

MOBILITY TRENDS IN CUTTING-EDGE CITIES

Final Report

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Foreword

When considering cities on the cutting edge in terms of mobility, we think of those which offer a wide range of transport options to their inhabitants, cities that value quality of life highly, that strive to offer new solutions to pressing mobility problems. This piece of research suggests that across all the cities analysed - Paris, Santiago de Chile, Singapore, Tokyo and Vienna - multimodality is the feature that is universal and on the increase. The only exception to this is Singapore, where individual car use is on the rise despite strong regulatory policies which make ownership and use expensive.

It is also evident that city-dwelling car owners are increasingly open to various alternative modes of transport and to the different services available. Despite owning a car, they often decide to use public transport or the bicycle, their choice of mode being swayed by considerations of traffic congestion or health. Mobility in cities is thus seen to be becoming progressively more diverse, with the benefits accruing to everyone.

This movement towards greater multimodality, together with an openness towards new mobility solutions in the cities of industrialised countries, is the prerequisite for the adoption of new products, such as electric cars, and for service innovations like car- or ride-sharing services. The trends presented in this research are only the initial signs of a more flexible, spontaneous and diverse mobility landscape which will be apparent in the years to come.

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Preface

Many new mobility trends are becoming evident in cities today. In the inner-city neighbourhoods of Europe, high rates of growth are being recorded in public transport use and cycling. Cycling infrastructure is being further developed, and new concepts such as car sharing and bicycle sharing are emerging. Elsewhere – for instance in the large cities of Latin America and Asia – innovative transport concepts are being implemented.

Emerging mobility patterns are heavily shaped by their local context: the motives of users, the quality of the transport infrastructure and mobility services, regulation and land use. This study explores mobility trends in their city-specific context in five cities: Paris, Santiago de Chile, Singapore, Tokyo and Vienna. It uncovers new mobility practices and the reasons that lie behind them. It builds on an extensive analysis of quantitative data from the last ten to fifteen years. It combines this analysis with an in-depth qualitative inquiry into the underlying motives of the trendsetting users.

Each city teaches its own lessons. Paris demonstrates how the adoption of new concepts of transport in the city centre, such as bicycle sharing, is both a rational choice and at the same time a symbolicemotional one, i.e. a means whereby the user can express themselves or their social position. Santiago can serve as role model for an unexpected trend: bringing cycling back into the mainstream of mobility culture. Singapore is still the benchmark for successful integration of transport planning and land use, but also shows the effects of regulating car use; Tokyo shows that even in a situation where transport demand is always growing, this can be handled by the implementation of appropriate transport systems. Vienna serves as an example to anyone who wants to study how successful long-term promotion of public transport can be achieved, and how this might in turn affect user behaviour.

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Executive Summary

I. Description of research

This report analyses the mobility trends of the last decade in five cities around the world: Paris, Santiago, Singapore, Tokyo and Vienna. It aims to identify the most recent trends and developments in the individual mobility of the inhabitants of these cities, and adopts an explicit user perspective in analysing these trends, with the aim of finding out more about motives of the users and the underlying factors that motivate their behaviour.

II. Motivation and background

The urban mobility of today is becoming more and more diverse in character. Economic prosperity and growing use of the car, two phenomena which had been associated with each other for a long time, are not necessarily linked today as they were until a decade ago. When one looks at the aggregate numbers, it is evident that in many cities the modal shares of public transport, cycling and walking are growing.

On the one hand, these developments have been supported by substantial interventions and policies which affect the supply side. At the same time as road tolls and parking restrictions are challenging the attractiveness of the car, alternative modes are being improved: public transport coverage is increasing; cycling lanes and pedestrian areas are being expanded. New mobility options such as bicycle- and car-sharing schemes complement these changes. Their use, especially in combination, greatly benefits from information and communications technology and the digital age.

On the other hand, while it is true that a focus on the supply side can to some extent explain these trends, it does not take into account the fact that mobility and mode choices are heavily influenced by personal and social factors, habits and expectations. Car ownership statistics cannot be understood purely in terms of rational factors, so why should this be the case for other modes of transport? Moreover, the 'built environment' may also shape mobility decisions. Compact and dense cities enable people to live virtually car-free, and there is evidence that people choose their residential location because they explicitly seek the lifestyle that goes with their choice.

The study documented in this report provides an exploration of the motivations of transport users who are responsible for ongoing changes observed in the mobility sector in five cities: what drives cycling *pioneers* in Santiago? What makes people own and use cars in Singapore although this incurs heavy costs? What made public transport in Vienna become so attractive that many users hardly even consider using other modes? How do people value an efficient system that handles enormous transport demand in Tokyo? What is behind the choice of so many to live car-free in the centre of Paris, Continental Europe's most populous agglomeration, and why does the car continue at the same time to be so important in the suburbs of the very same city?

III. Methodology

To investigate these questions, an approach was used which combined both quantitative and qualitative research. Quantitative analysis was used to describe each city's mobility landscape and to uncover (statistically) visible mobility trends. The factors looked at included those most relevant in the context, for example travel behaviour, transport infrastructure, policies, economic development, spatial structure and density. This analysis helped to identify the city-specific developments and the key trends to be explored in more depth for each city. In-depth interviews with notable experts were conducted in each of the five cities, helping to further isolate the trends and to select target groups for the user analysis. Instead of a standard methodology, specific methodological approaches were designed to fit each case: focus groups where an active discussion was needed, in-depth interviews with users to obtain detailed information about motives, and a qualitative online survey to put a broad spectrum of questions to a higher number of users.

The data consisted mostly of official transport surveys and statistics from the cities, in which, where needed, we carried out some of our own data analysis. The qualitative aspect involved more than 20 experts and almost 150 users.

The analysis presented in this report is structured by the following modes of transport:

- walking;
- cycling;
- public transport; and
- the car.

The first two, walking and cycling, are summarised under the heading 'non-motorised transport' (NMT). We use a framework that clusters the motives into 'rational-instrumental' and 'social-emotional' factors.

IV. Results

The results of the report highlight the fact that transport systems vary greatly from one city to another. There is no one trend that can be readily identified in all the cities. Rather, context-sensitive analysis and case-specific descriptions are indispensable for understanding mobility trends.

Non-motorised transport illustrates this finding: it has seen a sharp increase in Paris and Vienna, stagnation in Tokyo and a decrease in Santiago (no statistical data on NMT is available for Singapore). A close look at the data and its spatial distribution shows that NMT is particularly important in densely populated city centres, but of much lower relevance in suburbs. Disaggregating data further reveals that trends can sometimes be very location-specific. The increasing modal share of the bicycle in Santiago doubled over the last decade across the whole city, but increased eightfold in a number of its municipalities. Further investigation showed that this trend is driven by a social elite. For this group, using and riding a bicycle for everyday activities is not only a reasonable alternative because of the advantages of speed and flexibility that it affords in notoriously overcrowded traffic, but is also, more importantly, a status symbol that evidences the lifestyle of an educated and wealthy younger generation.

In recent years, walking has become the main mode in terms of number of trips in Paris. It is behaviour in the city centre that is largely responsible for this trend, while the suburbs, on the other hand, are still dominated by cars. As well as walking, cycling is gaining importance as an NMT mode, enabled chiefly by the public bicycle-sharing scheme Vélib'. A multimodal lifestyle in which there is no ownership of any actual vehicle – no car, motorbike or bicycle – is the expression of an urban generation that wants to experience freedom, flexibility and spontaneity. Which mode of transport is used is more a matter of trip purpose than of habits or social status.

Public transport, like NMT, displays a variety of developments. Its modal share has remained almost unchanged in Paris and Singapore, while it has increased in Tokyo and Vienna. In Santiago it has undergone a noticeable decline. Remarkably, all five cities made efforts to improve their public transport systems, but evidently with varying degrees of success. The effect of spatial differences on mode choice is less strong than is the case with NMT. Combining public transport for longer-distance trips with walking or cycling for shorter distances is an obvious behaviour, and one that is commonly seen.

Our analysis of motives reveals that, for the most part, rational motives guide the users of public transport in making their mode choice. This is especially true in Singapore, where despite its high quality and a high modal share, public transport has an image problem, being considered as only a second-best alternative to the car. In Vienna, however, almost the opposite is the case – people appear to enjoy using public transport because it is fast and comfortable, and allows them to read or use their mobile devices.

Car ownership and use are increasing in some of the cities and declining in others, and there are also significant differences between different locations within the same city. In Singapore, car use remains at a constantly high level, despite high costs, strong regulation, and improvements in both the extent and the quality of the public transport network. In Paris, the overall decline in car use masks a significant difference between the inner city and the outer suburbs: in the centre, car use is less prominent than walking and use of public transport, while in the outer suburbs it is by far the most common mode. In Vienna, car ownership

and use have been steadily declining, although the absolute number of cars has continued to increase as a result of population growth. In Tokyo, both ownership and use have been constantly falling: car use in Tokyo has the lowest modal share of all our sample cities. In Santiago, both car ownership and car use are constantly increasing, and the infrastructure is also continuously being expanded.

Our analysis uncovered a broad spectrum of rational and social-emotional motives which explain the great variety in developments. Singapore serves as a good example to show that social-emotional factors can still explain car ownership, as is evidenced in situations where high costs of ownership do not stop the users from wanting to buy cars. Our results indicate that the aspiration to own such a luxury good actually increases with the price. Quite independently of 'instrumental' (practical) benefits such as speed, flexibility and the ability to accommodate a family, car ownership is still highly influenced by social expectations and status - owning and driving a car expresses wealth and social affiliation. In contrast, many car owners in Vienna no longer use their vehicle every day - evidently they find that public transport and walking outperform the car in terms of speed and cost. But despite an aggregate decrease in both its ownership and its use, the car remains a mobility resource in the portfolio of the population in Vienna, one which is reserved for special occasions such as outings on the weekend. Having said that, young people still want to keep their options open and obtain their driving licences.

V. Conclusion and implications

In summary, the findings confirm that urban mobility around the world can only be understood in a cityspecific context. Transport policies and measures exert an important influence on mobility, and so does the spatial structure in which citizens move, and their residential location. But social aspects also play an important role: the aspiration for car ownership in Singapore cannot be explained solely by looking at the supply side, and the (as yet small) group of cycling pioneers in Santiago exemplify dynamics which arise on the demand side.

Nonetheless, a few more general insights from across all five cities can be gained:

- Decisions about car use and ownership may become more pragmatic in the future, particularly in dense city centres. Nevertheless, the car will remain in the mobility portfolio, at least amongst those who can afford it.
- Public transport can be successful provided it is of good quality and has broad coverage. People regard public transport as attractive if it is good enough to merit being considered as an option in its own right, not merely as a second-best solution or the only mode available.
- Walking and cycling play an important role, and can even become the most dominant modes in central areas of cities at least. Given sufficient economic prosperity, it is possible that such trends in non-motorised transport may spread also to cities that are at present less developed.



1_Study Objectives



The way in which mobility patterns are developing is changing: long-term trends - steady increases in car ownership and driving, for example - are not going to continue indefinitely. Particularly in cities in developed economies, there are signs of a decrease in per-capita distance travelled, increasing use of public transport, decreasing car ownership, and an increase in multimodality and/or intermodality. But in cities in developing countries also, unexpected changes are occurring, such as an increase in cycling. These changes are being matched by changes in transport supply: car-sharing and bicycle-sharing schemes have emerged, public transport has improved substantially, and driving is becoming both more expensive and increasingly subject to stricter regulations. Apart from changes in transport supply, changes in people's attitudes and values might also be expected to have an impact on the developments outlined above.

The *Mobility Trends in Cutting-Edge Cities* project explores the most recent urban mobility trends and their underlying driving forces. For a study sample of five cities - Paris, Santiago, Singapore, Tokyo and Vienna - it seeks to understand the directions in which change is taking place, the driving factors behind those changes, and the implications for the development of urban mobility.

The five cities were selected as the result of an in-depth screening process across cities that appear to be trendsetting. The objectives of the study were to answer the following questions:

- What have been the major changes in mobility patterns among different segments of the population (age, income etc.) within these cities over the period of the last five to ten years?
- What are the main drivers of these developments, such as changes in transport supply, improvements in the quality of public transport, car sharing, bicycle sharing, economic influences (changes in personal income, mobility costs, values and attitudes etc.) towards modes?
- What possible insights can be gained with respect to the future development of mobility trends?

The study is not comparative in the narrow sense of comparing levels and percentages of modal shares between the cities. Rather, it seeks to identify city-specific trends, their context, and the user motives that underlie and explain the various changes in mobility behaviour. Nonetheless, the study does provide a synthesis of the findings. Although we do not intend to compare the very heterogeneous sample cities, we discuss the extent to which certain trends - and the underlying factors behind them - show similar patterns in different cities. These results will lead us to a qualitative outlook for the future of urban mobility.

As a first step, the study gives insights into the recent developments within the sample cities by describing their social and spatial structure, mobility landscape, and the main mobility trends evident in them over the last five to ten years (Chapter 3). Subsequently, the results of the qualitative analysis are presented separately for non-motorised transport (Chapter 4), public transport (Chapter 5) and the car (Chapter 6). The text ends with a discussion of the findings and, derived from our work, the outlook for future developments (Chapter 7).





2_Study Design

This section describes the methodological approach of the study. It presents information on the selection process for determining the case study cities, the research methods, and the framework we used for deriving recent mobility trends.

2.1 Case-study selection

Paris, Santiago, Singapore, Tokyo and Vienna were selected as case study cities. These are cutting-edge metropolises as regarding mobility trends. The following criteria guided our selection:

- indications of mobility trends visible in the modal split, such as decreasing car ownership and increased multimodality, or other evident trends such as a shift towards non-motorised transport (NMT) modes;
- visible initiatives centred on transport supply and regulation;
- data availability, which in most cases meant household travel surveys; and
- (in assessing the set as a whole) as much difference as possible between the case studies, so as to capture a wide variety of trends.¹

2.2 Research approach

After the selection of case studies, the approach to research followed three main steps (see Figure 2.1)

Step 1: Identification of city-specific trends through data analysis

As a first step, we conducted extensive data-based research into recent mobility trends in each of our case study cities. We used secondary data and statistics to detect recent trends and to explain their roots. We focused mainly on transport indicators, such as trip data, with respect to users and spatial structures. We furthermore analysed each city's context, its infrastructure, its economic development and its social structure, in order to be able to interpret our findings.

Step 2: Expert interviews to validate the identified trends and prepare the qualitative analysis

After identifying trends, we conducted expert interviews in each of the case study cities. For our experts we chose people who have in-depth knowledge about each city's transport system and developments. They came from a variety of backgrounds, for the most part either being scientists or belonging to institutions related to the transport sector (see Appendix A for the list of experts). The interviews were conducted using semi-structured interview guidelines, with predominantly open-ended questions. These guidelines varied between the cities.

¹ Our case selection was guided by the concept of selecting 'critical cases' such as those defined in Flyvbjerg (2006), for different types of mobility trends. We aimed to include cities which are leading the way in terms of noteworthy developments and which we consider to be of strategic importance in relation to understanding various developments in the field of transportation.

Step 3: In-depth analysis of the users to understand drivers behind the trends

The last step of the analysis focused on the user; here, our aim was to understand the drivers of the mobility changes detected in Steps 1 and 2. The explicit adoption of a user perspective led us to choose various qualitative methodologies. This required considering each case-specific context in terms of the mobility trends we analysed, but also in terms of the surroundings, conditions and cultural specifics that favoured different methodologies in each city. Step 3 of Figure 2.1 shows the three methodologies that we used, and which was adopted for which city. In total, we selected in-depth interviews in three cases and focus group discussions or an online survey in the remaining two cities.

	Step 1	Step 2	Step 3
Paris Singapore	Data analysis		In-depth interviews <i>Guided, semi-</i> <i>structured</i>
Vienna		Expert Interviews <i>Guidelined,</i> <i>semi-structured</i> 22 interviews	46 interviews
Tokyo			Online survey 104 respondents
Santiago			Focus groups 3 rounds
Purpose	Trend identification & Specification		User analysis to identify drivers
	Target group selection		

2.3 Framework for explaining mobility trends

The project seeks to explain mobility trends, their causes and their drivers. Therefore we adopt an explicit user perspective. Our main interest is in explaining trends from this perspective, and, in keeping with the approach of our study, to generate new findings in the qualitative phase also from a user perspective. However, the conditions found in each environment – such as recent changes in the transport supply, or general societal values – cannot be ignored, as these influence, and are also influenced by, the user-related trends, making it necessary to embed the analysis of user motives alongside our contextual findings. To assess these factors within an appropriate methodological framework, we define the following criteria that the framework should be able to capture:

- surrounding conditions, and changes in those conditions which affect the transport system;
- user reactions to those changes; and
- explanation of intrinsic motives to explain the user behaviour.

Regarding the surrounding conditions, the results are derived for the most part in Step 1 (see Figure 2.1), and enhanced by the results of the expert interviews (Step 2). As for the user perspective, we aimed to cluster the drivers to enable better understanding of them. We reviewed a broad spectrum of different models which seek to explain user behaviour and reactions in the transport system. These included theories from the fields of engineering, economics and the social sciences, as well as psychological models (Ajzen, 1991; Fogg, 2009; Steg, 2005).

For our study, a distinction between the surrounding (external) conditions and user motives provides the most suitable framework. The user motives should furthermore be clustered in order to differentiate between different types, leaning towards more psychological models to explain individual behaviour. We thus divide them into 'rational' and 'social-emotional' motives.

The graphic representation in Figure 2.2 shows this structure:



Figure 2.2. Framework for Explaining Mobility Trends SOURCE: Author's representation (DLR).

Under the category 'Surrounding conditions' we consider all aspects related to the supply side of the transport system. This also includes external factors such as economic policies and developments.

The division of the user motives into rational and social-emotional has used the following definitions:

- Under rational motives we group all motives where a user considers factors affecting the instrumental (practical) use of transport - such as speed, cost and reliability - in his mode choice. These factors are very likely to be influenced at least partially by the surrounding conditions.
- Social-emotional motives include all motives whereby a user is influenced, in choosing a mode of transport, either by his or her personal desires or by social norms. An example of the latter could be the use or ownership of a certain mode of transport owing to social expectations, or perhaps peer pressure.

This approach is in some respects similar to that of Steg (2005), although we use only two rather than all three of Steg's categories ('instrumental', 'symbolic' and 'affective'²). A further difference lies in the fact that we also assess modes of which users cannot obtain personal ownership. We will use the framework that we have here outlined to structure and explain our findings.

² These terms are derived from the work of social psychologist Helga Dittmar. According to Steg (2005), Dittmar contends that the use of material goods fulfils three functions: 'instrumental', 'symbolic', and 'affective'. This implies that car use may have an instrumental function (i.e. a practical one: it enables activities), a symbolic function (i.e. the car is a means to express oneself or one's social position), and an affective function in connection with deeper, non-instrumental needs and desires.



3_City Profiles

The results of this report are based on five case study cities. We selected those cities because they all are outstanding examples of current mobility trends and represent a broad variety of types of development. We selected:

- 1 Paris
- 2 Santiago
- 3 Singapore

4 Tokyo

5 Vienna

These cities are now briefly introduced by explaining their setting and mobility landscape, and the latest trends observable in them. Background information on each city's mobility and transport infrastructure can be found in Appendix B, along with additional illustrations.

3.1 Case study: Paris (Île-de-France)

3.1.1 Background, density, population

Paris, the capital of France, is by far the biggest city of its country. Located in the Île-de-France region, together with its suburbs it reached a population of 12 million inhabitants in 2014. Paris not only represents the political, cultural and economic centre of its country, but is also one of the most prominent cities in Europe. The agglomeration's shape is heavily influenced by its history: it reaches enormous density levels of more than 21,000 inhabitants per square kilometre in its historic centre, but the suburbs are much more sparsely populated (see Table 3.1).

3.1.2 Mobility landscape and modal split

Looking at the overall modal split (Figure 3.1), two things stand out: first, that walking is the dominant mode in Paris; and second, that car use is almost as popular as walking (at about 38% and 39% respectively). It is, however, crucial to understand that Parisian mobility is characterised by huge differences between urban and suburban areas. The car is the dominant mode in the suburbs, attaining modal shares of 50% and more. In the city centre, however, walking, cycling and public transport trips together sum to more than 85% of all trips (STIF/DRIEA, 2010).

The total number of private vehicles circulating in the region is still increasing (standing at 4.9 million in 2010), which represents a household penetration rate of 70%, but again ownership differs spatially, with much higher rates in the suburbs. Paris' inhabitants accomplish, on average, 3.9 trips per day for a mean duration of 24 minutes, and covering an average distance of 4.4 kilometres, but with spatial disparities: trips in the centre are shorter but more numerous, while the opposite is true in the suburbs (see Table 3.2).

3.1.3 Main trends

As shown in Figure 3.1, in 2010 about 39% of all trips in the Île-de-France region were made by foot. While the modal share of walking has increased significantly since 2001, car use dropped by six percentage points, from about 44% to about 38%. Public transport, and cycling also, achieved slight growth during the last decade. Cycling nearly doubled its modal share, albeit from a low initial level in 2001.

In summary, some of Paris' main trends and developments over recent years are:

- There has been an overall increase in walking, and decreasing car use, but with considerable differences from one region to another.
- An increasing divergence has been seen in the modal split between the centre and suburbs, with continuing growth of car use in the outer suburbs.
- New mobility options such as the bicycle rental scheme Vélib' (2007) and the electric car-sharing service Autolib' (2011), have been introduced.



Figure 3.1. Paris (Île-de-France)'s Modal Split Over Recent Years

SOURCE: Author's calculations, based on STIF/DRIEA (2010).³

³ Modal split figures for Paris shown in this report differ slightly from the official numbers. This is due to (a) harmonisation of age groups between the surveys of 2001 and 2010 - in the values shown here only persons aged 6 years and older have been included; and (b) trips from the Île-de-France region (both in and out) not being counted.

Table 3.1. Paris at a Glance

	Central Paris [a]	Région Île-de-France [b]
Inhabitants (million)	2.24 (2014)	12.01 (2014)
Area (km²)	105	12,012
Density (inhabitants/km²)	21,346 (2014)	999 (2014)

SOURCE: Inhabitants: Paris & Île-de-France: Insee (a); Area: Paris: Encyclopædia Britannica, Inc., 2015; Île-de-France: Préfecture de Paris et d'Île-de-France. NOTE: See Figure B.1 for a map showing the areas corresponding to [a] and [b].

Table 3.2. Paris - Transport Indicators

	Central Paris [a]	Inner suburbs (petite couronne)	Outer suburbs (grande couronne)	Région Île-de- France [b]
Trips per day	4.2	3.7	3.9	3.9
Average trip distance (km)	2.8	3.6	5.9	4.4
Cars per household	0.5	0.9	1.4	1.0

SOURCE: Author's calculations, based on STIF/DRIEA (2010).

NOTE: See Figure B.1 for a map showing the areas, and in particular the areas corresponding to [a] and [b].

3.2 Case study: Santiago

3.2.1 Background, density, population

Santiago is the capital city of Chile, host of all the governmental offices, and the main economic and cultural core of the country. The city has more than 6 million inhabitants (approximately 40% of the national population), distributed among 36 municipalities or communes, each one of them having an independent, democratically elected mayor. The area of a single commune ranges from 15 km² to 70 km², and they cover in total over 700 km² (see Table 3.3).

3.2.2 Mobility landscape and modal split

Santiago's transport saw disruption in 2007, when Transantiago was introduced. The launch of this citywide integrated public transport system was accompanied by a relaunch of the bus system, and was intended to raise the standard of public transport by introducing BRT (bus rapid transit) standards in at least some parts of the city, and fare integration with the Metro. The introduction, however, went far from flawlessly, and led to overcrowded buses which did not run very often, and an increased need for transfers, particularly between bus and metro. Moreover, many took to using their cars instead. As a result, a significant modal shift occurred from buses to other modes of transport (metro, private transport and the two non-motorised modes, namely walking and cycling).⁴

The effects of this transformation still shape the city's mobility, as Figure 3.2 shows: private motorised transport has gained significant modal share between 2006 and 2012, while public transport's modal share has decreased. This is due mainly to those in middle- and high-income groups acquiring cars (see Table 3.4). Similarly, walking has dropped by almost four percentage points. Of note is that the popularity of cycling has seen steady growth, so that its modal share has more than doubled in only 11 years, while in some communes there has been an (almost) eightfold increase in their cycling trip count (see section 4.3 for our analysis of this trend).

3.2.3 Main trends

The following points summarise Santiago's recent mobility trends:

- Transantiago has been introduced, with a subsequent shift towards private transport, an increase in cycling, and a drop in patronage of public transport.
- There has been simultaneous densification in the central communes and low-density expansion of the urban sprawl, which has had direct effects on mode choice and trip length.
- The infrastructure for both metro and urban highways has expanded.

⁴ At the time of writing, the passenger numbers using Transantiago have stabilised; however, the system runs a large operational deficit and receives more than US\$500 million per year to cover its costs (EMBARQ, 2013, p. 90).



Figure 3.2. Santiago's Modal Split (Working Day) Over Recent Years

SOURCE: Author's calculations, based on EOD (Encuesta de Origen y Destino: origin-destination traffic survey) 2012 (SECTRA, 2012).

Table 3.3. Santiago at a Glance

Inhabitants (million)	6.2 (2012)
Area (km²)	752
Density (inhabitants/km²)	8,223 (2012)

SOURCE: Inhabitants: Census 2012, preliminary results; area: author's projection, based on INE (2002), Ferrando (2008), MINVU (2008) and Trivelli (2010).

Table 3.4. Santiago - Transport Indicators

	Average	Low income	Middle income	High income
Trips per day	2.8	2.0	3.0	4.3
Private vehicles per household	0.6	0.2	0.6	1.8
Trip distance (km, crow-fly)	5.3	N/A	N/A	N/A

SOURCE: Author's calculations, based on STIF/DRIEA (2010).

3.3 Case study: Singapore

3.3.1 Background, density, population

Singapore is a small city state located just off the southern tip of the Malay Peninsula. It is one of the world's major commercial hubs, as well as one of its busiest ports. In recent decades, Singapore has experienced a rapid growth in both economy and population, accompanied by a dramatic increase in travel demand. With over 5.4 million inhabitants (3.85 million of them being either Singapore citizens or Singapore permanent residents, and the rest foreigners) living on an island approximately 718 km² in area, Singapore is amongst the world's most densely populated cities. As well as its population growth, Singapore's density is increasing too – from 5,900 inhabitants per km² in 2000 to 7,615 inhabitants per km² in 2014 (SingStat, 2014a).

Guided by its Constellation Plan, it is a leading example of achieving a sustainable transport system by forwardlooking and successful integration of urban development (in a dense, accessible, mixed-use urban environment) and proactive transport planning (see Haque, Chin & Debnath, 2013; UN-HABITAT, 2013; Yang & Lew, 2009).

Singapore is famous for being the first city in the world to introduce a road pricing scheme, first by its Area Licensing Scheme in the 1970s and then, since 1998, by its Electronic Road Pricing (ERP) Scheme. The ERP is based on electronic toll collection at toll gates (ERP gantries), with prices which vary by time and gate, and which are adjusted frequently to aim for a certain traffic flow.

3.3.2 Mobility landscape and modal split

According to the Household Interview Travel Survey (HITS), the Singaporeans are in the habit of using public transport (see Figure 3.3): MRT (mass rapid transit) / LRT (light rail transit), bus and taxi account for 57% of the modal share in 2012. Before stabilisation at this level, the share declined from 1997 (when it was 64%) to 2008 (57%), since when it has remained fairly stable. In particular, bus and taxi faced significant losses while the rail-based public transport modes (MRT/LRT) increased in popularity. The rest of the trips are taken by car/motorcycle, with a modal share that increased from 36% in 1997 to 43% in 2008, and has remained stable since then. It should be noted that Singapore's published HITS statistics include only motorised modes - neither walking, cycling nor other non-motorised modes feature in data collection.

3.3.3 Main trends

With an expanding economy and increasing population size in Singapore, it is not surprising to see that travel demand has increased tremendously over recent decades (see Figure 3.3):

- In 2012, an average of 11.1 million trips were generated daily a growth of 48% from 1997, equating to approximately 2.6% p.a.
- The number of ERP gantries has been continuously expanded, from 45 to 72 between 2004 and 2013 (LTA (g)), and the road infrastructure is also being extended.
- The public transport infrastructure is being continuously expanded, with new MRT lines connecting suburban housing districts, and LRT lines for rail-based fine distribution of passengers.



Modal share

Trips (million)

Figure 3.3. Singapore's Modal Split and Daily Travel Demand (Motorised Modes Only) Over Recent Years SOURCE: Author's calculations, based on LTA (e).

Table 3.5. Singapore at a Glance

Inhabitants (million)	5.47 (total) (2014)
Area (km²)	718
Density (inhabitants/km²)	7,615 (2014)

SOURCE: Inhabitants and area: SingStat (2015a).

Table 3.6. Singapore - Transport Indicators

Trips per day	2.1 (walking and cycling excluded) (2012)		
Average trip distance (km, 2008)	Car / van	10.0	
	Bus	7.3	
	MRT	13.2	
Cars per household	0.4 (2012)		

SOURCE: Author's calculations, based on LTA (e); SingStat (2014b).
3.4 Case study: Tokyo

3.4.1 Background, density, population

The Tokyo Megalopolis Region, or Greater Tokyo (Metropolitan) Area (labelled 'A' in Figure B.2), is regarded as the most populous metropolitan area in the world (UN-HABITAT, 2013).⁵ The Greater Tokyo Area is home to 37.8 million inhabitants (30% of Japan's total population). Its core ('23 Special-ward Area') ('C') accommodates some 9 million inhabitants in an area of about 623 km², resulting in a high population density - about 14,440 inhabitants per km² (TMG, 2013). This figure is continuously rising: after a longrunning era of negative net migration in the core due to the soaring land price (leading to urban sprawl), the trend reversed in 1997 (see Figure B.3).

3.4.2 Mobility landscape and modal split

With an average daily ridership of 8.5 million, the world's most used metro system is located in Tokyo (UN-HABITAT, 2013). Consequently, the underground and overground railway modes dominate the passenger transport system of Tokyo, accounting between them for 41% of the modal share in 2008 (Figure 3.4). It is notable that the non-motorised modes, walking (23%) and cycling (15%), are the most common modes of transport after rail-based public transport, whereas bus and tram play only minor roles (with just 3% of passengers between them). Private motorised transport, i.e. car and motorcycle, is responsible for 14% and 2% respectively of passenger transport. The proportion of car users in particular shows a decreasing trend (falling five percentage points in the ten years since 1998).

3.4.3 Main trends

To sum up, the following trends characterise Tokyo:

- After a long period of population decline (negative net migration), Tokyo's population has been growing since the end of the 1990s, and the growth rate has actually accelerated in the last few years. One consequence has been re-densification and re-urbanisation of the central area.
- Car use has continually declined and has now reached a very low level, with public transport taking over the majority of this share.
- The rail network, already very dense, has continued to expand (with 7% being added to total track kilometres between 2001 and 2012).

⁵ However, according to a recent study for World Bank based on empirical observation and using satellite imagery and demographic data (World Bank Group, 2015), the Pearl River Delta urban area in China, which includes Dongguan, Foshan, Guangzhou, and Shenzhen, has now become the largest single urban agglomeration in the world (with 42 million inhabitants in 2010).



Figure 3.4. Greater Tokyo Area's Modal Split Over Recent Years SOURCE: TMATPC (2012).

Table 3.7. Tokyo at a Glance

	Greater Tokyo Area (A)	Tokyo Metropolis ('Tokyo-to') (B)	23 Special-ward Area ('ku') (C)
Inhabitants (million)	37.8 (2014)	13.2 (2013)	9 (2013)
Area (km²)	13,556	2,188	623
Density (inhabitants/km²)	2,791	6,038	14,543

SOURCE: A: UN DESA (2014); B: TMG (2013, p. 7); C: TMG (2013, p. 5). NOTE: See Figure B.2 for a map of the area.

Table 3.8. Tokyo - Transport Indicators

		Greater Tokyo Area (A)		Tokyo Metropolis ('Tokyo-to') (B)	23 Special-ward Area ('ku') (C)
Т	rips per day	2.5		N/A	N/A
А	Average trip distance (km)	Commuting	12.2	N/A	N/A
	Home – personal business	3.6			
	Other – personal business	4.6			
C	Cars per household	0.5		0.6 (outside the 23 Special-ward Area)	0.4

SOURCE: AIRIA; MLIT (2010); TMATPC (2012). NOTE: N/A - not available

3.5 Case study: Vienna

3.5.1 Background, density, population

The city of Vienna is both the national capital of Austria and also one of Austria's federal provinces ('Bundesländer'). With a total area of 414 km² and a population of about 1.79 million, it is by far the largest municipality in the country. Vienna is a growing city, and has seen an overall 10% increase in population (and population density) between 2005 and 2013 (Statistik Austria, 2015a).

Positive net migration, both external (from foreign countries) and internal (from the rest of Austria / other Bundesländer) are the two most important causes for the growing population – and of the two, external migration has contributed the larger part (see Statistik Austria (2014a) for more information on the migration balances within Vienna).

3.5.2 Mobility facts

Between 2001 and 2013, the data shows relatively stable modal shares for walking (varying between 27% and 28%) and car passengers (9% decreasing to 8%) - see Figure 3.5. It is noteworthy that the share of car drivers reduced significantly from 26% in 2001 to 20% in 2013, while public transport's share increased from 34% to 39%. Cycling is becoming more common as well: its modal share has doubled from 3% to 6%. While the aggregate number of cars in Vienna increased from 2001 to 2012 (by 5%), the number of cars per 1,000 inhabitants decreased by 4% (see Figure B.4).

It is worth mentioning that, even though large changes in the modal split occurred over the last decade, indicators such as travel time (per trip and per day), distance travelled and the number of trips per day remained fairly stable, as Figure B.5 shows. This could be interpreted as a successful implementation of good alternatives to the car, but could also be explained as simply lending support to previous findings of the scientific literature, which speak of the '*law of constant travel time and trip rates*' (Hupkes, 1982).⁶

3.5.3 Main trends

The following trends characterise Vienna's development during the last decade:

- There has been a reduction in car travel. Given that the road infrastructure changed only slightly, this is related to policies penalising the car, such as parking management.⁷
- The developments have been taking place within the context of a strong policy in favour of enhancing public transport, which has, unsurprisingly, resulted in a steady growth of public transport's modal share.

⁶ However, while the average values might appear to indicate stability, the variance of travel times would need to be further analysed for more solidly grounded interpretation of the observations.

⁷ Although most parking management measures, along with the district parking restrictions, were introduced in the core area of the city (Districts 1 to 9 and District 20) in the late 1990s, the effects have become evident after a delay of about five to ten years.



Figure 3.5. Vienna's Modal Split Over Recent Years

SOURCE: Stadtentwicklung Wien, Magistratsabteilung 18 - Stadtentwicklung und Stadtplanung (2013, p. 34); Wiener Stadtwerke Holding AG (2014).

Table 3.9. Vienna at a Glance

Inhabitants (million)	1.79 (2015)
Area (km²)	414
Density (inhabitants/km²)	4,326 (2015)

SOURCE: Statistik Austria (2014b); Statistik Austria (2015a).

Table 3.10. Vienna - Transport Indicators

Trips per day	2.8 (2012)
Average trip distance (km)	6.8 (2012)
Cars per household	0.6 (2010)

SOURCE: Socialdata (2012); Statistik Austria (2013).





4_Non-Motorised Transport: Walking and Cycling

This chapter discusses the role of non-motorised transport (NMT) in each case study city. Our focus lies on developments that take place in city centres, where cycling and walking is much more common than in peripheral areas.

Overall, our sample of cities shows a broad variety of developments with respect to the non-motorised modes walking and cycling, in terms of both observable patterns and how they are changing (see Table 4.1). Our results include the following range of findings: walking is in some contexts (Paris) the main mode when it comes to number of trips; in Santiago it has been constantly declining for the last decade; and in one case - Singapore - it does not feature at all because it is not included in the official statistics as published. Cycling shows a broad variety too, being a long-established mode in Tokyo, a new and sensational but also "elitist trend" in Santiago, and in Vienna a mode that is steadily catching up with the others in popularity.

In this chapter, we will first give an overview of the statistical developments and present condensed results of the qualitative analysis. We will then cover the trends in **Paris and Santiago in more detail** as they each represent remarkable examples of NMT: Paris for NMT in general, and Santiago in particular for the developments it has seen in cycling.

Table 4.1. Overview of Trends in Use of Non-Motorised Transport

City	Trend summary from data analysis	Years	Trend and modal share		
			Walking	Cycling	
Paris	Growth in walking trips, making it the main mode, with a high share in the city centre; cycling increasing in the centre	2001 2010	⊼ 35% 39%	⊅ 0.9% 1.6%	
Santiago	A boom in cycling over the last several years, with an annual increase of 6%. Strong growth in central, high-income parts of the city (e.g. a nearly eightfold increase between 2001 and 2012 in the east - 'Oriente' in Figure 4.2)	2001 2012	⊻ 38% 35%	7 2% 4%	
Singapore	No data available	_	_	-	
Tokyo	Walking and cycling remaining constant at a high level	1998 2008	 → 24% 23% 	→ 15% 15%	
Vienna	No big change in the modal share of walking in the last ten years, but an almost doubling in the proportion of cyclists – although from a basis of only 3% (2001 to 2013)	2001 2013	 → 27% 27% 	⊼ 3% 6%	

SOURCE: See Chapter 3.

4.1 Summary: non-motorised transport in our case study cities

Paris: "Cycling is faster for everything... and also allows me to discover Paris."

Context: Non-motorised travel, in particular walking, is becoming the main mode of transport in terms of daily trip numbers. The share of cycling has increased as well, but from a much smaller base, and this increase is confined primarily to the centre of the city.

Motives: Our in-depth inquiry into user motives revealed a mix of rational and emotional factors lying behind the growing popularity of walking and cycling: speed, efficiency, low cost, freedom and discovery. It also highlighted the influence of a specific transport service, the bicycle-sharing scheme Vélib'. This offers major advantages for users, such as a low price and universal and flexible availability, while avoiding disadvantages such as everyday maintenance costs, theft and depreciation/deterioration.

Santiago: "We see [the boom in cycling] happening in high-income groups only. It is an elitist trend."

Context: The research highlights that the recent remarkable increase in cycling is driven principally by the group of young professionals with middle to high incomes, living in centrally located communes. This trend can be characterised as elitist.

Motives: This trend is driven to some extent by status, where cycling is associated with people who are active and take 'smart' decisions. This symbolic value attributed to cycling is complemented by a set of practical motives: particularly for those who choose to live in a central location, cycling is an efficient and healthy form of mobility in comparison with the alternatives. Of somewhat surprising prominence is the role played by following the example of others. People bring home cycling experience from abroad, take up cycling after observing their peers, or simply recognise that this mode of travel is becoming more visible on the streets.

Singapore: "I cycle on weekends, but more for leisure."

Context: The role of NMT modes in the mobility of Singaporeans is minimal. No publicly available official statistics exist to show the share of walking or cycling. The city infrastructure and facilities are designed to ensure very efficient use of the car. On the other hand, non-motorised travel - and cycling in particular - is only now beginning to play a part in transport and urban planning.

Motives: In some ways this mirrors the viewpoint of users. While participants in our research can imagine walking as part of their journey to work, cycling seems a realistic option, if at all, then only for leisure trips on weekends. In addition to the perceived lack of infrastructure, the warm, humid tropical climate makes it unfeasible to commute by cycling or walking in a society where shower facilities are not normally available at working locations.

Tokyo: Cycling - a healthy and stylish mode of transport

Context: Walking and cycling have been, and continue to be, major mobility options. About 15% of all trips in the Greater Tokyo Area are made by bicycle, and the figures indicate almost no change from past years. Moreover, feeder trips to public transport stations are common uses of these modes.

Motives: Health-consciousness and, related to that, the willingness to improve personal "lack of exercise" appear as overriding factors. In addition, owning a high-quality bicycle is considered to be a status symbol in some parts of Tokyo. These social-emotional factors combine with a noticeable tendency among people living in the 23 Special-ward Area (the centre of Tokyo) to use their bicycle also for commuting.

Vienna: Walking for short trips, public transport for longer ones - the intense promotion of cycling leads nevertheless to only moderate growth.

Context: Walking is very often chosen as an alternative to public transport for short distances. Particularly in the inner city, people seem to like walking because of the appealing environment, and also its value as a physical activity. Cycling, on the other hand, still tends to be considered a physical activity for leisure time rather than a means of transport.

Motives: Our research reveals that public transport, as the main competitor to the bicycle, is a major reason for the limited growth in cycling. Interviewees often stated that they would rather use the highquality public transport for long distances, or walk for short distances, than use a bicycle. By comparison, cycling on a daily basis seems much more complicated. Apart from safety concerns, factors influencing the Viennese in not using their bicycles include the narrow cycling lanes, unpleasant weather conditions, and the fear of theft.

4.2 Paris - "Cycling is faster for everything... and also allows me to discover Paris"

4.2.1 Context

Between 2001 and 2010, the number of trips made by foot grew significantly, by more than four percentage points (from 35% to 39%). As a result, walking became the main mode of transport in terms of daily trips. The cycling share also increased, but remaining relatively small in absolute terms (1.6% overall, about 3% in Paris centre). However, the observation is a little different in terms of distances, with a reasonable stability in the daily average distances travelled by foot in the region. It is very particular to Paris that the modal split is characterised by very large spatial differences: walking is the main mode amongst those living in the centre, with the car accounting for only 10% of all trips there; the opposite situation, however, holds true in the outer suburbs - see Figure 4.1 (STIF/DRIEA, 2010).



Figure 4.1. Paris Modal Split in 2010 by Residential Location - Centre / Inner Suburbs (Petite Couronne) / Outer Suburbs (Grande Couronne)

SOURCE: Author's calculations, based on STIF/DRIEA (2010).

4.2.2 Experts

According to the experts interviewed for Paris (see Appendix A), the above-mentioned trend has several causes, among which the following stand out:

- Jean-Pierre Orfeuil sees a trend towards **more local lifestyles**, in which daily activities are conducted in the vicinity of the place of residence. This is also true of the Parisian suburbs, which in increasing numbers are becoming 'full-scale' cities in their own right, with all the facilities one would associate with the inner city available locally.
- The **revival of the bicycle** is a trend seen by *all experts*. As one explanation for this they point out the practical advantages and the users' desire for freedom the ability to get around nimbly, to choose one's own schedule and to park more or less unhindered. Cycling has benefits in terms of efficiency and speed in a dense urban environment in comparison to walking (which is slower) and public transport (which is less flexible).
- The recent **advances in information and communications technology** were highlighted by *Bruno Marzloff*, particularly because they allow for an enhanced, seamless integration of different modes as part of one trip:

"...to the logic of multimodality⁸ was added the logic of intermodality.⁹" (Bruno Marzloff)

4.2.3 Users

Our user analysis relies on the depiction of an archetypal Parisian living with new mobility options, 'Alexandre' (see Appendix C for a description of him). He represents a growing group of people who are involved in the present and ongoing changes in Paris' transport, primarily because they make use of different modes of transport depending on the circumstances - mainly walking, cycling and public transport.

Alexandre's mobility

Alexandre travels mostly within Paris and its inner suburbs. He chooses most commonly to travel by foot, bicycle or public transport in his daily routine. He travels mainly on foot for short trips. Whenever he wants to travel further - 700 metres or more - he uses a bicycle. Alexandre cycles a lot, almost exclusively using the bicycle-sharing scheme Vélib':

⁸ Multimodality in this sense implies a choice between different modes of transport.

⁹ Intermodality is the combining of more than one mode of transport into one trip.

"Cycling is faster for everything... and also allows me to discover Paris."

Alexandre does not have a bicycle of his own, for which he gives various reasons.

Financial reasons: the depreciation and the regular maintenance costs would exceed, over a given time period, the price of a service such as Vélib'. Besides having to worry about these constraints, he fears the risk of theft or vandalism, which does not apply in the case of a rental bike:

"It is much more expensive – as soon as there is a problem, a buckled wheel, you have to make repairs; even if it is €10 here and there, that's still more than the €27 for the annual Vélib' subscription."

The ownership of a bicycle also requires **a place to store it**, and owning one's own bike is also **more limiting**: riding a bike to a destination and then using a different mode for a second journey is easy when using Vélib':

"I'll drop it off nearby and follow my friends because they don't want to take a bike. I don't have a bike somewhere that I have to look after."

To overcome the constraints of using Vélib', such as the availability of bicycles at the starting point and parking places at the destination, smartphone apps help him to avoid wasting time looking around for bikes. He has, furthermore, developed a knowledge of how the service operates, and takes advantage of the credit offered by Vélib' for drop-off at certain bicycle stations at certain times, which has allowed him to accumulate hundreds of hours of free rental. This sometimes allows him to keep a bike for several hours:

"I even left the bike in the park once when I went to Vincennes to see a play that lasted three hours. Sometimes I go to university for a short time and attach it to a tree." Asked about what he likes about cycling, he spontaneously lists a large number of reasons to justify this choice:

- **Speed, efficiency**: according to him, Vélib' is faster than alternative modes for many journeys, even after allowing for the time spent looking for an available bike or a parking spot at a bicycle station.
- Liberty: spatial freedom he can choose his itinerary; temporal freedom there is no time limit for the service, as it is always possible to use a Vélib' bike; freedom of rhythm - he can adapt his speed to his circumstances, going fast if he is late, or taking his time if the situation permits, thus transforming his journey into a leisurely ride.
- Low cost: he considers the annual subscription price to be very affordable, almost derisory given his usage, and with his understanding of how the service works, he never pays anything regardless of how long he rents the bike for. In a sense he considers that he travels 'free of charge'.
- **The element of discovery**: travelling on a Vélib' bike has enabled him to learn more about Paris, and, furthermore, to enjoy the journey more than when travelling on the underground.

4.3 Santiago and the cycling boom - "We see [the boom in cycling] happening in high-income groups only. It is an elitist trend."

4.3.1 Context

Santiago has seen a rapid rise in cycling in the last few years: whereas in 2001 this mode accounted for only 2.1% of all trips, it has almost doubled its share in 11 years to 4%. This alone might not seem spectacular, but what is remarkable is that in some communes the number of trips has increased almost eightfold between 2001 and 2012, and, moreover, the strongest growth has occurred in the rich, eastern parts of Santiago ('Oriente' in Figure 4.2). While cycling was, for a long time, considered a recreational activity, and was common only amongst the lower-income groups, it is now becoming an increasingly common mode of transport for daily mobility. Although expansion of the bicycle network is taking place, the infrastructure is still far from being inviting for cyclists: Santiago's political structure hinders the development of a connected cycling infrastructure, leading to numerous disconnected cycling lanes (see Gobierno Regional Metropolitano de Santiago, 2012, p. 65 for a map illustrating this).



SOURCE: Author's representation using ArcGIS®, in the style of and using data from EOD 2012 (SECTRA).

4.3.2 Experts

The following reasons where given by the experts to explain the increase in levels of cycling:

• The **trend in cycling** is seen as one driven mainly by those with high incomes, with **cycling having a positive image**, even one which elevates the perceived social status of the cyclist:

"We see [the boom in cycling] happening in high-income groups only. It is an elitist trend. The low-income group has always been riding bicycles." (Paola Jirón)

• Environmental concerns and a growing health-consciousness play a part, particularly amongst higher-income groups with a strong formal educational background; the practical advantages of cycling also have a bearing on its uptake:

"Now a lot of high-income people have started to use the bicycle as a sustainable choice. Because they were fed up with congestion and spending time in traffic jams, they decided to go and move forward to cycling."

(Leonardo Basso)

• Several experts recognise that part of the new demand for cycling is in **imitation of trends** seen in other countries, initiating a more local trend which then spreads by similar means:

"International students coming back have helped to open the minds of the elite. But this is only really successful if you combine that learning from abroad with local knowledge."

(Lake Sagaris)

4.3.3 Users

We now turn to the results of a 'Bicycle Users' focus group discussion conducted in December 2014 as part of the user analysis. This focused on the motivations of cyclists for taking up the bicycle as a mode of transport, and the issue of whether lifestyle and/or symbolic factors play a role in opting for bike use.

The discussions revealed several factors as a **motivation**, one of which was **relocation to a more central residential area**:

"I used to live in El Bosque¹⁰ and travelled by metro or bus... and I suffered for almost 25 years from spending two, three, sometimes even four hours in a bus, until I had the privilege of moving to the centre. Since my job was very near the centre, I started using the bicycle."

(Rodrigo, 34, geographer)

The **speed advantages** of the bicycle also stand out:

"I realised it was more efficient to go by bicycle – it's faster than the bus or walking. Routes are more direct; you don't have to go packed with others in a bus. You can zigzag and do several things on your way." (Daniela, 29, actress)

The **imitation** of practices from elsewhere, as had been assumed by the experts, did indeed play another important role:

"My best friend was using it a lot and told me: Nacho, this thing is great! Trips are shorter than what you think, give it a try! ...and I did." (Ignacio, 26, engineer)

¹⁰ A peri-urban, low-income commune

"Santiago is not a friendly place for cyclists, but seeing more people on the streets provided a different sensation... it didn't seem so crazy to use a bicycle this time."

(Emanuel, 41, architect)

Health matters were also frequently mentioned, with users either seeking to improve their overall shape or taking up cycling because they found it had a positive effect on their mood:

"When I started cycling the distance was short... but then I changed my job and it was a long distance and uphill. Despite this I continued going by bike because I felt good, I arrived more awake... the mood in the Metro was a disaster, everyone was so negative... I preferred to go by myself, relaxed, even if it was cold or raining." (Sofía, 32, economist)

One foreigner who participated in the focus group discussions mentioned that the recent development of a **cycling culture**, together with the increase in cycling-oriented infrastructure, influenced him:

"I lived in Milan until 2012; I always got around by bicycle there. When I visited Chile in 2008, 2009 and 2010 I didn't use the bicycle because the infrastructure was poor and you didn't see anyone cycling on the streets. When I came back in 2012 to stay, I saw a lot more people cycling and a little bit more infrastructure, so I bought a bicycle."

(Emanuel, 41, architect)

Regarding **lifestyle**, some participants stated that they use the bicycle mostly for their regular or commuting trips, but not, for example, for shopping; others, however, stated that they use this mode for every trip.

Participants identified two main categories of cyclists in terms of lifestyle. One is a relatively low-income group that are somehow 'captive' to the bicycle and have traditionally cycled in Santiago because cycling is the most cost-effective mode of transport. The other group, the 'new' group, who have higher incomes, consists of young professionals living in relatively central municipalities in Santiago:

"The group of urban cyclists is very homogenous, young professionals with no children... but there are also a significant number that have children and exchange the bicycle for a car."

(Ignacio, 26, engineer)

Participants were asked about their emotional perceptions of their bicycles, but for the most part they showed little emotional attachment to them. They were also asked whether they believed that riding a bicycle says something about the cyclist's personality. Most did not think this was the case, but were aware of what other people could think about certain types of cyclists:

"I do believe it says a lot about the person... seeing someone riding a Brompton is not the same as seeing someone on a mountain bike... the clothing also tells you something."

(Emanuel, 41, architect)

"Yes, riding a bicycle provides status, although not an economic one but that of someone who is intelligent, who voluntarily took a smart decision and is delivering a sociopolitical message."

(Alfredo, 44, engineer)

"When I see someone riding a bicycle I see someone who is not lazy... I associate it with young professionals, but I don't think it gives me status; although when I see someone riding one of those colourful track bikes I think 'OK, that's an expensive one'..."

(Michelle, 29, historian)



5_Public Transport

In our sample cities, a broad spectrum can be seen in the development of public transport (see Table 5.1). In Singapore, Tokyo and Vienna, public transport plays a major role, with the modal share ranging from almost 40% to considerably greater. In Tokyo and Vienna in particular, the importance of public transport has actually continued to increase in recent years. In Singapore, the overall share has remained fairly constant, but significant changes within the public transport sector have taken place, with rail-based MRT and LRT gaining importance while the bus, which is still the most commonly used means of public transport in the city state, has become less important. In Vienna, a steady growth in the modal share of public transport has meant that it stands today at almost 40%.

In Paris and Santiago, the levels of use of public transport, and the trends seen in that use, differ somewhat from that seen in the other three cities. Triggered mainly by serious problems resulting from a hasty implementation of Transantiago and its bus system in 2007, the modal share of public transport (including metro use) in Santiago fell from 33% to 30% between 2006 and 2012. In Paris, at first glance, transport surveys suggest no obvious major developments in patterns of use of public transport. However, as the experts suggest, there are perhaps some demand-side effects that our quantitative data does not reveal, for instance the increasing travel demand due to improved quality of service in off-peak hours.

In this chapter, we will give an overview of the developments in the case study cities, and go on to cover **Vienna in more detail** to explain the remarkable increase in public transport's modal share in the last decade in this city.

Table 5.1. Overview of Trends in Use of Public Transport

City	Trend summary from data analysis	Years	Modal share of public transport	Trend
Paris	Relatively small modal share that remained stable, with a higher share in the central area (33%), but less than 10% in the outer suburbs	2001 2010	19% 20%	→
Santiago	Decrease is considered a direct result of the deterioration of the service after the implemen- tation of Transantiago	2001 2012	33% 29%	Ч
Singapore	Modal share remained stable, but strong shift from bus to MRT/LRT because of infrastructure expansion	2004 2012	49% 50%"	→
Tokyo	Increasing modal share that goes hand-in- hand with the infrastructure expansion of the Metro network	1998 2008	40% 44%	7
Vienna	Steady growth as a result of supply-side enhancements	2001 2013	34% 39%	ק

SOURCE: See Chapter 3.

¹¹ These figures do not include taxis - with them they would stand at 57% in both years (Singapore's statistics exclude non-motorised modes).

5.1 Summary: public transport in our case study cities

Paris: Public transport - the rational choice

Context: In Paris, public transport accounts for the smallest modal share of our five case study cities, a share which has remained almost unchanged over the past decade. Significant efforts were undertaken in recent years to enhance bus services in the outer suburbs of Paris, especially during off-peak hours. Thanks to this significant increase in temporal and spatial coverage, public transport is gaining credibility as a means of meeting the varied trip purposes and requirements of customers at off-peak hours as well during the peak. Real-time passenger information contributes to the attractiveness of public transport. The significant increase (a fifth) in the absolute number of trips made by public transport between 2001 and 2010, is, in fact, not reflected in any change in the modal share, being masked by an increase – albeit slightly lower – in overall mobility (driven primarily by walking) over the same period.

Motives: Choice of public transport is almost exclusively linked to **effectiveness** and very rarely to personal tastes or symbolic preferences. People choose public transport when it is **fast**, **convenient** and **safe**.

Santiago: "I travel faster by car."

Context: Public transport in Santiago has to struggle against attractive alternative modes of transport. The (perceived) worsening of the quality of service as a result of the introduction of Transantiago pushed many passengers towards other modes: instead of encouraging people to use a well-integrated public transport system (bus and metro), an increase in car use and cycling was triggered because of serious implementation problems affecting the bus system.

Motives: For many users, the car is still more convenient overall, despite the current high congestion levels. This is worsened by the poor (perceived) quality of the bus system, which is not seen as a good alternative, while the Metro has suffered a worsening of its formerly good reputation owing to excess demand.

Singapore: "I still take buses sometimes, and the waiting times can be frustrating."

Context: Public transport plays a key role in the transport system of Singapore. Singapore has been responsible for pioneering a wide array of innovative tools, strategies and ideas to encourage people to use public transport. The experts, and the users also, highlight the specific disadvantages of the bus, which is seen as inferior to the rail-based MRT and LRT. Despite its objectively high quality of service and its high modal share, public transport is nevertheless seen only as a second-best alternative to the car.

Motives: Despite the fact that Singapore offers a better public transport service than many other countries and cities in the world, users state that the system cannot compete with the private car, which still provides a lower overall journey time and a higher level of convenience, accessibility, and flexibility – especially in areas and during periods not covered by public transport services. Public transport is seen as being competitive when **direct**, **rail-based** connections exist.

Vienna: "You can be spontaneous - you don't need to think ahead all the time."

Context: The continuous growth of the modal share of public transport is a major trend in Vienna. The experts contributing to our study identify two main reasons for this: policy instruments (such as parking restrictions) to reduce the attractiveness of car use, and moves to strengthen the use of public transport through the more intense use of the network and the reduction of annual season ticket prices – a ticket costs only \notin 1 per day (\notin 365 p.a.).

Motives: Users in Vienna clearly confirm these changes as important to their own travel decisions and mode choice, explaining the underlying trend of increased public transport ridership. Their motives are quite rational. **Reliability, time efficiency** and **punctuality** are important attributes. In their opinion, public transport is **convenient**, especially for owners of an annual season ticket. Users appreciate route information and **real-time updates** about departure times for all tram and bus lines. With time efficiency being such a crucial motive, it is not surprising that respondents prefer a **minimum number of interchanges** per trip. The need to save time can also be a major reason for respondents not using a car: the traffic conditions mean that it would simply take them longer.

5.2 Vienna - "You can be spontaneous - you don't need to think ahead all the time."

5.2.1 Context

Public transport (bus, underground, tram), already the dominant mode of transport in Vienna, is still increasing in importance. This statement is underlined both by the modal split (see section 3.5.2) and by detailed statistics: figures indicate a doubling of annual public transport cardholders between 2005 and 2014 (+111% from *c*.303,000 to *c*.640,000 people), with a sharp increase of about 76% from 2011 to 2014 (see Figure 5.1). Consequently, while in 2005 only 19% of the population owned an annual public transport card, this proportion had almost doubled by 2014 (to 36%). Similarly, the number of passengers using modes of public transport rose from 747 million p.a. in 2005 to 900 million in 2013, an increase of 20% (Magistrat der Stadt Wien (a)).



Figure 5.1. Vienna: Annual Public Transport Cardholders and as a Proportion of the Population

SOURCE: Inhabitants: Statistik Austria (2015a); Annual public transport cardholders: Magistrat der Stadt Wien (2014).

5.2.2 Experts

The continuous growth of public transport use is the major transport trend in Vienna. Between 2001 and 2013, the modal share of public transport increased by five percentage points, from 34% to 39%. The experts consider the following points as the main drivers of that trend:¹²

- The **annual public transport season ticket price has been reduced** to €365 p.a. (representing a highly symbolic €1 per day), established by the Green Party in 2012. This is seen as the main cause of the growth in public transport cardholders from 2011 to 2014.
- Parking space management has reduced the scope for parking private vehicles in the inner city.
- The experts interpret the general shift towards the 'green modes' as an expression of a **shift in personal values and mobility patterns** that can be observed in Central and Northern Europe. They state that slow shifts in behaviour patterns are seen mainly in the younger generation, who have contemporary attitudes: rather than having changed their behaviour, they were already manifesting these new habits as they grew up.

In addition, the experts point towards particular negative side effects which were possibly the unintended consequences of successful policy strategies, for example:

- The cheaper annual season ticket for public transport has motivated many people to buy and use it, which caused the capacity limit to be reached more often during peak hours and made the travel experience unsatisfying.
- New mobility options which are meant to encourage drivers to give up their car (e.g. car2go, car sharing etc.) also attract cyclists and public transport passengers to switch to these new modes, perhaps to an even greater extent than drivers. Sharing offers could therefore trigger an increase in car traffic rather than reducing it.

5.2.3 Users

In terms of sociodemographic characteristics, our interviewees belonged to two different status groups (see Appendix C for more details):

- Target Group 1, composed mainly of young people (aged below 30) living in an urban environment and belonging to a better-educated middle or upper class. They grew up with new mobility options and do not have a previous habit of car ownership.
- Target Group 2 consisted of people who recently altered their mobility behaviour after a lifechanging situation. Most of them transferred from car to public transport after changing their residential location.

¹² The experts take into consideration the fact that the figures reported for the modal split in Vienna include only trips made by Viennese citizens. However, there are a significant number of commuter trips made by people who work in Vienna but live outside the city. The experts state that if these trips were also to be counted, the share of car trips would be dramatically higher. In their view a regional perspective is therefore needed.

All interviewees of Target Group 1 like using public transport because of the well-developed network. They consider the use of public transport as **convenient**, especially when owning an annual season ticket:

"It is really convenient. You can always board [public transport], if a means of public transport arrives. You can be spontaneous - you don't need to think ahead all the time."

"Easy, it simply carries you and you don't have to concentrate on anything."

For the interviewees of Target Group 1, **reliability** is one of the most important factors when using public transport. This statement is in line with their rational behaviour concerning mobility choices. The use of **smartphone apps** plays an important role in their lives, and for a number of respondents it has become second nature to use the app 'qando Vienna' to obtain schedule information for each route and real-time information about departure times for all tram and bus lines:

"Reliability is most important when it comes to public transport. The connections should be exactly like it is shown in the 'qando' app. The pricing for public transport should be reasonable."

"The punctuality in Vienna is very good and there was never a problem with connections between means of transport – everything worked out as announced in the 'qando' app."

The **time** factor appears to be very important, because **frequency**, **fast transport**, **punctuality**, **a minimum number of interchanges** and the **relationship between travel time and number of interchanges** were all mentioned as relevant to their mobility behaviour. The interviewees also state that they do not want to change more than twice per trip because then they get the feeling that they are spending too much time waiting for the connecting line:

"Routes with two interchanges are the limit. Changing more often is out of the question."

Negative aspects associated with public transport use refer to the very high utilisation during daily peak periods, and the cleanliness of vehicles:

"Peak hours in public transport are exhausting because of the crowds of people."

"In Vienna, the subway line U6 is not great at all as regards cleanliness (especially in the evening). Cleanliness and safety are also important criteria for the use of the means of transport."

The respondents of the Target Group 2 had changed their behaviour significantly after moving from one residential area to another. All representatives from this group now use public transport. As reasons for changing from car, they state facts mainly related to cost and travel speed:

"Reasons for switching from car use to public transport are, first, the well-developed public transport network and, second, the parking fees and congestion etc., in consequence of which the public transport is faster and cheaper and the car does not pay off."

Respondents further mention that the **cost-performance** ratio of public transport in Vienna is very good, and that the existing network covers every corner of Vienna. They perceive it as advantageous in comparison with the car in enabling the user to **concentrate on other things** such as reading, phoning or listening to music while travelling.

Several participants point out that **regularity**, **cleanliness** and **time efficiency** are particularly important for them, for example:

"Public transport must be attractive. That means the interval between buses is important as well as short waiting times 'because it is annoying to stand forever at the bus stop'. Further criteria for use are the costs and cleanliness. The information concerning public transport, however, is something that could always be improved."

"The regularity of the means of transport is important, and also that it doesn't just leave once an hour. A minimum number of transits to other lines is also important because of the time spent waiting for the next vehicle."

"Good network coverage is necessary so you do not need a car. Furthermore, the frequency is important – but at the moment you wait 3-4 minutes for the U3 until 10 p.m., and after that the intervals are longer, and it would be hard to increase the frequency."

"It is important that public transport is attractively laid out and clean, and that one feels comfortable. The frequency as such is relatively unimportant because you can adapt to it or, if necessary, use another mode of transport - or just walk."

The interviewees agreed that a car is not necessary in Vienna because of the variety of alternative options for getting from one place to another. City bicycles and car sharing were also mentioned in this context as alternatives in areas where the frequency of public transport is not adequate.

In the category of social and emotional motives, the attractiveness, cleanliness and comfort of the vehicle were all listed. 'Attractiveness' in this context means that it is attractively laid out and the design is appropriate, which seems to be an important factor over shorter distances when the decision between public transport, cycling or walking must be made (see Table 5.2).

5.2.4 Comparison of motives of the two target groups

Target Groups 1 and 2 identified some very similar motives and aspects that influence their mobility behaviour. The interviewees agreed that regularity and time-related aspects of travel were important factors. In addition to the common factors such as frequency, short waiting times and a minimum of interchanges, a public transport service that operates 24 hours a day was mentioned as a relevant criterion for the acceptance of the services offered. Only slight differences between the two groups exist (see Table 5.2) regarding their motives: it seems that both groups, despite being unlike in their social composition, value the same things as positive when it comes to public transport in Vienna.

Social and emotional motives
- Cleanliness - Comfort
- Safety - Ambience (of both stations and trains)
- Attractiveness

Table 5.2. Vienna - Rational Motives Versus Social and Emotional Motives





6_The Car: Status Symbol or Utilitarian Mode of Transport?

This chapter covers the car and its role in mobility. In general, our sample of cities reveals a wide variety in the present patterns and ongoing evolution of car use. Our results show large differences across cities, both in terms of overall share as well as in trends.

- Over the last decade, the car has lost first place in the modal splits of Vienna and Paris, and is today the single most important mode (in terms of share of total trips) only in Singapore. More than 40% of all trips in the island state are made by car, despite the high regulation of car ownership and use, and the promotion of alternative modes – which in this case means public transport.
- With just 14% of all trips made by car, Tokyo is at the other extreme of the continuum.
- Santiago shows an upward trend in car use, while it is in decline in Paris, Vienna and Tokyo.
- Socio-spatial differences are evident within each city. Amongst the residents of the centre of Paris, the modal share of car use by the residents stands at only 10%, while it rises to as much as 56% in the outer suburbs. Similar effects are visible in the other cities; however, we have given them only limited coverage in this project.

Table 6.1 summarises the developments that we have detected, and indicates the direction in which they are tending. After a brief overview of the developments in all the cities, this chapter discusses a selected aspect of car use in the case study cities of **Paris**, **Singapore** and **Tokyo**.

Table 6.1. Overview of Trends in Car Ownership and Use

City	Trend summary from data analysis	Years	Modal share of car	Trend
Paris	Increasing car use in the outer suburbs, off- set by a disproportionately high growth of NMT in Paris city centre	2001 2010	44% 38%	ע
Santiago	An increase in car ownership and use after the implementation of Transantiago and also associated with growing incomes	2001 2012	23% 28%	ק
Singapore	Increasing ownership cost alongside a steady growth rate in the number of cars, indicating a high aspiration for car ownership	2004 2012	41% 43%	ק
Tokyo	Declining overall ownership and use, a trend which is more pronounced the more central the residential location in question	1998 2008	19% 14%	ע
Vienna	Public transport and NMT becoming viable alternatives to the car and taking modal share away from it at a rate of almost 1% p.a.	2001 2013	35% 28%	ע

SOURCE: See Chapter 3.
6.1 Summary: car use in our case study cities

Paris: "In any event, we are forced to use the car as soon as we want to go a little further."

Context: While car use in the centre and in the inner suburbs (the petite couronne) of Paris has declined over the past two decades, it has continued to rise in the grande couronne, the wider metropolitan area. This trend is not a merely spatially driven one, but can also be explained by social aspects, specifically age: particularly in the suburban districts, older and retired people are behind this growth in car use.

Motives: The increase in the popularity of the car in the periphery is seen to be driven largely by instrumental (practical) reasons: the necessity to drive in order to reach destinations for work, services or recreation; another factor is the lack of alternatives. Aside from its very practical aspects, the car has a strong role in undergirding personal independence and freedom. On the other hand, in central Paris there has been a declining interest in using cars, and to a certain degree also a fall in the number of young people acquiring a driving licence. Their reasons they give are the desire to avoid burdens such as fixed expenses, as well as the availability of alternatives like sharing/renting a vehicle. It appears from the study that these very practical reasons dominate the thinking behind their decisions.

Santiago: "It's very practical, if you can afford it."

Context: Both the number of cars and the extent to which they are used have increased consistently over the past decade, and with it the efficiency of the road infrastructure. According to the experts, the fact that investment in car-related infrastructure has greatly outweighed investment in public transport has favoured this trend. Continuing economic growth may also explain in part the recent growth of this mode.

Motives: Looking at the car from the perspective of users, motivations for using the car are in general more related to practical aspects of life and daily routines that correspond to work-related or family needs. Day-to-day mobility seems to be highly dependent on car use. A car is regarded not so much as something 'fun' or as a status symbol, but primarily as a functional and useful tool.

Singapore: "If you want to date, owning a car makes it easier."

Context: In Singapore, car ownership has risen slightly in recent years; vehicle kilometres travelled, in contrast, have decreased. In the highly regulated, market-oriented system, demand for Certificates of Entitlement (COEs) exceeds their supply, which has made car ownership very costly. However, the traffic flow for cars in Singapore is excellent, which is helped by the fact that the ERP adjusts its prices to optimise the flow of vehicles.

Motives: Motivations amongst Singaporeans for acquiring a car can be very clearly divided into rationalinstrumental and social-emotional ones. The major instrumental reasons are related to the stage in life that they are passing through - either to enable the fetching of children or as part of caring for elderly relatives/ friends: in these situations, the car is much more practical than other modes. Aside from this, the long commuting distances that result from the growth of suburbia seem to be a factor that promotes car ownership. Furthermore, many people see the car as the best alternative in terms of speed and flexibility. On the other hand, the high price tag of owning a car makes it even more desirable: it is considered a symbol of success and provides status, and is also associated with the aspiration to imitate Western lifestyles. In addition to all of this, there also seems to be a 'lock-in' effect - once an individual owns a car, they would get used to driving and be less likely to give up their car, even if they later relocate and end up living near their place of work. Further strengthening this effect is the high fixed cost of acquiring and running a car, which promotes driving once a car has been bought, in order to justify the 'sunk' costs and exploit the relatively low marginal cost of each mile driven.

Tokyo: "While families do still want to own cars, the younger generation are looking for other status symbols."

Context: Decline in car ownership and use in Tokyo has been substantial and continuous. Car ownership has decreased, both in absolute numbers and relative to the increasing number of households in the city. Lower ownership rates in the centre, together with the remigration back to it, may also explain the overall decrease.

Motives: This trend appears to be related to cost concerns, but also to the high quality of the public transport system, which has emerged as a much more convenient alternative. These rational motives are supported by a decrease in the emotional and symbolic value that Tokyo residents attach to the car.

Vienna: Use it selectively, but hang on to it to keep your options open.

Context: Vienna has experienced a significant decrease in motorised individual transport over the last ten years, a fall that is related on the one hand to the strengthening of public transport, and on the other to the restrictions imposed on car users, chiefly through parking measures. In tandem with that development, the total number of cars has increased by 5%, but the motorisation rate (cars per inhabitant) has *decreased* by 4% between 2002 and 2012, together with the average annual vehicle kilometres driven (6% down from 2003 to 2012 - see Statistik Austria, 2014c). Spatial and social distinctions also characterise Vienna: while the motorisation rate generally decreases from the suburbs to the centre, the central, wealthy 'first district' is a notable exception in that it shows the highest motorisation rate of all the districts in Vienna.

Motives: The results suggest that people do not really need a car in Vienna, and use one only for certain occasions - trips to the countryside, transportation of goods and the like - or simply for reasons of convenience. Furthermore, they regard the car as a very expensive item, owing to parking fees, insurance costs and fuel prices. Most of those interviewed would not want to incur the expense of a car, even though the majority have a driving licence. In other words, it seems that cars have lost their image as a status symbol in this city.

6.2 Paris - "We are forced to use the car as soon as we want to go a little further"

6.2.1 Context

Car ownership and use are declining in the Île-de-France region. This decline began as early as the 1990s among Parisians, and has become more pronounced since the beginning of the new millennium. When considered in terms of the number of trips per day, however, the centre and the suburbs show great differences (see Figure 6.1):

- In the city centre, car use has been steadily declining since 1991.
- Among residents of the inner suburbs (the petite couronne), the decline started only in 2001, but then proceeded with an intensity similar to that observed in the centre of Paris.
- By way of contrast, in the outer suburbs (the grande couronne), car use continued to grow at a substantial rate in comparison with previous periods, partly because the inherent limitations of alternative modes of transport in this particular context have promoted use of the private car.

One explanation for this increase in the outer suburbs is that it is boosted by the retired segment of the population, who more than doubled their total trip count between 1991 and 2010 (see Figure 6.2). Another factor, at least in short-term developments, is the decreasing rate of acquisition of a driving licence among younger people - for the age group 25-34 this dropped from 81% in 2001 to 75% in 2010 (Insee, 2010).

Trips per day per person



Figure 6.1. Paris - Evolution of Car Use, Trips Per Day and Person SOURCE: Author's calculations, based on STIF/DRIEA (2010).



Trips (thousands)



6.2.2 Experts

According to the experts interviewed for Paris, the general reduction in car use and the spatially diverse development can be explained by the following factors:

The **increase in the suburbs** was explained by *Laurence Debrincat* as follows:

- The female population has caught up with males in terms of car use, as a result of their increasing participation rate in the workforce.
- Retirees are driving more as a result of generational shift, specifically amongst newly retired people who are familiar with cars, but also because more and more are 'catching up', in that they are acquiring driving licenses at a more advanced age than hitherto.

The **declining use of the car in Paris city centre** was ascribed to many different causes:

- There has been a significant decrease in the rate of licence holding in younger generations, resulting from various factors: the end of the compulsory military training in France at the end of the 1990s; the rising cost of the licence; how drivers' relationship with the car has evolved; and a decrease in symbolic relevance of the car all these are seen by *Laurence Debrincat* as contributing to the phenomenon.
- Jean-Pierre Orfeuil links the decline in car use more to the constraints imposed on it rather than any explicit wish for a life with less emphasis on cars, or the attraction of alternative modes.
- Similarly, *Bruno Marzloff* thinks that young people, who make up a large part of the city centre's resident population, want to avoid the expenses and constraints that car ownership would impose on them, and prefer instead to opt for more flexible solutions.

6.2.3 Users

For the user analysis, we will use two fictional characters to describe recent developments: 'Alexandre', who is representative of young people living in centre of Paris; and Marie, a woman about 60 years old who lives in the suburbs of Paris (see Appendix C for more details of these characters).

6.2.3.1 Alexandre, city centre dweller

Driving licences

Alexandre holds a Class B driving licence (for use of private vehicles) and plans to acquire a motorcycle licence as well. He considers both as being useful, although not specifically necessary. He obtained his car driving licence when he was 20 years old – not because he necessarily had the intention to drive immediately, but because he wanted to have the option to do so, whether straight away or sometime in the future:

"Now that it's done, it's done."

Holding a licence is often mentioned as a something essential to have under one's belt - so that one is not constrained in the future regarding mode choice - rather than a means of having access as soon as possible to a new mode of travel.

Some of his friends do not hold a driving licence, but all those living in the suburbs (whom he met at university in Paris) hold one, and acquired it at an early stage:

"All those who lived in the suburbs, they all have their licence – they obtained it as soon as they could; those who live in Paris itself – it depends, some of them hold one and some don't."

For his suburban friends it was clearly a necessity, and some had to try several times before finally passing the test:

"They failed three or four times but they kept trying again."

The private car

Alexandre does not own a car, but can easily borrow one from his parents. He sees a consensus among all his Parisian friends that owning a car is not a priority. Ideally they have one at their disposal - if not, they can find other solutions such as Autolib', which they also find useful for keeping in practice.

The ownership of a car is associated with several constraints and costs (insurance, maintenance and parking) and is of virtually no interest in view of how little they would use it:

"There is no interest [in having a car] - I only rarely use one."

6.2.3.2 Marie, living in the suburbs

Marie started accompanied driving in her fifties with her husband. She then went to a driving school and in the end successfully obtained a driving licence. This achievement was, for her, truly liberating. She promptly purchased a small used car and – according to her – this new mobility changed her life:

"Having a car changed many things."

This new-found freedom came about first and foremost because driving her own car put an end to a situation of dependency, and enabled her to regain control of her time:

"If I need to go shopping I don't have to wait until my husband is available. I am not dependent on someone... I don't have to wait any more."

With a car she was able to expand her home territory and so add variety to her life:

"I can go to Meaux, Val d'Europe, Chelles, to my appointments at the hospital in Val-de-Marne..."

It even became a factor in her personal development, in that it gave her the opportunity to be the one who can assist and accompany others:

"When my husband is sick I can drive him to the doctor... I can pick up my grandchildren from the train station."

Asked about what having a car means to her, she cites *freedom* as the most important factor.

However, she does not regret failing to acquire a driving licence sooner; in fact she takes pride in having managed to fend for herself without one for so long:

"I can take a shopping trolley, hop on a train, and go shopping in Paris."

She does use public transport for some occasions - for example when going to Paris, so that she can avoid driving in the city. She drives to a train station instead and then takes the train or RER (the commuter rail service serving Paris and its suburbs). But this is becoming less frequent because she is able to find more and more things locally:

"It's a 'little Paris' right next door to me. It has everything! Before, I had to travel more frequently because we didn't have much in our area. Now I don't feel the need to go to Paris any more, not even for department stores: I find everything in Val d'Europe."

Despite the rising price of fuel, she will never go carless again:

"My independence - I keep it."

When asked about the possible consequences of ageing on her automotive mobility, she partially evades the question and appears unable to conceive of life without a car. She can quite easily envisage a decrease in her automotive mobility in the future, but cannot imagine its complete disappearance. She is willing, however, to contemplate strategies which would allow her to partially overcome this problem - for example by relying increasingly on home deliveries.

She sometimes travels by foot, to access local public services, or just to go for a walk. However, the need for a car quickly resurfaces on many occasions:

"In any event, we are forced to use the car as soon as we want to go a little further."

6.3 Singapore - "If you want to date, owning a car makes it easier"

6.3.1 Context

In Singapore, car use changed only slightly from 2004 to 2012 (its modal share rising from 41% to 43%), and the infrastructure saw no great change over that period. Because the car population's growth rates are determined by the Vehicle Quota System (VQS), the COE price can serve as an indicator of the attractiveness of cars. Figure 6.3 tracks the price of the COE since 1999, showing that it has picked up dramatically in the last few years, having dropped to almost zero during the economic crisis of 2009. Since then, there has been an excess of demand over supply, with the price for a COE peaking at almost S\$96,000 in January 2013 for vehicles with a capacity of more than 1600cc. Consequently, car ownership has risen only slightly over recent years, whereas vehicle kilometres travelled has, by contrast, decreased (see Figure 6.4).



Price per car (S\$)

Figure 6.3. Singapore - Price Per Vehicle (COE, Singapore Dollars) for the Vehicle Quota System SOURCE: Author's representation, based on LTA (Land Transport Authority) COE bidding data (LTA (g)).



Figure 6.4. Singapore - Evolution of Private Car Population and Average Annual Vehicle Kilometres Travelled Per Vehicle (VKT) SOURCE: Private cars: (LTA (f)); VKT: (LTA (g)).

6.3.2 Experts

The experts explain the fact that car ownership is rising despite its high cost as follows:

- Car ownership confers practical advantages in terms of **speed** and **accessibility**: owners consider the car as superior to all other modes of transport because of its high average speed, even during peak hours.
- All experts generally confirm the existence of the **symbolic value of cars**, as well as the importance of its role in the motorisation of Singapore. The high price tag of owning a car makes it even more desirable, as owning one is considered a symbol of success:



Besides the motives explaining the high aspiration for owning a car, the most important factors behind car ownership and use in Singapore include income level, stage of life and residential location. Owning a car is for the most part a question of financial ability - those who can afford to will try to get their hands on a licence plate.

The experts also offered possible explanations for why car ownership, which is rising, and use, which is falling, are diverging: the symbolic value of cars may encourage individuals without genuine need, and who scarcely have the resources, to buy a car, but then actually drive it only a little. Individuals – especially those who purchased their cars mainly for reasons of symbolic value – might use public transport for commuting and cars for other activities.

Finally, all experts agree that relying on cars alone will not provide an efficient transport system in Singapore, and that this explains the various restrictions which the government currently imposes on road traffic:

"Ironically, the city was first designed for cars. Then after some time the government had to restrict the usage of cars." (*Prof. Lee*)

6.3.3 Users

6.3.3.1 Instrumental value vs symbolic value of cars

The in-depth interviews asked respondents for the main reasons for owning a car, and the triggers that influenced their decision to buy one. Their perceptions provided insights into whether they viewed the car as an instrumental need, or as having a symbolic function.

All respondents shared the common view that ownership of a car is mainly to satisfy **real-life needs**. They named **family commitments** such as taking care of aged parents, which typically involved visiting them and ferrying them between home and clinics/hospitals, and, even more commonly, the necessity to take care of their children and their household needs:

"When you think about it, getting around by taxi is cheaper than driving. But if you want to get something in the middle of the night (say 5 to 10 minutes away), it's more convenient to have a car, as it is too far to walk but too near to use a taxi."

(Lawyer, male, 26)

"Currently, I have two children, and this means two strollers and a heavy baby bag. A typical family outing means my car is fully occupied with my wife, maid, two children on two car seats and myself. I cannot imagine taking a taxi with all these."

(Manager, male, 32)

"You could say that the reason behind getting a car was to take care of the elderly... You cannot expect them to stand in the hot sun and wait for a taxi." *(Technician, male, 48)*

Some respondents bought their cars because their job made it a necessity; one cited the need to own a car to achieve time savings, making it possible to commute between a day job and night classes. Others explained that their places of work are not accessible by public transport. The respondents who owned cars felt that they have got used to driving and would find it hard to make the move to public transport:

"The nature of my job requires me to go to places where taxi cabs are not allowed, so it's better for me to drive because the locations are far away from any bus stops or [an] MRT [station]."

(Project Manager, male, 33)

Besides emphasising the instrumental value of cars, the respondents acknowledged the **symbolic value** that comes with owning a car. For example, one interviewee mentioned the importance of **status**:

"I have a different status, and I definitely have to live up to my status. As a businessman you are judged based on such assets as people can see - like what car do you drive and where you stay."

(Businessman, male, 53)

The symbolic value of cars may encourage people without real needs and with insufficient financial resources to obtain a car, and then not use it much. One respondent talked about a low-income individual who bought a special 'off-peak car' that has lower price, but can only be driven on weekends:

"I admit that the 'envy factor' associated with owning a car is definitely present. After I got a car, I realised that friends around me also wanted one. There was a friend who was only earning S\$3,000 but ended up with a red plate car [cars allowed to be driven only during off-peak periods] needing a monthly loan of S\$600. He lives very near his workplace and does not even drive to work. It was [all because of] the status of having a car on weekends to drive around."

(Engineer, male, 30)

The ambition to possess a car is also apparent in the attitude of one young professional, who is considering owning one. He sees driving as the most desirable mode of transport, despite the proximity of his home to the train station and the high COE prices:

"But I will still get a weekend car, as during the weekends I will not be in the CBD [central business district] area. [Living in the CBD] is not my top priority - I mean if I were to choose between spending my pay on rental in the CBD area or getting a weekend car, I would definitely go for the latter. With a car, everywhere is nearby, but staying in the CBD does not mean that I would be near to all my destinations."

(Lawyer, male, 26)

6.3.3.2 Sensitivity to cost of car ownership and use

As a result of the COE price hike in recent years, some of the respondents who owned cars are currently driving second-hand cars. Many car owners made their transactions during the period in which COE prices started increasing drastically:

"After I came back from my overseas posting last year in 2013, I had to buy second-hand cars because of the high COE value and high upfront down payment required to purchase the car. The price of owning brand new cars was beyond what I could afford then."

(Project manager, male, 33)

We found a general consensus that **parking** in Singapore is not too expensive, and thus does not constitute a huge disincentive to driving. When faced with potentially high parking costs, the driver would simply look for nearby alternatives.

The ERP charge, parking fees, and the availability of car parks all have impacts on individuals' car usage, especially for trips to the CBD area, where the costs associated with using a car are the highest of anywhere in Singapore. Most respondents will either take public transport or refrain from driving to urban centres during peak hours. For example, one respondent commented:

"I try not to drive into the CBD area during weekdays because of the high car parking and ERP charges. I will usually take the MRT into the CBD at these times."

(Engineer, male, 33)

6.3.3.3 Alternatives for car users

One respondent, who has recently changed his job, switched to public transport as his main mode of travel for commuting to work, but still plans to keep his car:

"Although I take public transport to work now since it is much faster, I will not give up my car."

(Manager, male, 32)

Another respondent, who is a car owner, mentioned that he would rather take a taxi than drive by himself on the weekend:

"If we choose to go out for, say, a family dinner on the weekends, my first thought would be to take a taxi. I would usually drive only if I knew that getting a cab for the return journey would be difficult from the location where we are headed."

(Civil servant, male, 43)

6.4 Tokyo - "While families still want to own cars, the younger generation are looking for other status symbols"

6.4.1 Context

In Tokyo, the use of the car has seen an ongoing, steady decline in recent years, dropping to a modal share of only 14% in 2008 (see Figure 3.4). Consequently, expansion of the road network has also almost levelled off, with a growth of only 3% in road kilometres in the ten years to 2013.

Following this, car ownership has decreased both in absolute numbers and relative to the increasing number of households in Tokyo. This development, which does not hold true on a national scale, applies to both the central 23 Special-ward Area of Tokyo and the outer areas, with ownership in the central 23 Special-ward Area remaining lower than in the outer areas, as shown in Figure 6.5.



Number of cars per household

Number of cars per household (Japan national average)

Number of cars per household (within the Tokyo metropolis but outside the 23 Special-ward Area)

- Number of cars per household (23 Special-ward Area)
- Number of cars (23 Special-ward Area)

Number of cars (within the Tokyo metropolis but outside the 23 Special-ward Area)

Figure 6.5. Number of Vehicles in Tokyo Metropolis and 23 Special-Ward Area (Excluding Kei Cars) SOURCE: Kanto District Transport Bureau: AIRIA.

6.4.2 Experts

According to the experts, there are several reasons behind the decreasing car ownership and use of recent years.

• Amongst the reasons stated, various **cost** factors were mentioned: the cost of owning and running a car: parking (which, both at potential destinations and also close to the residential location, is sometimes highly regulated and restricted); maintenance costs; and fuel prices, which have been increasing in recent years:

"Because the public transport in the central area of Tokyo has become more convenient, the need for car use is disappearing. Also, the high cost of car parks in the central area increases the burden of parking." (Prof. Yamanaka)

• The **relatively small advantage of cars** compared to public transport. Despite the fairly low modal share of cars, traffic jams in Tokyo are chronic, and the level of service of public transport is reasonable, making it often a more convenient alternative:

"Because of traffic jams generated chronically in the central area and the high level of service of the public transport, it is more convenient than a car." (Prof. Ishida)

• Changing attitudes towards cars among young people, who are, moreover, becoming less active:

"While families do still want to own cars, the younger generation are looking for other status symbols such as video games or smartphones, or even fashionable bicycles."

(Assoc. Prof. Muromachi)

"Young men tend to spend more time at home instead of going out than they used to."

(Assoc. Prof. Muromachi)

• The experts were not consistent in their opinions as to whether **the rise in double-income house holds with children** would lead to an *increase* or to a *decrease* in car ownership. Those families might have a bigger need for a car because of the practical aspects which help in organising daily activities. Having children might, however, also be one reason for the ongoing relocation that is in evidence back to more central areas of Tokyo, where there are more facilities supporting day-to-day activities and needs, and where a car is less imperative:

"It seems that the number of families who would like to live in the central area is increasing because there are a lot of households in which both partners work, and [this location] is convenient for wives who are looking for jobs and commuting, while the income of young adults is decreasing."

(Prof. Taniguchi)

6.4.3 Users

The following results are based on a qualitative online survey that we conducted in order to find out about changes in mobility behaviour. The questions were related to car ownership and car use in terms of modal split (both of which are decreasing), and the effect of residential relocation on car use. Participants were all aged 35 or above, and had families. They had reduced their use of the car over the last ten years, but had not necessarily abandoned it completely.

6.4.3.1 Reduction in car use

Amongst those respondents who reduced their use of the car, two distinct groups emerged.

The first group consists of people who moved to a different type of residential area in the last ten years, either to a more central or a more suburban one than their previous abode. For the most part, those people altered their mobility behaviour immediately after changing their residential location. The reasons for which they reduced their car use upon relocating, however, varied: some mentioned that they found better ways of meeting their daily needs close by – grocery stores or restaurants, for example – thus reducing the need to have a car for such activities. Other participants stated that they found more attractive means of transport at their new residential location, leading them to change modes.

The second group is composed of people who have not moved in recent years. Most of these people switched modes because either the location of their daily destination changed, or because better alternative transport options became available.

6.4.3.2 Reduced levels of vehicle ownership and vehicle kilometres travelled

The reasons given by respondents for giving up ownership of a vehicle - or at least reducing the number of vehicles in the household - included high maintenance costs, congestion in the central area, difficulty in finding car parks, and the decreasing role of the car as a status symbol. Another factor mentioned was the perfectly adequate nature of the public transport service. Interestingly, there were no significant differences between the reasons given by those who moved to the centre of Tokyo and those of respondents who didn't move.

Among all the car-owning respondents, the proportion of those whose vehicle travel distances decreased lies somewhere between 40% and 60%. One reason cited by many respondents for reducing the distance travelled was the increasing costs of car use, including fuel and maintenance expenses.



7_Mobility Trends in Cutting-Edge Cities: Conclusions and Possible Implications for the Future

THE REAL PROPERTY AND ADDRESS OF

This final chapter provides a synthesis of findings from Chapters 4 to 6. Although we do not intend to compare the very heterogeneous sample cities, we discuss the extent to which certain trends – and the underlying factors behind them – show similar patterns in different cities. The chapter summarises findings for the trends seen in each mode of travel, the underlying motives, and the role played by spatial context. These results will lead us to a qualitative outlook for the future of urban mobility.

7.1 Overview of transport trends

The data for transport trends and shares for different modes clearly indicates that there is no one dominant trend even within one city, let alone a single trend that is evident across all of the cities (see Table 7.1):

- In Paris, car use is in decline, while cycling and even more so walking are becoming more prominent.
- In Santiago, a rise in individual motorised travel and cycling is happening at the expense of use of public transport.
- In Singapore, the attractiveness of the car remains robust.
- Tokyo and Vienna share a common trend of declining car use, a somewhat stagnant role for non-motorised travel, and a remarkable increase in the prominence of public transport.

City	Period	Walking	Cycling	Public transport	Car use
Paris	2001 - 2010	ק	Я	\rightarrow	И
Santiago	2001 - 2012	ע	ק	ע	7
Singapore	2004 - 2012	-	-	→	ת
Tokyo	1998 - 2008	\rightarrow	→	ק	Я
Vienna	2001 - 2013	→	ק	ק	И

Table 7.1. Overview of Transport Trends Across All Considered Modes (Summary of Tables from Chapters 4, 5 & 6)

Non-motorised transport: generally on the rise, with some outstanding examples

Across the cities, the trends seen in walking and cycling are perhaps the most consistent when compared to the other modes. With the exception of Singapore, where no data is available, in the sample cities the share of non-motorised transport remained either constant or increased over the past decade. In particular, cycling has gained importance in recent years. However, this trend is not always visible on aggregate. In Santiago for example, the cycling boom in the centre is outweighed by increased use of the car across the city as a whole.

In Paris, non-motorised travel, in particular walking, is becoming the main mode of transport in terms of daily trip numbers. The share of cycling has increased as well, but from a much smaller base, and primarily in the centre of the city.

In Santiago, bicycle use has increased in the last decade. The research highlights the fact that this trend is driven principally by the group of 'young professionals' with middle to high incomes and a preference for living in a central location.

In Singapore, cycling and walking are not counted in official statistics. Our interviews with users about their mode choice confirmed that non-motorised travel in general, and cycling in particular, are only slowly beginning to play a part in the city's transport planning.

In Tokyo, walking and cycling have always been important modes of transport, and continue to be major mobility options. About 15% of all trips in the Greater Tokyo Area are made by bicycle, and the figures indicate almost no change from past years. Our qualitative inquiry detected a noticeable tendency among people living in the 23 Special-ward Area (the centre of Tokyo) to increasingly use their bike for commuting.

In Vienna, walking is very often chosen as an alternative to public transport for short distances. Particularly in the inner city, people seem to like walking because of the appealing environment, and also its value as a physical activity. Cycling, on the other hand, still tends to be considered a physical activity pursued now and then for leisure purposes, rather than a means of transport for routine trips.

Public transport: successful when a clear policy priority

The trends in public transport use vary considerably across the cities. There appears to be an intimate connection between the direction of these trends and the perceived quality of supply, revealing this to be an important factor in mode choice.

The decline in public transport use in Santiago is explained by the reduction in the quality of service that occurred with the introduction of Transantiago in 2007. By contrast, Tokyo and Vienna have consistently seen an improvement in the public transport offer, which is reflected in rising modal shares.

Singapore is a case where despite substantial improvements in the supply of public transport, the modal share has on aggregate changed little over the past ten years. Significant changes have occurred with respect to this mode: while mass rapid transit and light rail transit (LRT), after the network extension, are being used more often, the slower bus has lost its attractiveness.

Car ownership and use: ups and downs across the sample and within cities

In Paris, the overall decline in car use masks a significant and growing difference between the inner city and the suburbs. Whether or not to own and use a car is a question of where in Paris you live. While car use in the centre of Paris has declined over the past two decades, it has continued to rise in the grande couronne, the wider metropolitan area.

In Santiago, the overall amount of motoring continues to rise. Both in terms of numbers and use, the car has been on the rise consistently for the past decade, and with this the capacity of the road network has also grown.

In Singapore, the car does not seem to have lost its power to attract. It remains the single most important mode in terms of modal share with more than 40% of all trips made by car, despite high regulation of car ownership and use as well as promotion of public transport.

In Tokyo, decline in car ownership and use has been substantial and continuous. Car ownership has decreased, both in absolute numbers and even more sharply, as the number of households in the city has increased, in terms of cars per household.

In Vienna, both car use and car ownership per person is slowly but steadily declining, but by way of contrast to that trend, the total number of cars is rising. Spatial differences exist too, with high rates of car ownership in the wealthy most central district, and in the more outlying of the suburban districts. And despite decreasing car ownership and use, the rate of driving licence acquisition, although still low in national terms, keeps on increasing.

7.2 Motives and drivers

Across the sample cities, both users and experts appear to attach higher relevance to instrumental factors than to social-emotional factors when it comes to explaining mode choice.

Cycling: both practically useful and a means of self-expression

The **bicycle** is perhaps the one mode of transport where social-emotional factors are as much in evidence as rational-instrumental reasons. With the exception of Singapore, the bicycle is considered a very practical and relatively fast means of transport that can be used flexibly and at comparatively low cost. But the bicycle can also be a means of self-expression for its users, as is the case in Santiago and Paris.

In Santiago, particularly for those who choose to live in a central location, cycling is an efficient and healthy form of transport in comparison with the alternatives, and people are happy to show that they are making a smart mobility choice. In Paris, the practical advantages of the bicycle are evident when you consider the Vélib' system. This bicycle-sharing scheme offers major advantages for users, such as a low price and universal and flexible availability, while avoiding disadvantages such as everyday maintenance costs, theft and depreciation/deterioration. Users consider the bike to be the genuinely rational transport option for Parisians living in the centre.

These advantages coincide with considerations of personal health and, interestingly, the ability to express a particular status and lifestyle. In Santiago, the group of young professionals clearly mention the practical value of cycling, but also want to be recognised as being active and taking smart decisions. In the sense that they are status-driven, they even show similarities to the car owners of Singapore.

Public transport as the rational choice

Public transport use, in particular, is rationally driven. The city of Vienna, where public transport has become more attractive, illustrates this point and shows the range of rational motives. Reliability, time efficiency and punctuality are important attributes, as is an attractive pricing scheme. Users appreciate route information, and real-time updates about departure times for all tram and bus lines. With time efficiency being such a crucial motive, it is not surprising that respondents prefer a minimum number of interchanges per trip. The need to save time is also a major reason for respondents shunning the car: the traffic conditions mean that it would simply take them longer.

Although rational factors dominate in most cities, care should be taken not to exaggerate their influence. Despite their rational arguments, users of public transport in Vienna consider this mode to be their number one choice for getting around, and do not seem to miss much that might be provided by alternative modes. On the other hand, Singapore's highly valued public transport system accounts for a large modal share, but is still seen mainly as a second-best alternative for those who cannot afford to own a car.

Car use: primarily rational, but that's not the whole story

Rational motives also dominate car ownership and choice of car as a mode of transport.

In Santiago, our results emphasise the efficiency gains provided by the road infrastructure, and the great practicality of the car for routine trips and work-related or family needs. Day-to-day mobility seems to be highly dependent on the use of the car, which is regarded not so much as something 'fun' or as a status symbol, but primarily as a functional and useful tool.

In Vienna, rational motives also underlie the trend, opposite to Santiago's, for using the car less and at the same time more selectively. The interviews suggest that people do not consider that they really need a car in Vienna, and use one only for certain occasions, such as trips to the countryside, transportation of goods, or simply for reasons of convenience. Furthermore, they regard the car as a very expensive item, owing to parking fees, insurance costs and fuel prices. Most of those interviewed would not want to incur the cost of a car, even though the majority have a driving licence.

In Paris, rational motives explain both car use and non-car use in different spatial contexts. The increase in the popularity of the car in the periphery is seen to be motivated largely by the need to drive in order to reach destinations for work, services or recreation, connected with the decision to move to those more peripheral locations. On the other hand, in central Paris there has been a declining interest in using cars, and, among younger people, in acquiring a driving licence. The reasons they give are the desire to avoid burdens such as fixed expenses, as well as the availability of alternatives like sharing/renting a vehicle. It appears from the study that very practical reasons dominate these decisions.

In Tokyo, reasons are related to cost concerns, but also to the high quality of the public transport system, which has emerged as a much more convenient alternative. These rational motives are supported by a decrease in the emotional and symbolic value that Tokyo residents attach to the car. The truth is that the younger generation are looking for other status symbols.

Across the sample, the respondents in our study emphasise that major life events and family-centred reasons such as residential relocation, the birth of children or the need to take care of elderly members of the family are key in explaining car ownership and the choice to travel by car.

Using a car may also boost one's status

Although rational motives appear more prominent, **social-emotional factors** likewise play a role. The Singapore case demonstrates this clearly, in a way that seems to contrast with the other sample cities. It appears that the high price tag of cars makes owning one even more desirable as this is considered a symbol of success. This might be an important factor to consider if cities want to implement policies aimed at dampening car ownership in the future: simply making cars more expensive - or even a 'luxury good' - might have the effect of rendering them even more desirable.

7.3 The importance of spatial differences within cities

In all of our case study cities, we have explored whether spatial differences exist both in trends and in motives. The findings show that it is indeed appropriate to spatially disaggregate the different trends, as they do not occur uniformly across a given city. The study found several reasons for this unevenness (although we suggest further research of this phenomenon):

Firstly, a process of residential self-selection of people and households has taken place, with a particular preference for mobility. In Tokyo, after a long period of suburbanisation, people have started to rediscover the city centre as a residential location. This trend means that the use of public transport and non-motorised modes has become more popular. In Paris, the suburbs continue to sprawl, and the modal split between the centre and the suburbs keeps on diverging. In Santiago, the city centre, after a long phase of decline, is regaining its attraction, drawing amongst others young professionals, who are driving the trend towards cycling in the city and who oppose suburban, car-based lifestyles. Some of them seem to be willing to adopt a lifestyle similar to that in dense, Western European cities – something many of them have already experienced while living abroad.

Secondly, the context varies significantly from one location to another in each of our cities. This has to do with the availability of transport options. The availability and efficiency of transport options is very much higher in dense city centres than in suburban locations and the periphery of cities. At the same time, city centres abound with destinations for work or services much more densely than elsewhere. Together, these contextual factors strongly influence the motives and the mobility practices of people in the five case study cities. Across the cities, our respondents report a high sensitivity to these contextual factors when it comes to the choice of transport mode. As well as availability, cultural factors such as tradition, lifestyle and social expectations can also play an important role in mode choice.

7.4 Future development of mobility trends

Finally, which of our findings might become important when seeking to discern future trends? Our analysis discovered a broad spectrum of developments – some in which the importance of one mode is rising, while the significance of others is falling. It is therefore not possible to discern general trends that hold true for all sample cities. However, the following implications can be derived:

Walking and cycling: of growing importance in central areas

- Our study shows that non-motorised transport (NMT) can play an important role in the transport life of a city, even to the point of being the **most-used mode** in terms of trips.
- However, this importance is **concentrated principally on central locations**, Paris being a good example of an extreme case of this kind of focus, with very high NMT shares in the centre, but considerably lower ones in the suburbs.
- Santiago is a remarkable example of how cycling which was considered not long ago to be a means of getting around just for those who could not afford motorised modes of transport - can become the **mode of choice for an urban elite**. People take up cycling for a plethora of reasons, including practical advantages, health benefits and - last but not least - status-related motives. Whether or not this will prove to be an example which other Latin American or emerging cities worldwide will follow remains an open, but very interesting, question.
- Vienna shows that the combination of public transport for longer trips and walking for short distances can make the car virtually obsolete in everyday life.
- Tokyo's remarkably high share of NMT shows that megacities, too, can be good places for cyclists

 and it will be interesting to see if this nascent trend can be sustained and emulated elsewhere and even go on to lift the modal share of cycling in large cities more generally.
- In all cases, **dense**, **lively cities** seem to be the major drivers of a resurgence in non-motorised transport.

Public transport: strong, and popular if the perceived quality is good

• The **quality and coverage** of public transport is the precondition for its appreciation by users. With the exception of Vienna, where passengers were for the most part positive about their public transport service, and some even proud of it, in all of our other cities using public transport comes across as more of a necessity. Even in Singapore, where the fact is that a very good public transport system exists, people would prefer to use a car if they owned one.

- In Singapore and Santiago, people make a clear distinction between rail-based public transport and buses - the latter having much more negative connotations. The reasons stated for this latter opinion often involved the perceived inferior reliability and punctuality of the bus, and also the greater discomfort of the ride.
- The question should therefore be asked: **how can attractive feeder services in suburbs, and in less dense locations generally, be provided?** Singapore shows evidence of attempts to achieve this, with its fully automated LRT feeder systems - however, these cover only a very small part of the total system as yet. But this is the only way that public transport will gain in importance across entire cities, and perhaps even overcome its present low standing in the suburbs.

The car: used selectively and for pragmatic reasons, but a major mode while its image is positive

- In Singapore, the symbolic value of owning and driving a car remains robust, reinforced by its high price arising from mounting fees and taxes. It is also perceived as the fastest and most convenient mode of transport in the city, and hence remains the number one choice - at least for those who can afford it.
- In the centres of Vienna and Paris, pragmatic decisions about car use and ownership can be observed, with a tendency towards more selective use - i.e. for certain types of trip only, and to reach certain locations within those cities. In neither case are people completely giving up on car use, but they are keeping their options open and are seeking to use cars in a more discerning way.
- Tokyo is a case that illustrates just **how far car use can decline**: user evaluation of alternatives favours other mobility options (consideration being given to economic constraints, and personal motives such as lifestyle choices and pursuing personal fitness).
- Similarly, in Vienna also, one can see tendencies to seek high-quality alternatives to the car as a substitute for its use in previous times.
- On the other hand, Santiago is a city where car use as a **very practical option** has been increasing in recent times, and might continue to do so in the future, **driven by those who will become able to afford it** if economic prosperity continues to rise.
- The car can be expected to remain the first choice of mode in the mobility portfolio of **high-income households**, regardless of where they live and what the alternatives are.

7.5 Conclusion

This study has uncovered mobility trends in five cities, which have been carefully selected on various criteria and cover a broad variety of different types. Although - as with all case study research - the results need to be related to the specific context in which they sit, their value extends well beyond the single selected case study cities.

Urban mobility in the future is changing. What is more, the great variety seen in the trends documented in this study suggests that there is no such thing as a general concept for its future. Nonetheless, it is possible to learn from outstanding examples: **Paris** demonstrates how to integrate new concepts of transport use, for example bicycle sharing, into existing transport infrastructures; **Santiago** can serve as role model for bringing cycling back into the mainstream of mobility culture; **Singapore** is still the benchmark for successful integration of transport planning and land use, but also shows the effects of regulating car use; **Tokyo** shows that even in a situation where transport demand is always growing, this can be handled by the implementation of appropriate transport systems; and **Vienna** serves as an example to anyone who wants to study how successful long-term promotion of public transport can be achieved, and how this might in turn affect user behaviour.

Last but not least, this study has focused on the user of transport in the city. It illustrates the broad spectrum of motives - both the rational and the social-emotional - on which they base their mobility choices. The research has demonstrated that in the urban context, every mode of transport, if it is to achieve continued success, needs to be highly responsive to both the rational and the social-emotional aspects of those who consider using it.





Appendices

Appendix A: List of Experts

City	Affiliation
Paris	
Laurence Debrincat	Engineer, Head of the General Studies Department of the Syndicat des Transports d'Île-de-France (STIF)
Prof. Jean-Pierre Orfeuil	University professor, head of a research laboratory and member of several editorial boards
Bruno Marzloff	Sociologist and 'futurist', founder of the consulting firm Chronos
Santiago	
Paola Jirón Martínez (PhD)	Associate Professor at Institute of Housing, Universidad de Chile
Leonardo Basso (PhD)	Associate Professor, Transport Division of the Civil Engineering Department, Universidad de Chile
Lake Sagaris (PhD)	Postdoctoral researcher, Center for Sustainable Urban Development, Pontificia Universidad Católica de Chile; founder of the NGO "Ciudad Viva" ("Living City")
Ernesto Lopez-Morales (PhD)	Associate Professor, Department of Urbanism, Universidad de Chile
Prof. Juan de Dios Ortúzar	Full Professor, Transport Engineering and Logistics Department, Pontificia Universidad Católica de Chile
Singapore	
Prof. Der-Horng Lee	Professor at National University of Singapore
Prof. Qiang Meng	Professor at National University of Singapore
Dr. Yi Zhu	Postdoctoral researcher at the Singapore-MIT Alliance for Research and Technology (SMART)

City

Affiliation

Tokyo

Prof. Ishida	Professor at University of Tsukuba
Prof. Taniguchi	Professor at University of Tsukuba
Assoc. Prof. Muromachi	Associate Professor at Tokyo Institute of Technology
Dr. Kokura	Research Director at Sumitomo Mitsui Trust Research Institute Co., Ltd.
Prof. Tanishita	Professor at Chuo University
Prof. Yamanaka	Professor at Tokushima University
Prof. Kin	Professor at Ibaraki University
Assoc. Prof. Suzuki	Assistant Professor at Tokyo Institute of Technology
Vienna	

Martin Mayr	CEO, INTEGRAL Markt- und Meinungsforschungs GmbH (market research)
Judith Wittrich	Arbeiterkammer Wien, Abteilung Kommunalpolitik (Vienna Chamber of Labour, Municipal Policy Unit)
Gabriele Gerhardter	Head of Innovation & Mobility Department, ÖAMTC (Austrian Automobile, Motorcycle and Touring Club)

Appendix B: City Profiles – Background

B.1 Paris (Île-de-France)

Figure B.1 shows various different geographical definitions of what is meant by 'Paris'.

- Île-de-France has a relatively dense road network of over 40,000 km of roadways packed into an area of little over 12,000 km². This network comprises *c.*1,300 km of motorways and express ways, *c.*10,000 km of national and departmental roads, and *c.*26,000 km of communal roads, along with other more minor roads. (Road length information has been calculated by IAU-îdF for the year 2013, based on their own data.)
- Île-de-France's public transport consists primarily of heavy rail lines (5 RER¹³ lines and 7 suburban lines), 16 metro lines and 8 tram lines, as well as bus routes. The overall configuration of the public transport network is radial, and most of these lines interconnect through the centre of Paris.
- The RER network was built in the 1960s and was extended in subsequent decades. Unlike suburban lines, RER lines do not terminate in Paris but run underground though the city, hence directly connecting suburbs.
- The underground network (called the Métro) was built in the beginning of the twentieth century and is made up of 16 lines running mainly through the centre of the agglomeration (16 lines, 200 km and 300 stations).
- The tram network was launched in the early 1990s with a first line (T1) north of Paris, and has been gradually extended since then (at present there are 8 lines in operation). Most of these lines operate in the suburbs, except the circular line T3 which operates solely within Paris.
- Public transport in Île-de-France also includes a bus network managed by both public and private companies. The RATP (Régie Autonome des Transports Parisiens) operates a total of 321 daytime bus routes across the region and 64 in the city of Paris alone. Private transport companies grouped under the association called OPTILE (Organisation Professionnelle des Transports d'Île-de-France) operate 1,081 daytime bus routes in the suburbs. In addition, 47 night-service routes, making up what is called the 'Noctilien' network, are operated by the RATP (31 routes) and SNCF (Société nationale des chemins de fer français) (16 routes).
- The region is also host to a large-scale cycling network comprised of dedicated cycle routes and mixed bus-cycle corridors. In 2008, this covered some 2,193 km. Although it is relatively dense and coherent within the city of Paris, it suffers from a lack of continuity at the regional scale, as transport routes and infrastructures cut across the cycle routes.

¹³ Réseau Express Régional, the commuter rail service serving Paris and its suburbs


Paris ** [a] "Centre" / Paris city proper
Métropole du Grand Paris ** / Greater Paris
Agglomeration parisienne * / Urban Area
Région île-de-Fra nce ** [b] / Parisian Region

Aire Urbaine * / Metropolitan Area

* demographic constructions established by the French National Institute for Statistics and Economic Studies (INSEE) ** administrative boundaries

Figure B.1. Paris: Overview of Administrative and Territorial Boundaries of 'Paris'

SOURCE: Author's representation using ArcGIS® map data by IaU-îdF, original graphic from Justinien Tribillon for urbancontroversies.com

NOTE: [a] and [b] define the areas referred to in Tables 3.1 and 3.2.

B.2 Santiago

Santiago's transport system consists mainly of a road network and a public transport system that includes a metro network and the Transantiago bus system described in section 3.2.2.¹⁴ Furthermore, significant efforts are being put into the development of a network of cycle lanes.

In terms of urban highways, there are three private freeways: the Autopista Central, which cuts the city in half from north to south; the Costanera Norte running along the Mapocho River from east to west; and two thirds of the Autopista Vespucio (the main ring road). All were constructed in the mid-2000s, are private, and are charged by kilometre of use, with prices that vary by time of day to adjust for the expected level of congestion. In 2010, the urban highway network comprised 155.2 km of roadway; the total length of the road network (all types of road) was 15,864 km (SECTRA).

The public transport system is divided into the bus network and the metro; the former has a central coordination office called Directorio de Transporte Público Metropolitano¹⁵ (DTPM) which has been in operation since the implementation of Transantiago in 2007, but the Metro is operated and coordinated by an independent public company. The bus system is operated by private companies, which are assigned to different zones and corridors by auction (these companies are termed 'business units' and today there are seven of them). Before 2007, the system was also privately run, but in a more informal way. (The definition of the system was poorly defined, and public tender was made on a route-by-route basis, with the result that hundreds of different companies offered public transport. There was no fleet management and no control over daily operations.)

The underground system depends on a different entity - Metro de Santiago, a private company, partially owned by the government. The Metro network has been in permanent growth since 2000, having so far attained a total network length of 103 km and boasting 108 stations. Currently, two lines are under development (lines 3 and 6) that will contribute significantly to the extension of the network, which is expected to reach almost 150 km in total length by 2018. Currently, the Metro operates at very high frequencies, with a headway of 2-3 minutes between trains during peak hours and 4-8 minutes during off-peak periods.

Santiago today has approximately 216 km of cycle lanes, roads and paths of diverse qualities and standards, arranged in a more-or-less disconnected fashion. Most cycle lanes are located in central, rich communes. The standard of cycle lanes is also significantly higher in richer communes, with those in Providencia and Las Condes displaying the highest-quality infrastructure (Gobierno Regional Metropolitano de Santiago, 2012, p. 65).

¹⁴ There is also a southbound regional train service called Metrotren, connecting Santiago to the city of Rancagua.

¹⁵ Metropolitan Public Transportation Department

B.3 Singapore

Singapore has been a test bed for a number of state-of-the-art transport innovations aimed at improving the efficiency of the transport system and managing travel demand. The city has long experience of a combination of strict disincentives to private car ownership (Vehicle Quota System and Certificates of Entitlement; Electronic Road Pricing; high import taxes etc.) and measures that very strongly support the attractiveness of a multimodal public transport system in combination with a compact, pedestrian and safe urban environment.

Road network

In terms of road transport infrastructure, new expressways and road network capacity was constructed steadily with the development of Singapore. The expressways of Singapore are special roads with limited grade-separated access that allow drivers to travel quickly between urban areas. From 2005 to 2014, the total length of all expressway lanes increased from 963 km to 1,093 km (with a 2014 total expressway length of 164 km), an increase of more than 13% over 9 years (LTA (a)). The total length of all road lanes increased from 8,458 km in 2005 to 9,233 km in 2014 (ibid.), which represents an increase of a little over 9% during a nine-year period, meaning that on average, the road network in Singapore was expanding at the relatively slow pace of approximately 1% per annum. The Land Transport Authority (LTA) has forecast that in the next 15 years, road space growth will slow down yet further.

Although the expressway network has been expanding gradually, from 150 km in 2005 to 164 km in 2014 (LTA (b)), its average peak hour speed¹⁶ has decreased from 66.7 kph in 2002 to 64.1 kph in 2014 (LTA (g, c)).

Public transport network

Singapore aims to establish and maintain a high-capacity and high-quality public transport network that occupies a small amount of land but nevertheless carries a major portion of its trips (Lam & Toan, 2006). A wide range of public transport alternatives exists throughout the entire island, including the mass rapid transit (MRT) system, the light rail transit (LRT) system, buses and taxis. The MRT, a heavy rail passenger system, has been in operation since 1987 and serves as the backbone of Singapore's public transport system. The bus system and the LRT provide the feeder service to the MRT, with taxis filling the role of high-end services.

The MRT and LRT networks together form Singapore's Rapid Transit System. During the 9-year period from 2005 to 2014, the total length of MRT increased by 41%, from 109.4 km to 154.2 km (LTA (d)). Meanwhile, the LRT, which stood in 2014 at a length of 28.8 km, was introduced in 1999 (ibid.). To further promote the use of public transport, the LTA plans to double the track length of the overall MRT/LRT network to about 360 km by 2030, by adding new lines and extensions.

¹⁶ Average of a.m. peak (0800-0900) and p.m. peak (1800-1900)

B.4 Tokyo

Figure B.2 provides an overview of Tokyo, and of the 23 Special-ward Area in detail. Figure B.3 gives an indication of the ebb and flow of the population between the Metropolis and the 23 Special-ward Area over the last three decades.

The Tokyo Metropolis road system forms a dense road network of about 24,500 km, out of which *c*.585 km are highways, the rest being local municipal roads and other regional roads. Extensions to the road network in the Tokyo Metropolis have virtually levelled off, with the network increasing by only about 3% in the last ten years or so (TMG Statistics, 2014a).

Tokyo Metropolis is served by a thicket of criss-crossing railway and metro lines, which function as the backbone of Tokyo's passenger transport system. The total length of the railway lines increased by about 7% between 2001 (661.8 km) and 2012 (707.8 km), meaning that the proportional increase in length of railway lines is larger than that of the road network (TMG Statistics, 2014a). The Metro system alone consists of 13 lines, which serve 290 stations and make up a network of length of 305 km. Its first line began operations in 1927 (UN-HABITAT, 2013). There are several major underground rail operators in Tokyo, which form completely separate networks: Tokyo Metro Co. Ltd. (Tokyo Metro) and Tokyo Metropolitan Bureau of Transportation (Toei Subway).

Two further modes complete Tokyo's public transport network: the bus and the bicycle.

Tokyo's buses operate along a 780 km network of 137 different routes, and a single 12 km tram route (TMG Statistics, 2014a).

Although cycling is an important mode of transport in Tokyo (as Figure 3.4 shows), the construction of a separate cycling network has been neglected until recent years. There were only 8.7 km of bicycle lanes on roadways at the end of 2011 in Tokyo Metropolis, two orders of magnitude less than in many other notable capital cities (Kidd, 2014). Cyclists have at least been permitted to ride on pavements in Japan since the 1970s. However, an expansion of the total length of bicycle lanes up to 120 km is planned in the 23 Specialward Area in the period leading up to the 2020 Summer Olympics.

Figure B.3 shows the development of the net migration in Tokyo's 23 Special-ward Area (area C in Figure B.2) and the Tokyo Metropolis area (B) since 1987. During most of this time there has been positive net migration in the Tokyo Metropolis area (B), in other words more people moving into than out of this area. Net migration was negative in the central 23 Special-ward Area until 1997, but has been positive since then, resulting in an increase of the population in the 23 Special-ward Area in recent times.



Figure B.2. Tokyo: Overview of Administrative and Territorial Boundaries of 'Tokyo' SOURCE: Author's arrangement, based on TMG (2013, p. 6f).



Thousands

Figure B.3. Tokyo: Migration Balance within the Territorial Units of Tokyo Metropolis SOURCE: TMG Statistics (2014b).

B.5 Vienna

Figure B.4 shows how the number of cars, both in absolute terms and per inhabitant, has changed since the turn of the millennium. Figure B.5 details various indicators that paint a picture of the inhabitants' travel behaviour.

The overall length of Vienna's public transport infrastructure has increased from 917 km in 2001 to 1,013 km in 2012. During this period, the total length of the daytime bus routes and that of the underground have both grown - the bus routes far more markedly, and almost entirely from 2010 onwards (Magistrat der Stadt Wien (a)). The length of trams and night bus infrastructure, however, has decreased slightly over the same period. The decrease in tramways can be explained by the expansion of the underground system (to be specific, underground lines U1 and U2), which has replaced other public transport services including trams. Vienna's S-Bahn (short for Schnellbahn, literally 'fast train', rapid transit railway) is a suburban railway network. In contrast to the city-run urban underground rail network, it extends beyond the borders of the city and is operated by the Austrian Federal Railways.

The total length of the railway system in Vienna is about 170 km (as of 2011). A large and ongoing infrastructure project is the new main railway station and retail complex, Wien Hauptbahnhof. This opened in October 2014 and is the major station of the network. The joining of the Western lines to the Southern and Eastern lines was accomplished by constructing a new 15.4 km connection, which included a 12.3 km tunnel (the Lainzer Tunnel) opened in 2012.

Moreover, the city of Vienna operates a road network of total length 2,820 km (2014) (Magistrat der Stadt Wien (b)). This has remained relatively stable (being 2,788 km long in 2004), while the bicycle infrastructure has, by contrast, continuously expanded from 953 km in 2004 to 1,270 km in 2014 (Magistrat der Stadt Wien (c)).

Car parking is a very sensitive issue in the Viennese inner city districts because of the increasing number of private vehicles using the limited space in this dense urban area. Substantial parking management measures first began back in 1993 for the first district, when parking regulations were extended from street sections to district-wide parking zones; they have since then been expanded to other districts (see Magistrat der Stadt Wien (d) for an overview of the parking scheme and its spatial coverage). Residents can apply for a residential parking ticket, which permits them to park their cars without time restrictions in their home district, but gives no guarantee of a parking space. The change of parking management from street to district-wide measures considerably changed the modal split, especially in the wider core districts (i.e. Districts 1 to 9).

As for public transport, in 2012 the city government decided to lower the prices for annual season tickets and raise the prices for single trips instead, in order to encourage passengers to purchase season tickets and use public transport more. The tariff reduction from the annual season ticket was from €449 to €365, set at a symbolic €1 per day, making Viennese public transport some of the cheapest within Europe (derStandard.at, 2013).



Figure B.4. Vienna: Number of Cars and Motorisation Rate

SOURCE: Author's figure, based on Magistrat der Stadt Wien (e); Statistik Austria (2015a)



Figure B.5. Vienna: Daily Mobility Indicators (Per Person, Daily Averages) SOURCE: Author's figure, based on Socialdata (2012).

Appendix C: User Analysis - Composition

C.1 Paris (Île-de-France)

In Paris, our analysis was based on two imaginary people living in different residential locations and at different stages of their lives, whom we called 'Alexandre' and 'Marie'.

Characterisation of Alexandre

Alexandre is 24 years old and is currently living in the 14th arrondissement of Paris in a small studio (15 m²) which he is occupying alone. He has always lived in this arrondissement of Paris, except for a year that he spent in Germany as part of his studies. He moved out of his parents' home a few years ago. The apartment belongs to his slightly older brother who had to vacate. Alexandre took the opportunity to leave the parental home and rent the apartment from his brother.

Alexandre has just completed his master's degree and is about to start a six-month long position in Germany. He dreams about taking some time off in the near future and travelling before entering into working life.

Regarding mobility, he does not own a car, but stated that he could if he wanted to. He does not own a bicycle either, nor does he have a monthly season ticket for public transport. Instead, he is subscribed to Vélib', Paris' bicycle rental scheme, which allows him to rent a bike for free for the first 30 minutes of each ride.

Characterisation of Marie

Marie is a mother, still working but soon to be retired, who has lived in the peri-urban fringe of the Îlede-France region for 30 years. Marie lived carless after her arrival until obtaining a driving licence and acquiring a vehicle. She will help us to better understand the constraints experienced by individuals in less densely populated areas on the outskirts of the city, who are often dependent on a car for their travelling.

Marie currently has lived in a small town in Seine-et-Marne near Disneyland Paris for nearly 30 years. She and her husband are homeowners, living with their youngest child.

Marie and her husband are around 60 years old and have four children. The oldest is currently 40, and the youngest, who will soon leave the family home, is 25.

Prior to moving to Seine-et-Marne, Marie and her husband lived with their first three children in a rented apartment in a town in Seine-Saint-Denis. They made the decision to move and buy a house in the outskirts of Paris to provide a better environment for their children.

C.2 Santiago

In Santiago, discussions were held with three focus groups, named 'Car Users', 'Bicycle Users' and 'Central Dwellers'. The selection of individuals for inclusion in the focus groups was based on the type of user that each group was used to target. For each focus group, interviewees were recruited using social media, the university website, a mailing list and signs put up on two different university campuses. Taking into account the potential number of members and given the outreach which was being attempted, the participation rate was modest. Despite this, it was possible in every case to form focus groups with five or more participants covering an adequately wide range of age, occupation and commune of residence.

Participants of Car Users focus group

- 5 individuals who use the car as their main mode of transport
- 3 females, 2 males
- Ages ranging from 32 to 70 years old
- Coming from four different communes, three of them being high-income communes and one being a low-to-mid-income commune. Two of the communes are relatively central and two are closer to the periphery.

Participants of Bicycle Users focus group

- 7 individuals who use their bicycle frequently (three or more times per week) to commute
- All individuals started to use the bicycle as a mode of transport less than six years ago
- 3 females, 4 males
- Ages ranging from 25 to 44 years old
- Coming from four different communes, all of them relatively central: two communes of high income, one of mid-to-high income and one of mid-to-low income
- All have a professional degree
- Only one has children

Participants of Central Dwellers focus group

- 8 individuals who live in the commune of Santiago (central commune of Santiago); 6 of them moved there from other communes less than ten years ago
- 5 females, 3 males
- Ages ranging from 28 to 38 years old

C.3 Singapore

The major purpose of the in-depth interviews in Singapore was to understand the underlying drivers of the above-mentioned mobility trends in the city from the perspective of the users.

We selected interviewees along three dimensions:

- a) car ownership status;
- b) income level and stage of life; and
- c) housing tenure and location.

Eventually, 12 individuals were interviewed for Singapore, ten males and two females. Their ages range from 26 to 56 years. Ten out of the 12 respondents are long-standing car owners. In terms of annual income, one respondent, who has just begun work having recently graduated, earns about S\$80,000 a year. Three more respondents earn about S\$90,000. The remaining eight respondents earn S\$100,000 or more annually, with two of them earning more than S\$250,000. None of the 12 respondents live in the central business district area. Five respondents reside in the North-East region, and five in the East region of Singapore. The other two respondents live in the central part of Singapore, i.e. Toa Payoh and Bendemeer. Ten out of the 12 respondents live in public housing, of which four respondents are within five minutes walking distance of an MRT station. The other two respondents live in private housing and belong to wealthy households which own more than one car.

C.4 Tokyo

For Tokyo, we conducted a qualitative online survey to examine the influence of residential location and relocation on car ownership and use, and the perception of cycling. The survey focused on men and women aged 35 and over who have a family. The survey can be summarised as follows: the total sample size is 104 participants. The questionnaire was targeted at those over 35 years old. They are subdivided into three groups: ¹⁷

- persons who moved to the 23 Special-ward Area from outside the wards within the past ten years (sample size: 31);
- persons who moved outside the wards from the 23 Special-ward Area within the past ten years (sample size: 21); and
- persons who, whether living in the 23 Special-ward Area or the outside the wards, have lived in the same place for at least the past ten years (sample size: 52).

¹⁷ See section 3.4.1 for an overview of the different spatial categories within Tokyo.

Key elements of the questionnaire concerned the following issues:

- personal information such as age, occupation, number of household members and tenure (owning or renting);
- any change of means of transport, and the reasons for it;
- reasons for moving to the 23 Special-ward Area;
- change of automobile ownership, and the reasons for it; and
- change in the use of bicycle, and the reasons for it.

C.5 Vienna

We conducted the user analysis in Vienna with two different groups:

- Target Group 1 consisted mainly of young people (aged below 30) living in an urban environment and belonging to a better-educated middle or upper class. They are representatives of young social milieus with pragmatic attitudes towards mobility ('digital individualists' - no status orientation regarding mobility, maximising individual utility, the future elite, well-educated, flexible, fun-oriented but rational, trendsetters, urban dwellers, technology-oriented, participators in the 'sharing economy' for pragmatic reasons).
- Target Group 2 consisted of people who recently altered their mobility behaviour after a lifechanging situation. In our case, we selected participants who both changed their residential location and subsequently reduced (or even abandoned) use of the car.

Between five and seven representatives of each group were recruited in Vienna for in-depth interviews:

Target Group 1

- 7 individuals:
 - 2 females, 5 males
 - ages ranging from 17 to 28 years
 - 5 students or part-time employed, 1 high school student, 1 employee

Target Group 2

- 5 individuals:
 - 2 females, 3 males
 - ages ranging from 23 to 43 years
 - 2 students, 1 PhD student, 2 employed
 - 3 individuals who moved from the countryside, 2 who moved from elsewhere within Vienna

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