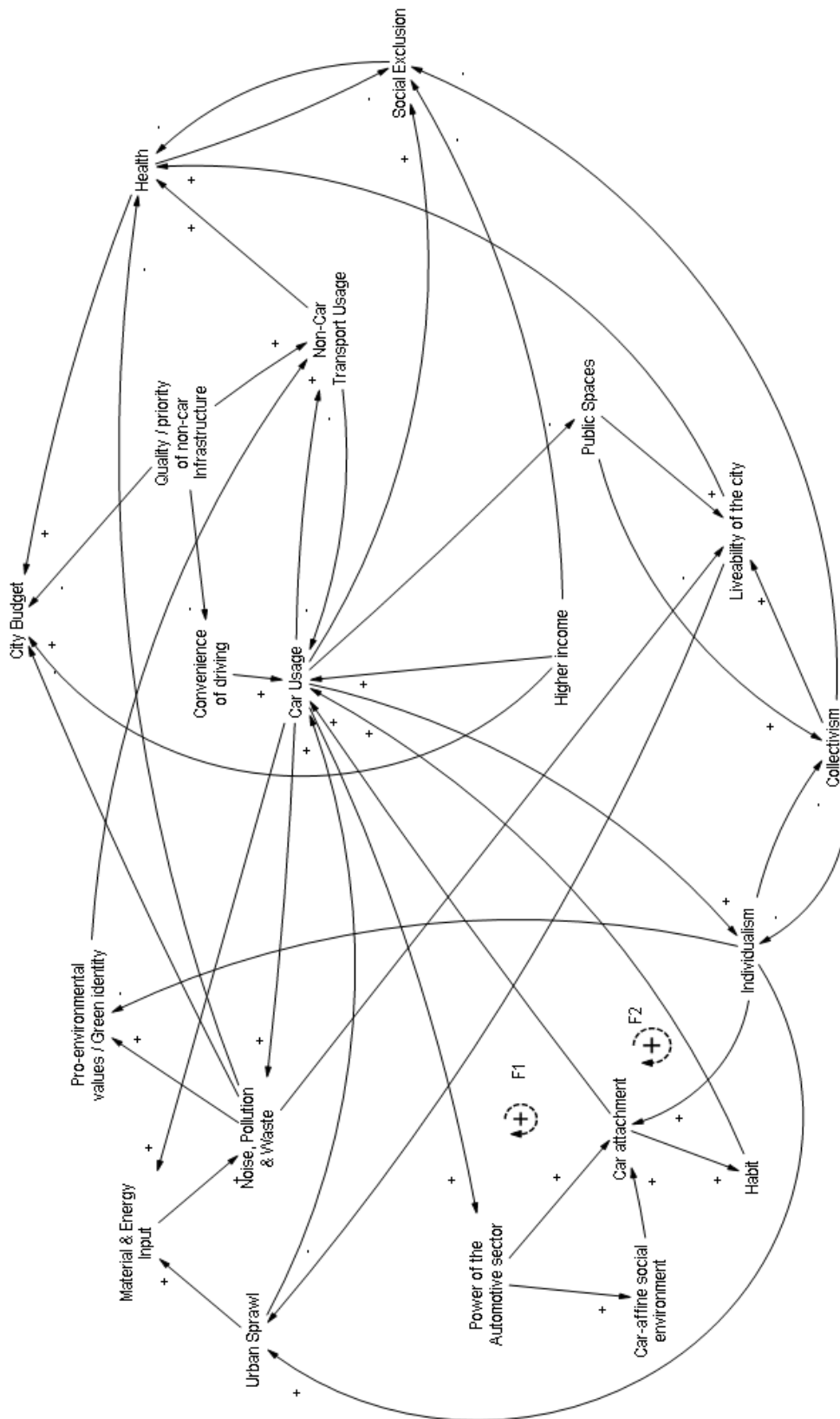


Figure 10: The analytical frame of the current imaginary for group 3, source: author's illustration

6) Discussion

In order to discuss as well as connect the theory to the results of this paper the following chapter is structured in three parts. Firstly, the results will be confronted with Anable's theoretical framework. Secondly, appropriate policy measures will be debated, bearing in mind the paradigm of the new imaginary. Thirdly, the feasibility of 'the shift' will be questioned. Fourthly, the research as such and its possibility for applications outside of Vienna are discussed.

6.1) Critical Considerations of Anable's Theoretical Framework

The cluster analysis has been based on questionnaires undertaken in different parts of Vienna, from both very central and well-accessible to more remote, less accessible parts of the city. The cluster analysis has thereby followed the model of Anable (2005) as to investigate to which extent the model is applicable to other contexts. To answer Q1 and Q2, it has been surprising, yet pleasing to see that the results from the analysis turned out to be very similar to Anable's results. And even though the first step, the hierarchical cluster analysis has demanded for a 5-cluster rather than a 4-cluster solution for car-owning groups, the other four groups could be well-recognized in her characterizations with only slight differences in certain factors. The extended TPB with its various different variables therefore seems a very appropriate model to explain behaviours and derive policy recommendations from its results. However, it ought to be mentioned that Anable does not strictly follow the basic proposition of the TPB which states that intention is always the predictor of a specific behaviour. Group 1 and 2 for example have very strong intentions to use the car less and alternatives more, yet are restricted in their options, which is not merely a perceived but a real behaviour control. The actual TPB does not include this possibility, Anable's explanation does though. The same applies to the factor "habit" which she included within her model. Habit as such is not congruent with the theoretical underpinnings of the original TPB according to which intention and PBC alone should influence one's transport behaviour (Donald et al. 2014). It is hence questionable to which extent Anable's model is an extension of the TPB or maybe rather a new theory in itself.

One problem that occurred within the usage of her model is the strict distinction between the variables identity, environmental concerns and moral norms. For most people pro-environmental behaviour is caused by concerns about ecological problems which eventually might lead to a so-called "green identity" which in turn entails certain morals and norms (such as avoiding plastic or saving electricity). To treat them as isolated units seems both theoretically and practically difficult.

The inclusion of habit seems a very useful addition to the general TPB. The cluster analysis has only focussed on car-related habits, yet habit seems a strong predictor of behaviour for all means of transport. It therefore seems especially important to address young people within policy-making because once habits are created, they are very difficult to change. Another aspect that ought to be observed critically is the influence of subjective norms, hence social pressure. Anable's as well as my research have been based on quantitative methods, namely surveys. Questionnaires are a method that inherently follow the logic of methodological individualism; they ask each single person about their specific opinions,

values, behaviours etc. Thereby, they treat people as rather isolated and are incapable of observing social relations and interactions. The influence of social pressure (subjective norms) however can only be observed in interaction. Therefore, it is little surprising that both car owners and non-car-owners state in equal measure that their behaviour and values do not depend on other people's values and behaviours. They are therefore convinced that their behaviour will not change if the one of their surrounding changes. The results of the survey however show that car usage is significantly higher and more frequent if the respondent's surrounding uses their cars on a regular basis too, and if it is perceived positively by their social environment. The following figure illustrates that there could indeed

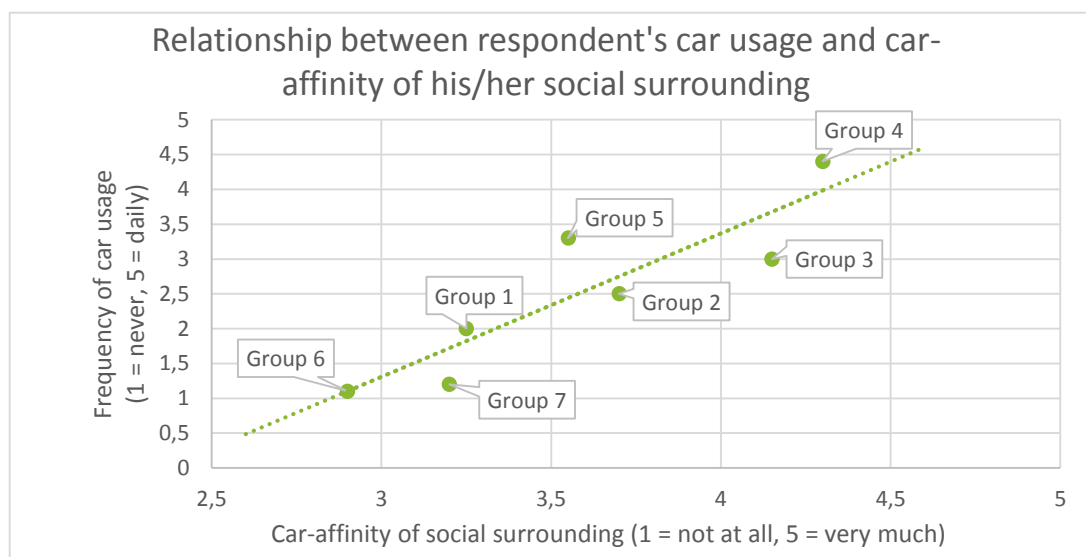


Figure 11: The role of one's social surrounding on car usage, source: author's illustration

be a positive relationship which is very hard to investigate within quantitative research.

Methodologically, it is not clear how Anable retrieved her predictions about the likeliness of policies to be successful for the different groups. For this reason, I added the factor "POLIC" which includes questions on whether different policy measures would influence the respondent's level of car usage. This question only applies to car-owning groups because very occasional car usage would very likely not be changed by the proposed policies. The derived levels of potential switchability are close to Anable's classification. Group 4 and 5 show a very low potential or interest in being influenced by car-reducing policies. Group 1 shows the highest potential, with group 3 coming shortly after. Thereby, group 3 within this study shows a higher potential for changing behaviour after policy implementations than Anable's group of Malcontent Motorists. Group 2 shows a moderate potential but cannot be compared to Anable's results because she did not have this group.

In general, the cluster analysis has shown that there are various motivations for car usage. The same motivations can lead to different behaviours whereas on the other hand, similar behaviours can be caused by strongly differing motivations. Intentions based on values, attitudes and norms surely do have explanatory power (the lower the intentions, the higher car usage in general). However, necessity caused by a lack of alternatives can outweigh the power of intentions (which is the case for group 1 and 3 to a certain extent). The presented model acknowledges in a powerful way that for different people, different factors or variables are the most influential ones. Whereas for some people attitudes towards transport means (hence rather rational reflections and comparisons) are very influential, others are

more influenced by internalized habits or by strong environmental values. For others, none of these play a role if they feel incapable of using a certain mode (high PBC) or if they make their choices based on current emotions in a spontaneous way. It should hence be an important aspect of a theory of transport behaviour to acknowledge that transport mode choices are influenced both by instrumental/rational and symbolic/affective factors. Going back to the theoretical models presented within chapter 3.1, it appears that the TPB is not entirely opposed to the RCT. It can rather be argued that the TPB is an extension of the RCT which makes use of the various psychological and sociological findings from different scientific fields. Both theories assume people to make reasoned choices and the TPB allows for rational or instrumental choice motives within their model.

The extent to which different factors are influential might strongly vary among different spatial and cultural contexts. Both models do not include the possibility that cultural differences impede the overall applicability and usefulness of that model. They rather argue that culture just influences either the “black box of preferences” within the RCT or the attitudes and role of social norms within the TPB. On these grounds, it seems useful to investigate the local conditions and, if the model is applicable, adapt the applied policies respectively. The next sub-section will do this “adaptation process” for one specific cluster group generated within the Viennese context, namely the Malcontent Motorists.

6.2) Examining Policy Measures

The purpose of this sub-chapter is to explore some possible policy measures as response to the results from the empirical research in order to answer research question Q3. It is not to propose a complex and comprehensive urban strategy because this would go beyond the scope of this paper. There is no prioritization or strict timely order to be found within these measures, and none of them can stand alone. This list should rather be understood a collage of opportunities, illustrating the various paths towards a more sustainable transport imaginary as developed in chapter two. The proposals as such are based both on Anable’s policy proposals (see appendix 3) but include knowledge from the desk research and the outcomes of the survey. All proposals somehow aim at increasing the general urban liveability but specifically target the group of malcontent motorists and their car-usage motivations as defined in chapter 5.2. As stated within the theoretical framework, urban liveability is defined as both dematerialized and “re-urbanized”, hence collective, dense and creative. The presented measures deliberately do not focus on the construction of new infrastructure, first because this can be considered very material-intense and second, because many studies already deal with this proposal. It also excludes any measures focussing new technologies such as E-mobility because it is questionable whether this would solve the problems of extensive material intensity and the individualisation of car usage.

Policy area 1 –Diminish convenience of driving

The malcontent motorists display a strong intention to diminish car usage but tend to use it for all purposes except for daily commuting. Habit hence seems to be one of the main influential factors for their mode choice and should therefore be targeted within policy-making.

More concretely, this could entail the following measures: (1) establish more one-way streets as to decrease the ease of travelling or (2) establish zones where only shared cars, taxis and PT means as well as cyclists have access to or (3) establish so-called “encounter zone” where

maximum speed is strongly reduced and all traffic participants have equal rights without usage of normal street signs. Pedestrians and cyclists therefore have the right to cross and use streets as long as no traffic participant is endangered or obstructed deliberately. In some way, these changes should occur at different times as to ensure that people do not get used to the new routing too quickly and fall back to existing habits.

This helps to achieve a dematerialization indirectly through a potential shift towards alternative mode of transport. It additionally addresses the goal of re-urbanization by using creative measures to re-shape urban spaces and allow for more collective usage of the latter. Especially the establishment of encounter zones could open up spaces for public discourses and conviviality. Within the system-map, this policy area focusses mainly on decreasing the convenience of driving and increasing the convenience of using public infrastructure. Indirectly this could enhance a sense of urban collectivism and diminish habit. The coloured arrows in the map illustrate the potential effects of this policy.

Policy area 2 – Prioritize alternative modes in traffic planning

The malcontent motorists do actually have positive attitudes towards other means of transportation such as PT and cycling. This is a great potential to be used. Unfortunately, current traffic planning very much favours car users, especially those which frequently use them. Traffic lights and so-called green waves are adapted to car speeds, the breadth of intersections and lanes is also adapted to motorized transport and the quality of car-related infrastructure is often far better than alternative infrastructure. Furthermore, most public transport means have to share their infrastructure (e.g. tram tracks) with cars which slows them down significantly. Also, in many cases, newly-constructed biking infrastructure is implemented in very questionable ways (see Figure 12)



Figure 12: Bike lane in Vienna, source: http://cdn1.vienna.at/2012/10/mayssengasse_ja.jpg

Therefore, the second proposal would be to strictly prioritize alternatives to cars in urban transport planning. This could include different measures such as (1) reserve one lane for buses and shared cars, (2) adapt traffic light intervals to public transport means such as buses and trams as to minimize their waiting time, (3) use available money preferably for infrastructure used for more sustainable transport means, (4) turn certain streets into alternative urban spaces for collective use.

The target of increased dematerialization is again used indirectly through shift towards public alternatives, but even more directly through diminished resources for infrastructure. Bike infrastructure is exposed to less weight and therefore requires less frequent maintenance which saves both money and resources. Per pkm, this also applies to buses and shared cars within their separate lane. The target of re-urbanization is thereby met in different ways: first, by increasing the density of urban centres (if parts of streets are re-used for different

purposes), second by shifting the policy priority from the individual to the collective and by enhancing urban justice by prioritizing modes of transport that are open to all social classes. Within the system-map, this policy area focuses on diminishing the convenience of driving and the Individualist cultural values.

Policy area 3 – Use communication methods to emphasize negative aspects of the car & positive aspects of alternatives

The malcontent motorists are characterized by a fairly well-developed green identity combined with environmental values. Despite their great car attachment and habits, they show a rather low enjoyment of driving which can be attributed to the strong perception of car-related externalities. This potential needs to be used by strengthening the rather negative image of car travel and highlighting the benefits that alternatives could bring.

This policy proposal is also related to the history of car-affinity (see chapter 2) which has been strongly led by corporate initiatives highlighting the emotional, affective and freedom-related aspects of car usage. If media campaigns succeeded in convincing people that cars are more than noisy, polluting and disturbing vehicles, shouldn't they also be able to perform the contrary and discard the societal picture of a freedom-giving car? This new image could be based on the dependency-aspects related to cars: they require large parking spots and continuous large financial investments for maintenance, they also create dependencies in terms of required fuel. Once a gasoline-fuelled car is bought, the user is forced to continuously use it no matter how the global oil prize and local fuel price changes. On the other hand, bikes or car-sharing-offers can easily be presented as real liberators: they are available at all times, can bring you wherever needed, with no or very low fix costs and well-plannable variable costs. And even though PT means are less flexible than bikes and shared cars, they still have many positive aspects to be highlighted such as lower costs, environmental benefits, high reliability and low stress combined with time for other things (reading newspaper, working etc.). A holistic communication campaign would need to be developed by professionals from a marketing agency that design a project that is up-to-date and "sexy" enough to reach nowadays society.

This policy could support the goal of dematerialization by promoting the abandoning of cars and stronger reliance on less material-intense modes which also includes car-sharing as a mean of collaborative consumption. This policy indirectly supports the goal of re-urbanization by strengthening collectivist cultural values and creative means of re-defining the purpose of streets through these campaigns. Looking at the displayed variables in the system-map, this policy targets two "obstacles" to sustainable transportation, namely individualist values and the power of the automotive sector. Furthermore, it might help at strengthening people's environmental values.

Policy area 4 – Set up financial incentives to abandon car usage

The malcontent motorists showed an extraordinarily high affection to policies aiming at reducing car usage. Especially the proposals of reducing parking infrastructure and improving and cheapening PT were well received among the respondents. This is a great basis for policy-making. The first of the following proposals uses this knowledge and apply the concept of libertarian paternalism, which aim at "*preserv[ing] freedom of choice but nonetheless incline or steer people in a particular direction*" (Sunstein et al. 2013, p.2). This approach seems particularly useful for people having strong intentions to change their behaviour but are

subject to the power of habit. (1) A first proposal is hence to automatically pay back parts of the tax refunds in car-sharing contingents to people (in forms of monetary or hourly contingents) which they can opt out of under certain conditions. (2) Another proposal would be to tax certain parking infrastructure that is not needed for important public services. This could especially target parking spots close to large shopping malls outside the city centres, amusement parks, cinemas and other facilities used for leisure activities (which is the main usage purpose for this group). This could motivate the operators to offer alternative (public) ways to access their facilities. (3) Make people pay certain taxes more frequently to increase awareness of actual costs of car usage. (4) A last option is to issue free one-year memberships to car-sharing providers. This could be particularly successful for addressing people that use a car for everything but commuting to reach places outside of Vienna (for family trips etc.).

The target of dematerialization is again met through reduced usage of cars and car-related infrastructure (including parking spots). The target of re-urbanization is met in different ways. First, through the increased use of collective/shared means of transport; second through a potential re-centralization of certain infrastructures (e.g. shopping facilities); third through a higher motivation to use local facilities and increase the density (of people and services) within the districts and the urban centre. This could also diminish social exclusion considering that some areas are barely reachable without car. Within the system-map, this policy addresses convenience of driving and habit.

Subsequently, the new system-map is shown (see Figure 13) which illustrates exemplarily the effects of one of the proposed policy areas. It thereby aims to show through which variables (such as health, power of the automotive sector etc.) these policy proposals would finally affect car usage and urban liveability. Policy area 1 was chosen because it targets a wide range of variables and shows how one policy measure can have manifold impacts on the totality of the system.

6.3) Feasibility

On a very practical level, Vienna has good chances for successful implementation of such measures due to four reasons. First, the pressure of rising resource prices strengthens the interest/necessity of companies to invest in more resource-productive technologies. Second, increasing awareness of global ecological devastation and the potential effects of climate change on Austria's biggest economic sector – Tourism - could motivate people to act. Third, the fact of Vienna being a rather dense city with short travel distances also favours the concept of collaborative consumption and increasing use of public transportation. The fourth factor is a slowly emerging awareness about the importance of non-materialistic values in society. The study (see Table 11) has shown that pro-environmental and less car-attached people are mainly to be found among young respondents.

A more complex issue is the question of social and economic feasibility because it depends on everyone. Everybody takes part in shaping the political, economic and social landscape on a daily – or at least regular – basis. This happens through votes considering politics, through consumption choices considering economy and through social actions and relationships considering the social community. Theoretically, this sphere is hence much more immediately changeable. Practically, it is not. It is not because people are not rational and they are especially not predictable which makes the sphere of policy-making so difficult. According to the University of Leeds, policies aiming at shifting people's transport mode choices could lead to a variety of different outcomes among consumers such as combining journeys, changing modes (including mixing modes) or maybe just continue as before (Leeds University 2012).

However, socio-economic resistance from different interest groups and even from the part of the population can hinder the implementation of effective policies. This resistance can derive for various social, psychological or other reasons. Vienna and its government are highly interconnected with both public and private stakeholders at a global level. This interconnectedness turns all urban issues into "*multi-player collective action dilemmas*" which are much harder to tackle (Antal & van den Bergh 2013, pp.55–57, 64). Both the economy and politics are trapped in the vicious cycle of the growth paradigm which requires increasing sales numbers for its own stability. This represents an obstacle to the implementation of the presented policies because they evidently aim at decreasing sales numbers for the sake of dematerialization and re-urbanization. Yet, one economic argument that is hard to undermine is the importance of the automotive sector for employment and as such for the stability of the economy. Having said that, rising public discontent with such capitalist values as well as increasing societal awareness of environmental dangers and the inability of politics to regulate both effectively, might increase the chances of a radical change towards a more sustainable society at the urban (and maybe even larger) scale.

Furthermore, the freedom of movement to more remote places which cars created for individuals is hardly replaceable by any public transport means and only partly by cycling or walking. This represents a tangible obstacle to the proposals made. Besides this concrete dimension, it is very questionable whether on psychological level the attitudes towards car ownership and usage can be changed within a strongly consumption-oriented society, because this seems to be a mutually-reinforcing system, as illustrated by the figure underneath.

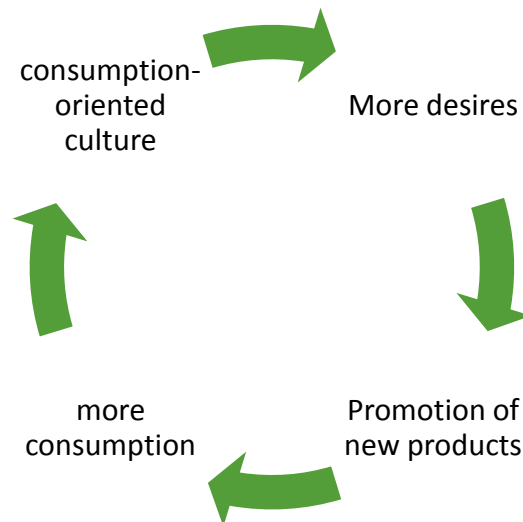


Figure 14: The mutually-reinforcing nature of capitalist structures and societal culture, source: author's drawing

A final aspect to be mentioned is the legal feasibility. To increase the general feasibility, only measures that are within the scope of Viennese competencies (as federal state) as defined by the constitution (Republik Österreich-Parlament 2014) have been proposed. This avoids any problems of scale.

Generally, it should be noted that one measure could address one or several groups at a time. Therefore it requires several measures to include all groups. The combination of measures however should be considered carefully to ensure that they do not sabotage each other.

6.4) Critical Discussion of this Research

One question that might occur to the reader is related to the generalizability of the acquired results. Is it possible to draw conclusions from Vienna to other cities, and if yes, how? Given the epistemology applied within this thesis, it seems important to mention that the author does not believe in an objective reality that can be perfectly illustrated in quantitative terms. Taking the perspective of critical realism, reality becomes something that can only be approached and experienced, but never fully understood by science (see chapter 4.1). Therefore, there is a tension between two opposing research goals: on the one hand, it's the aim of quantitative methods to derive results that can be generalized at least to a certain extent. On the other hand, the clustering approach aims at providing a more realistic picture of society, which however is shaped by research-related and place-related factors that turn the results context-dependent.

The research-related factors are mainly connected to the research process itself. Both the sizes but also the cluster centres regarding the different factors would be different when changing a few parameters: the gender imbalance for example might have a strong impact on the created groups considering that women (according to the results of this study) tend to be less car-affine and illustrate stronger pro-environmental attitudes. Hence, with a different sample population, more car-affine groups could potentially be much larger. The same goes for the locations chosen for the surveys conducted in person. They have been undertaken mainly in and around the ninth district - a rather central Viennese area which attracts people from all residential districts due to its central position as well as its service infrastructure and employment offers. Conducting the survey exclusively in peripheral

districts would very likely have strengthened the role of instrumental motives for car usage due to the generally less dense public infrastructure. However, this thesis aimed at illustrating the motivations throughout all districts. Given that about 30% of the Viennese population live in the central districts with dense public infrastructure, it seems especially interesting to understand why they still use cars. For some, it clearly still was a necessity (because they work in the periphery for example), but for others the reasons are very symbolic-affective. Unfortunately, the frame and resources of this study did not allow an extensive survey done personally throughout all Viennese districts with a larger sample. Therefore, it is difficult to generalize from the existing data.

The place-related factors relate to the socio-cultural context of the study. Vienna might have common features with many other European cities (in terms of size, quality of PT, cultural diversity), but there are also many features which are unique in defining the city's specific culture in relation to transport usage and car-affinity. The fact that Austria's and Vienna's economy is a big component supplier for international automotive companies might be one influential factor. Or the fact Austria's tourism is strongly built around the country's natural beauty might influence people's environmental attitudes. These and many other factors are historically grown and very hard to grasp. Therefore, no generalization can be made stating that the proposed groups and their share of the population will be the same in all cities with similar spatial or demographic features. It seems useful to conduct separate studies in different cities to study their respective classification and identify their specific motivations and obstacles toward a sustainable mode shift. Assuming that more or less the same obstacles (such as habit, car-affine social environment, necessity among others) can be found in different cities, knowledge on potentially effective policies can be used from former studies. Hence, we cannot generalize about the composition of the groups across different cities, but we can use knowledge from other cities about how to address the groups once their specific obstacles are identified. Moreover, existing studies may be used for new cities by drawing conclusions about the influence of the characteristics of different cities on the respective composition of groups (e.g. investigating which characteristics of a city turn people more car-affine or the opposite). Therefore, it seems useful to undertake such studies in many different cities as to be able to compare the outcomes for greater generalizability.

The research-related factors as stated above do not only affect the generalizability of the results. Even more importantly, they need to be questioned critically because they have an impact on the whole validity and trustworthiness of the study. The data needs to be generated very carefully in order to allow for greater representativeness (in terms of gender, class, age, spatial features and many more) and reliability. This ensures that reality is reflected in the best way possible, which is what this thesis aimed at doing.

7) Conclusion and Outlook

As a conclusion of this project, one can say that urban transport is a very complex topic that can be analysed from many different perspectives. A more holistic or comprehensive understanding therefore requires the inclusion of different disciplinary perspectives which has been tried within this thesis. My research qualifications as mentioned in the beginning allowed me to approach this complex and sometimes challenging project. The perspectives taken are based on this theoretical knowledge and have included insights from Human Geography, Sociology, Consumer Psychology, Economics and Policy-making. They all can be understood as different lenses that one takes to look at the topic of urban transport. Considering the increasing urbanization and concentration of economic and social (and therefore potentially polluting) activities in urban spaces, this scale seems of particular relevance for such a study. The city of Vienna has been chosen because the high car usage in spite of excellent infrastructure increased the doubts towards the commonly used rationale that people would not drive cars if they just had valid alternatives. In a more theoretical and elaborated way, this first doubt has guided the research questions of this thesis which were:

(Q1) Is the extended TPB and group segmentation a suitable approach to understand and predict the factors that influence people's transport mode choices in Vienna?

(Q2) Based on the results of the questionnaire, which type of travellers can be encountered in Vienna and what are their specific mode choice motivations?

(Q3) How could policies address these distinct groups of people as to reach the new imaginary of urban transport?

Research question one can simply be answered with a "yes". This paper has shown that indeed, this model is well-applicable to the case of Vienna, and that these factors are suitable to predict transport mode choices although the role of social norms within the model has been questioned due to the impossibility of measuring or observing it through the use of quantitative methods.

To answer question two, seven groups of distinct yet internally homogeneous groups of travellers could be identified. With small deviations, the characteristics of the groups are very similar to those that Anable has identified. The seven groups are divided into five car-owning groups, namely (1) Aspiring Environmentalists (20%), (2) Non-environmentalists (9%), (3) Malcontent Motorists (28%), (4) Die-Hard Drivers (22%), (5) Complacent Car-addicts (21%) and two non-car-owning groups, namely (6) Reluctant riders (33%) and (7) Car-less Crusaders (67%). This segmentation has been found to be very useful to address the different types of behavioural motivation within policy-making.

As to address the different groups, further research will be required. This thesis has only discussed possible policy measures that could address group 3 – as the largest and most promising car-using group. The overall policy-recommendations have been to (1) diminish convenience of driving, (2) prioritize alternative modes in traffic planning, (3) set up campaigns emphasizing negative aspects of the car & positive aspects of alternatives and (4) set up financial incentives to abandon car usage. All these policies have been led by the underlying ideas of the new imaginary that is to not forbid cars but to disfavour them.

Despite all these theoretical and empirical findings and large ambitions to develop alternatives, it needs to be said that we still live in a very consumption-based society, in which transport is only one of the manifold spheres of consumption. To a certain extent, as aspired within this thesis, it is possible to analyse the topic of transport independently of these societal challenges, but it will not be possible to change transport independently of its societal, political and economic context. Yet despite this great obstacle, it seems important to conduct feasible and constructive research on how alternatives to the current growth- and consumption-dependent lifestyle can be reached. In the case of this thesis, these alternatives are based on a new imaginary of urban culture and living, which is based on new urban values such as environmentalism, conviviality and social equity.

Thereby, this thesis has aimed at offering an alternative in various ways: first, by shifting the focus away from pure emphasis on new infrastructure towards the emphasis on people's behaviours and motivations as a possible starting point for societal change. Second, by connecting it to the work of Anable. The fact that the results are so similar uplifts her contributions and confirms mine. The fact that these cluster groups are actually formable confirms the theoretical importance of this topic and the used approach. Third, by introducing the rather new methodologically approach of system-mapping. It has been proven highly valuable for analysing and understanding complex systems such as transport as presented in this work. Fourth, by illustrating the importance of top-down approaches in transport policy-making. This is argued on the basis that individual interests conflict with the common interest of society and because pro-environmental "sacrifices" of some only create more space for unsustainable behaviour of others.

This thesis has been written in a time in which many stakeholders are very concerned about this topic and search for feasible alternatives, which could also be the basis for further research. Interesting options could be to develop policy measures based on the other segmented groups and to include the policies in the system-map. Furthermore, focus groups with specific car-owning members could lead to great qualitative insights on their motivations and the reasoning underlying them. Interviews with policy-makers or structural analysis of these institutions could also be of great interest to identify institutional barriers to the implementation of such group-specific policies. On a more personal level, I intent to propose this work to research institutes and/or political stakeholders in Vienna to discuss their views on the actual feasibility. My empirical research (and the countless talks with survey respondents on the streets of Vienna) have shown me the importance of finding and implementing good and just solutions for a topic that – at the first glance – seems very rational and logic, but which actually is so emotional for very many people.

A concluding thought of this project is that every socio-economic system (even capitalism) has somehow been constructed by people. Having that in mind, it is impossible to think that it couldn't also be people who have the power to deconstruct the current and create a new system. Applied to cars: if we all can imagine a futuristic city with flying cars and intelligent buildings, but we cannot imagine a city without individual cars, then maybe we need to change our imaginary...

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Appendices

- 1) Survey, English translation p. 63
- 2) Material needs for different means of transport p. 65



Appendix 1 – Survey (English translation)

Survey on Transport Mode Choices

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UNIVERSITY

Thank you for participating in this survey and helping me with my Thesis. The survey consists of three short parts and will not take more than 10 minutes of your time.

Confidentiality assurance: your data will be used exclusively within the frame of my Master Thesis and will not be handed out to any third party outside of Lund University.

Part 1 - Attitudes

How much do you agree with the following statements?	Strongly		Partly		Not at all
	1	2	3	4	5
① Environment					
Current Environmental problems concern me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I try to live environmentally-friendly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When consuming, I consider environmental issues	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am willing to pay more for ecological products.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I perceive car-usage as bad for the environment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
② Transportation modes	1	2	3	4	5
I have positive associations with car-driving	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I perceive car driving in Vienna as convenient	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I perceive car driving in Vienna as safe	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have positive associations with cycling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I perceive cycling in Vienna as convenient	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I perceive cycling in Vienna as safe	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have positive associations with public transport	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I perceive public transport in Vienna as convenient	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I perceive public transport in Vienna as safe	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
③ Social norms	1	2	3	4	5
Most people in my surrounding use cars on a regular basis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Most people in my surrounding think it is ok to use the car	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It conflicts with my values and principles to use a car on a regular basis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nothing hinders me of using a car (legal issues, health, fear etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would drive less if friends would do so	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Part 2 – Intentions & Habits

④ How much do you agree with the following statements?	Strongly		Partly	Not at all	
	1	2	3	4	5
In the future I want to use cars less	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I want to use more public transport means	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I want to bike/walk more	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I don't want to change anything	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

⑤ For which purposes do you use the following transportations?	Car	Subway	Bus & Tram	Bike & walking
Commuting to work	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Shopping	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Leisure (sports, friends, music)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Appointments (doctor, authorities)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Family activities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Weekend trips	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Special occasions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Part 3 – Transport Mode Choice

⑥ How often do you use these transport modes?	Rarely / never	Several times / Month	Once a week	Several times / week	Daily
Car	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Subway	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bus / Tram	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bike	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Walking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

⑦ What are your three main reasons to use the car?

- No access to public transport
- Time-saving
- Cost-saving
- Freedom & Flexibility
- Comfort
- Reliability
- Necessity
- Habit
- Family / Friends
- Status
- Fun-factor

⑧ What would convince you to use the car less?	Yes	No	Not sure
Rising costs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Longer driving times	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fewer parking spots available	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Better bike infrastructure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Better public transport infrastructure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cheaper public transport	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Part 4 – Personal Information

Age _____

Gender _____

Household size (Adults / Children) _____ / _____

Amount of cars within household _____ (+ car brand)

Ticket Wiener Linien? _____

District (location of living) _____

Km driven by car per year _____ Km

Monthly net household income (from income, pension funds, scholarships, governmental or family support)

- Less than 1.700 €
- Between 1.700 and 2.700 €
- Between 2.700 and 4.200 €
- More than 4.200 €
- No information

Appendix 2 – Material needs for different means of transport (Lähteenoja et al. 2006; Wuppertal Institute 2014)

a) MIPS for Infrastructure provision per person and year

	Mode of Transport	Abiotic (in t)	Water (in t)	Air (in t)	Total (in t)
1	Walking Infrastructure	0.00	0.00	0.00	0.00
2	Bicycle Infrastructure	0.10	3.00	0.00	3.10
3	Metro/Train Infrastructure	1.00	54.80	0.10	55.90
4	Road infrastructure (bus)	19.60	153.60	2.30	175.50
5	Road infrastructure (cars)	21.70	200.80	2.40	224.9

b) MIPS for usage of transport means per pkm

	Mode of Transport	Abiotic (kg/pkm)	Water (kg/pkm)	Air (kg/pkm)	Total (kg/pkm)
1	Walking	0.00	0.00	0.00	0.00
2	Bicycle	0.05	4.30	0.01	4.36
3	Bus	0.32	3.23	0.06	3.61
4	Conventional passenger Car	1.44	14.52	0.14	16.10
5	Metro/Train	0.53	28.01	0.03	28.57